Proposal for

Region 10 Education Service Center ("ESC")

HVAC Equipment, Installation, Service & Related Products

TDIndustries

At the Heart of Your Building

September 3, 2020

equalis GROUP

Region 10 ESC

Experience the Power of 1©

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TAB 1

TAB 1 CONTENTS:

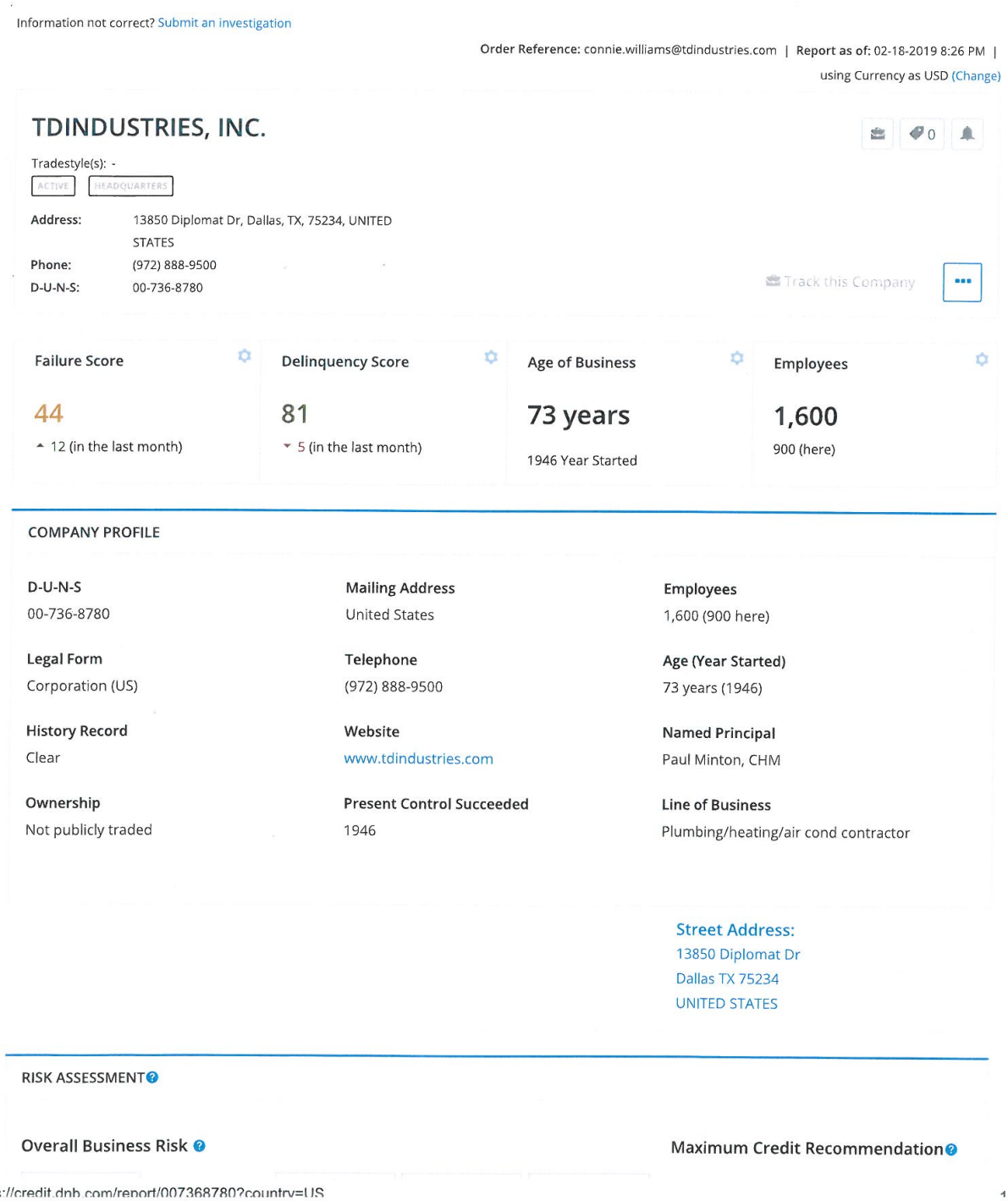
APPENDIX A: QUESTIONNAIRE

1. Company's official registered name.

TDIndustries, Inc.

2. Company's Dun & Bradstreet (D&B) number.

2/18/2019 D&B Credit - Report - Summary



Information not correct? Submit an investigation

Order Reference: connie.williams@tdindustries.com | Report as of: 02-18-2019 8:26 PM | using Currency as USD (Change)

TDINDUSTRIES, INC.

Tradestyle(s): -

ACTIVE HEADQUARTERS

Address: 13850 Diplomat Dr, Dallas, TX, 75234, UNITED STATES
Phone: (972) 888-9500
D-U-N-S: 00-736-8780

Track this Company

Failure Score	Delinquency Score	Age of Business	Employees
44	81	73 years	1,600
▲ 12 (in the last month)	▼ 5 (in the last month)	1946 Year Started	900 (here)

COMPANY PROFILE

D-U-N-S 00-736-8780	**Mailing Address** United States	**Employees** 1,600 (900 here)
Legal Form Corporation (US)	**Telephone** (972) 888-9500	**Age (Year Started)** 73 years (1946)
History Record Clear	**Website** www.tdindustries.com	**Named Principal** Paul Minton, CHM
Ownership Not publicly traded	**Present Control Succeeded** 1946	**Line of Business** Plumbing/heating/air cond contractor

Street Address:
13850 Diplomat Dr
Dallas TX 75234
UNITED STATES

RISK ASSESSMENT

Overall Business Risk

Maximum Credit Recommendation

https://credit.dnb.com/report/007368780?country=US 1/4

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

2/18/2019 D&B Credit - Report - Summary

LOW	LOW-MODERATE	MODERATE	MODERATE-HIGH	HIGH

Dun & Bradstreet Thinks...

- Overall assessment of this organization over the next 12 months: **STABLE CONDITION**
- Based on the predicted risk of business discontinuation: **LIKELIHOOD OF CONTINUED OPERATIONS**
- Based on the predicted risk of severely delinquent payments: **LOW POTENTIAL FOR SEVERELY DELINQUENT PAYMENTS**

US$ 2,650,000

The recommended limit is based on a moderately low probability of severe delinquency.

D&B Viability Rating

Portfolio Comparison Score

2

Low Risk (1) High Risk (9)

Company's risk level is: LOW

Probability that a company will go out of business, become dormant/inactive, or file for bankruptcy/insolvency within the next 12 months: **3.00 %**

Failure Score Formerly Financial Stress Score

44

Low Risk (100) High Risk (1)

Company's risk level is: MODERATE

Probability of failure over the next 12 months: **0.27 %**

Delinquency Score Formerly Commercial Credit Score

81

Low Risk (100) High Risk (1)

Company's risk level is: LOW-MODERATE

Probability of delinquency over the next 12 months: **2.47 %**

PAYDEX ®

79

Low Risk (100) High Risk (0)

Days Beyond Terms : **2**

D&B Rating

TDIndustries

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

Employee Size	Risk Indicator	Employee Size	Risk Indicator
1R : 10 employees and over	3 : Moderate Risk	1R : 10 employees and over	2 : Low Risk

LEGAL EVENTS

Events	Occurrences	Last Filed
Bankruptcies	0	-
Judgements	0	-
Liens	0	-
Suits	0	-
UCC	33	11-01-2017

TRADE PAYMENTS

Highest Past Due

US$ 20,000

Highest Now Owing
US$ 2,000,000

Total Trade Experiences
258

Largest High Credit
US$ 4,000,000

Average High Credit
US$ 69,858

OWNERSHIP

This company is a **Global Ultimate, Domestic Ultimate, Headquarters**

Global Ultimate, Domestic Ultimate
TDINDUSTRIES, INC.
UNITED STATES
D-U-N-S Number 00-736-8780

Total Members in Family Tree - 12

Branches
11

FINANCIAL OVERVIEW

This company does not have a Financial Summary.

WEB & SOCIAL Powered By FirstRain

NOTE: The information in this section is gathered using sophisticated search algorithms to identify relevant stories about this business. Please note that on occasion WWW and Twitter information may be erroneously matched to articles that may also contain similar terminology. Readers should ensure article applicability prior to making risk decisions.

COUNTRY/REGIONAL INSIGHT

United States

Risk Category

LOW MODERATE HIGH

Low Risk High Risk

Labour market strength continues to defy expectations.

Available Reports

Country Insight Snapshot (CIS) | Country Insight Report (CIR)

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

Texas & Louisiana People: Construction business updates for February 2019 ENR 05-Feb-2019

Satori Capital Invests in Able Machinery Movers Business Wire 11-Jan-2019

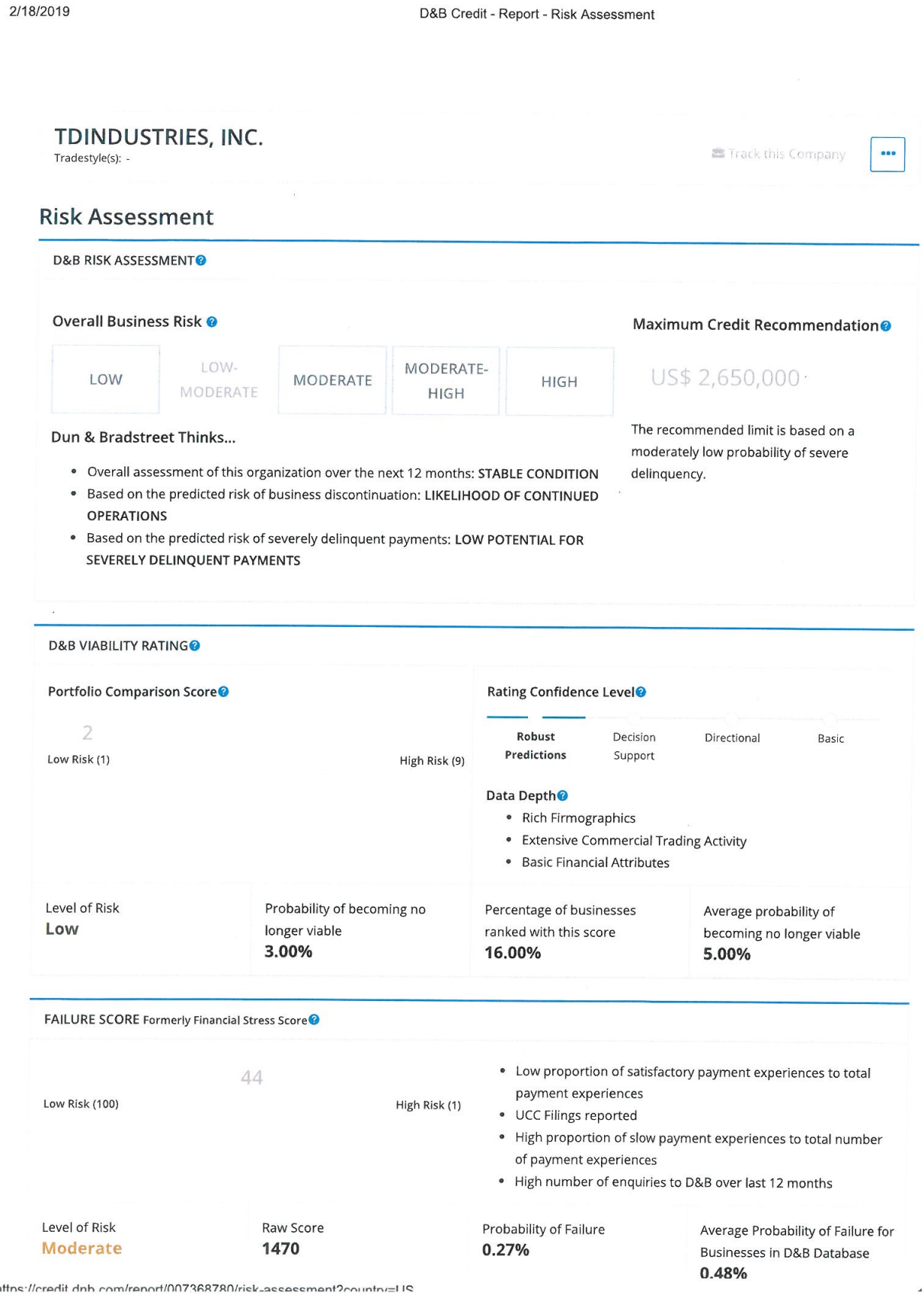
TDIndustries Promotes Sheri Tillman to General Counsel CONTRACTOR Magazine 18-Dec-2018

Pace of Work Holds Steady for Region's Subcontractors ENR 12-Dec-2018

Silicon Valley?s Radical New Idea: Treat Employees Well AFKInsider 07-Dec-2018

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.



2/18/2019 D&B Credit - Report - Risk Assessment

TDINDUSTRIES, INC.
Tradestyle(s): -

Track this Company

Risk Assessment

D&B RISK ASSESSMENT

Overall Business Risk

LOW | LOW-MODERATE | MODERATE | MODERATE-HIGH | HIGH

Maximum Credit Recommendation

US$ 2,650,000

The recommended limit is based on a moderately low probability of severe delinquency.

Dun & Bradstreet Thinks...

- Overall assessment of this organization over the next 12 months: **STABLE CONDITION**
- Based on the predicted risk of business discontinuation: **LIKELIHOOD OF CONTINUED OPERATIONS**
- Based on the predicted risk of severely delinquent payments: **LOW POTENTIAL FOR SEVERELY DELINQUENT PAYMENTS**

D&B VIABILITY RATING

Portfolio Comparison Score

2

Low Risk (1) High Risk (9)

Rating Confidence Level

Robust Predictions | Decision Support | Directional | Basic

Data Depth

- Rich Firmographics
- Extensive Commercial Trading Activity
- Basic Financial Attributes

Level of Risk	Probability of becoming no longer viable	Percentage of businesses ranked with this score	Average probability of becoming no longer viable
Low	**3.00%**	**16.00%**	**5.00%**

FAILURE SCORE Formerly Financial Stress Score

44

Low Risk (100) High Risk (1)

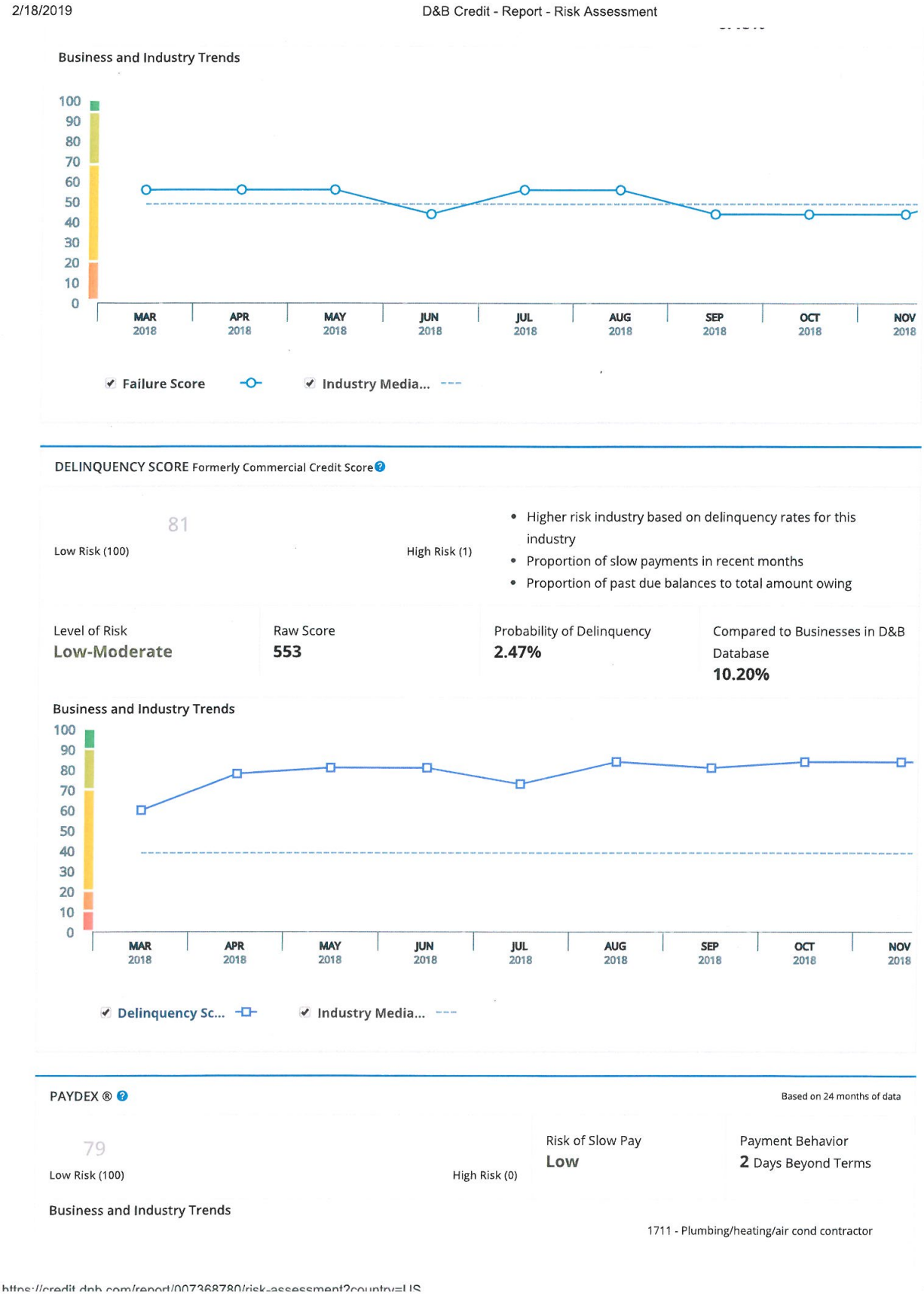
- Low proportion of satisfactory payment experiences to total payment experiences
- UCC Filings reported
- High proportion of slow payment experiences to total number of payment experiences
- High number of enquiries to D&B over last 12 months

Level of Risk	Raw Score	Probability of Failure	Average Probability of Failure for Businesses in D&B Database
Moderate	**1470**	**0.27%**	**0.48%**

https://credit.dnb.com/report/007368780/risk-assessment?country=US

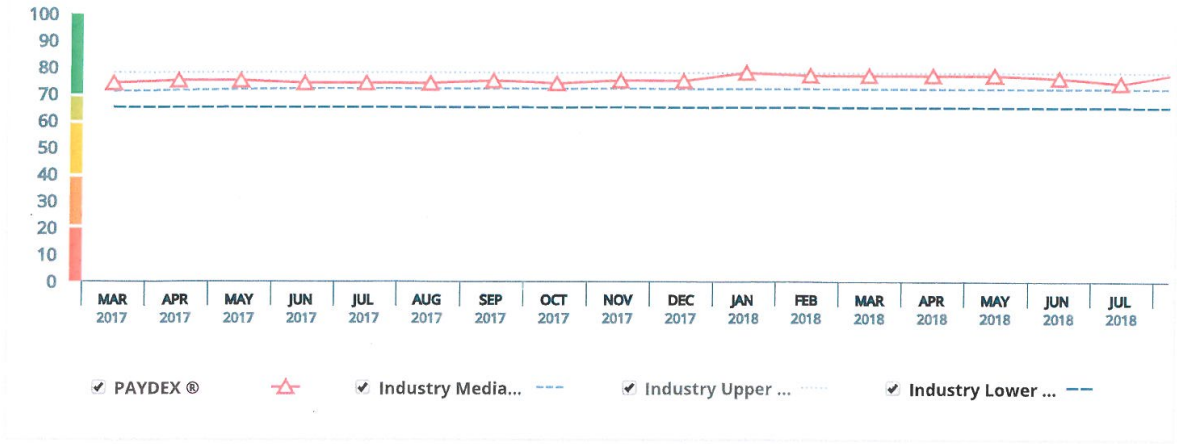
APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.



APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.



D&B RATING

Current Rating as of 04-26-2016		Previous Rating	
Employee Size	**Risk Indicator**	**Employee Size**	**Risk Indicator**
1R : 10 employees and over	3 : Moderate Risk	1R : 10 employees and over	2 : Low Risk

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

TDINDUSTRIES, INC.

Tradestyle(s): -

Track this Company

Trade Payments

TRADE PAYMENTS SUMMARY (Based on 24 months of data)

Overall Payment Behavior	% of Trade Within Terms	Highest Past Due
2 Days Beyond Terms	72%	US$ 20,000

Highest Now Owing:
US$ 2,000,000

Total Trade Experiences:
258
Largest High Credit: US$ 4,000,000
Average High Credit: US$ 69,858

Total Unfavorable Comments:
0
Largest High Credit: US$ 0

Total Placed in Collections:
1
Largest High Credit: US$ 0

TRADE PAYMENTS BY CREDIT EXTENDED (Based on 12 months of data)

Range of Credit Extended (US$)	Number of Payment Experiences	Total Value	% Within Terms
100,000 & over	19	US$ 12,650,000	98
50,000 - 99,999	10	US$ 640,000	92
15,000 - 49,999	34	US$ 890,000	83
5,000 - 14,999	32	US$ 227,500	78
1,000 - 4,999	56	US$ 102,500	65
Less than 1,000	57	US$ 20,500	61

TRADE PAYMENTS BY INDUSTRY (Based on 24 months of data)

Collapse All | Expand All

Industry Category	Number of Payment Experiences	Largest High Credit (US$)	% Within Terms (Expand to View)	1 - 30 Days Late (%)	31 - 60 Days Late (%)	61 - 90 Days Late (%)	91 + Days Late (%)
14 - Mining and Quarrying of Non-metallic Minerals except Fuels	1	35,000					

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

2/18/2019 D&B Credit - Report - Trade Payments

Industry Category	Number of Payment Experiences	Largest High Credit (US$)	% Within Terms (Expand to View)	1 - 30 Days Late (%)	31 - 60 Days Late (%)	61 - 90 Days Late (%)	91 + Days Late (%)
17 - Construction - Special Trade Contractors	6	1,000,000					
30 - Rubber and Miscellaneous Plastics Products	1	7,500					
35 - Industrial and Commercial Machinery and Computer Equipment	23	4,000,000					
36 - Electronic and other electrical equipment and components except computer equipment	7	500,000					
37 - Transportation Equipment	3	25,000					
38 - Measuring Analyzing and Controlling Instruments; Photographic Medical and Optical Goods; Watches and Clocks	2	10,000					
42 - Motor Freight Transportation and Warehousing	1	500					
47 - Transportation Services	1	1,000					
48 - Communications	12	95,000					
49 - Electric, Gas and Sanitary Services	1	250					
50 - Wholesale Trade - Durable Goods	62	1,000,000					
51 - Wholesale Trade - Nondurable Goods	9	20,000					
55 - Automotive Dealers and Gasoline Service Stations	1	15,000					
57 - Home Furniture Furnishings and Equipment Stores	1	1,000					
59 - Miscellaneous Retail	4	30,000					
60 - Depository Institutions	4	10,000					
61 - Nondepository Credit Institutions	7	25,000					
70 - Hotels Rooming Houses Camps and other Lodging Places	1	1,000					
72 - Personal Services	2	7,500					
73 - Business Services	18	60,000					
75 - Automotive Repair, Services and Parking	7	5,000					
87 - Engineering Accounting Research Management and Related Services	3	25,000					
93 - Public Finance Taxation and Monetary Policy	12	20,000					

https://credit.dnb.com/report/007368780/trade-payments?country=US 2/6

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

Industry Category	Number of Payment Experiences	Largest High Credit (US$)	% Within Terms (Expand to View)	1 - 30 Days Late (%)	31 - 60 Days Late (%)	61 - 90 Days Late (%)	91 + Days Late (%)

TRADE LINES

Select Date Range

Date of Experience	Payment Status	Selling Terms	High Credit (US$)	Now Owes (US$)	Past Due (US$)	Months Since Last Sale
02/19	Pays Promptly	-	2,500	750	0	1
02/19	Pays Prompt to Slow 45+	-	2,500	0	0	Between 2 and 3 Months
01/19	payment-status-discount	-	2,500	50	50	Between 4 and 5 Months
01/19	Pays Promptly	-	1,000,000	0	0	1
01/19	Pays Promptly	-	1,000,000	1,000,000	0	1
01/19	Pays Promptly	-	600,000	600,000	0	1
01/19	Pays Promptly	-	400,000	250,000	0	1
01/19	Pays Promptly	-	200,000	0	0	1
01/19	Pays Promptly	-	100,000	10,000	0	1
01/19	Pays Promptly	-	75,000	10,000	0	1
01/19	Pays Promptly	-	55,000	5,000	0	1
01/19	Pays Promptly	-	45,000	5,000	0	1
01/19	Pays Promptly	N30	45,000	45,000	0	1
01/19	Pays Promptly	-	40,000	0	0	Between 6 and 12 Months
01/19	Pays Promptly	-	30,000	2,500	0	1
01/19	Pays Promptly	-	25,000	15,000	0	1
01/19	Pays Promptly	-	20,000	0	0	Between 6 and 12 Months
01/19	Pays Promptly	-	15,000	7,500	0	1
01/19	Pays Promptly	-	15,000	10,000	0	1
01/19	Pays Promptly	-	10,000	0	0	1
01/19	Pays Promptly	-	7,500	2,500	0	1
01/19	Pays Promptly	-	7,500	7,500	0	1
01/19	Pays Promptly	-	7,500	2,500	0	1
01/19	Pays Promptly	-	5,000	0	0	1

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

2/18/2019 D&B Credit - Report - Trade Payments

Date of Experience	Payment Status	Selling Terms	High Credit (US$)	Now Owes (US$)	Past Due (US$)	Months Since Last Sale
01/19	Pays Promptly	-	2,500	0	0	Between 6 and 12 Months
01/19	Pays Promptly	N30	2,500	2,500	0	1
01/19	Pays Promptly	-	2,500	1,000	0	1
01/19	Pays Promptly	-	2,500	250	0	1
01/19	Pays Promptly	-	2,500	2,500	0	1
01/19	Pays Promptly	-	2,500	2,500	100	1
01/19	Pays Promptly	N30	1,000	0	0	1
01/19	Pays Promptly	-	1,000	0	0	Between 6 and 12 Months
01/19	Pays Promptly	-	1,000	0	0	Between 2 and 3 Months
01/19	Pays Promptly	-	1,000	0	0	Between 4 and 5 Months
01/19	Pays Promptly	-	1,000	0	0	Between 6 and 12 Months
01/19	Pays Promptly	-	1,000	500	0	1
01/19	Pays Promptly	-	1,000	0	0	Between 6 and 12 Months
01/19	Pays Promptly	N30	1,000	0	0	Between 6 and 12 Months
01/19	Pays Promptly	-	1,000	500	0	1
01/19	Pays Promptly	-	1,000	750	0	1
01/19	Pays Promptly	-	750	750	0	1
01/19	Pays Promptly	N30	750	750	0	1
01/19	Pays Promptly	N90	500	50	0	1
01/19	Pays Promptly	-	500	0	0	Between 6 and 12 Months
01/19	Pays Promptly	-	500	0	0	Between 6 and 12 Months
01/19	Pays Promptly	PROX	500	50	0	1
01/19	Pays Promptly	-	500	0	0	Between 2 and 3 Months
01/19	Pays Promptly	-	500	50	0	1
01/19	Pays Promptly	-	250	0	0	Between 4 and 5 Months

https://credit.dnb.com/report/007368780/trade-payments?country=US 4/6

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

2/18/2019 D&B Credit - Report - Trade Payments

Date of Experience	Payment Status	Selling Terms	High Credit (US$)	Now Owes (US$)	Past Due (US$)	Months Since Last Sale
01/19	Pays Promptly	-	50	0	0	Between 4 and 5 Months
01/19	Pays Prompt to Slow 15+	-	1,000	1,000	500	1
01/19	Pays Prompt to Slow 30+	-	250,000	0	0	Between 6 and 12 Months
01/19	Pays Prompt to Slow 30+	-	55,000	35,000	5,000	1
01/19	Pays Prompt to Slow 30+	-	25,000	0	0	1
01/19	Pays Prompt to Slow 30+	-	15,000	5,000	0	1
01/19	Pays Prompt to Slow 30+	-	5,000	5,000	1,000	1
01/19	Pays Prompt to Slow 30+	-	2,500	0	0	Between 2 and 3 Months
01/19	Pays Prompt to Slow 30+	-	1,000	750	100	1
01/19	Pays Prompt to Slow 30+	-	1,000	1,000	0	1
01/19	Pays Prompt to Slow 30+	-	750	0	0	1
01/19	Pays Prompt to Slow 30+	N30	750	0	0	Between 6 and 12 Months
01/19	Pays Prompt to Slow 60+	-	-	100	0	1
01/19	Pays Prompt to Slow 60+	-	2,500	0	0	Between 4 and 5 Months
01/19	Pays Prompt to Slow 90+	-	7,500	2,500	750	1
01/19	Pays Prompt to Slow 90+	-	2,500	500	500	Between 2 and 3 Months
01/19	Pays Prompt to Slow 90+	-	250	250	250	1
01/19	Pays Prompt to Slow 150+	N30	250	0	0	Between 2 and 3 Months
01/19	Pays Slow 30+	-	2,500	0	0	Between 6 and 12 Months
01/19	Pays Slow 30+	-	1,000	250	0	1
01/19	Pays Slow 30+	-	1,000	1,000	1,000	1
01/19	Pays Slow 30+	-	500	100	100	Between 2 and 3 Months

https://credit.dnb.com/report/007368780/trade-payments?country=US 5/6

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

2/18/2019 D&B Credit - Report - Trade Payments

Date of Experience	Payment Status	Selling Terms	High Credit (US$)	Now Owes (US$)	Past Due (US$)	Months Since Last Sale
01/19	Pays Slow 90+	-	50	50	50	Between 2 and 3 Months
01/19	Pays Slow 120+	-	1,000	1,000	1,000	1
01/19	-	Cash account	0	0	0	Between 2 and 3 Months
12/18	Pays Slow 15+	-	5,000	5,000	5,000	1
12/18	Pays Slow 90+	-	1,000	750	0	1
12/18	Pays Slow 180+	-	50	0	0	Between 6 and 12 Months

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

TDINDUSTRIES, INC.

Tradestyle(s): -

Track this Company

Legal Events

The following Public Filing data is for information purposes only and is not the official record. Certified copies can only be obtained from the official source.

Judgements	Liens	Suits	UCC Filings
0	0	0	33
Latest Filing: -	Latest Filing: -	Latest Filing: -	Latest Filing: 11-01-2017

EVENTS

All Event Types | All Dates | Apply | Reset

UCC Filing - Original

Filing Date	05-02-2017
Filing Number	170014892385
Received Date	05-09-2017
Collateral	Negotiable instruments and proceeds - Account(s) and proceeds - Timber and proceeds - Oil, gas and minerals and proceeds - and OTHERS
Secured Party	JPMORGAN CHASE BANK, N.A., DALLAS, TX
Debtors	TDINDUSTRIES, INC.
Filing Office	SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

UCC Filing - Original

Filing Date	05-01-2017
Filing Number	170014834644
Received Date	05-09-2017
Collateral	Account(s) and proceeds - Timber and proceeds - Oil, gas and minerals and proceeds - Fixtures and proceeds - and OTHERS
Secured Party	JPMORGAN CHASE BANK, N.A., DALLAS, TX

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

Debtors	TDINDUSTRIES, INC.
Filing Office	SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

UCC Filing - Continuation

Filing Date	01-23-2017
Filing Number	20170480662
Received Date	03-10-2017
Original Filing Date	06-28-2007
Original Filing Number	2007 2469111
Secured Party	JPMORGAN CHASE BANK, N.A., LOUISVILLE, KY
Debtors	TD INDUSTRIES, INC.
Filing Office	SECRETARY OF STATE/UCC DIVISION, DOVER, DE

UCC Filing - Original

Filing Date	04-11-2016
Filing Number	160011444405
Received Date	04-19-2016
Collateral	Leased Building(s)
Secured Party	NORTEX MODULAR LEASING AND CONSTRUCTION COMPANY DBA BOXX MODULAR, LEWISVILLE, TX
Debtors	TD INDUSTRIES, FORT WORTH, TX
Filing Office	SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

UCC Filing - Continuation

Filing Date	03-09-2015
Filing Number	1500068550
Received Date	03-10-2015
Original Filing Date	08-31-2010
Original Filing Number	100025337112
Secured Party	JPMORGAN CHASE BANK, N.A., LOUISVILLE, KY
Debtors	TDINDUSTRIES, INC.

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

Filing Office	SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

UCC Filing - Continuation

Filing Date	01-12-2012
Filing Number	2012 0161275
Received Date	02-24-2012
Original Filing Date	06-28-2007
Original Filing Number	2007 2469111
Secured Party	JPMORGAN CHASE BANK, N.A., LOUISVILLE, KY
Debtors	TD INDUSTRIES, INC.
Filing Office	SECRETARY OF STATE/UCC DIVISION, DOVER, DE

UCC Filing - Original

Filing Date	08-31-2010
Filing Number	100025337112
Received Date	09-07-2010
Collateral	Inventory and proceeds - Account(s) and proceeds - General intangibles(s) and proceeds - Equipment and proceeds - Chattel paper and proceeds
Secured Party	JPMORGAN CHASE BANK, N.A., LOUISVILLE, KY
Debtors	TDINDUSTRIES, INC.
Filing Office	SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

UCC Filing - Original

Filing Date	03-05-2010
Filing Number	100006401466
Received Date	03-19-2010
Collateral	Equipment and proceeds
Secured Party	UNITED RENTALS NORTHWEST, INC., IRVING, TX
Debtors	TDINDUSTRIES, INC.
Filing Office	SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

UCC Filing - Original

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

Filing Date	06-28-2007
Filing Number	2007 2469111
Received Date	08-07-2007
Collateral	Inventory and proceeds - Account(s) and proceeds - General intangibles(s) and proceeds - Equipment and proceeds - Chattel paper and proceeds
Secured Party	JPMORGAN CHASE BANK, N.A., LOUISVILLE, KY
Debtors	TD INDUSTRIES, INC.
Filing Office	SECRETARY OF STATE/UCC DIVISION, DOVER, DE

UCC Filing - Original

Filing Date	02-02-2007
Filing Number	2007 0434851
Received Date	05-21-2007
Collateral	Equipment
Secured Party	TOYOTA MOTOR CREDIT CORPORATION, TORRANCE, CA
Debtors	TD INDUSTRIES LTD
Filing Office	SECRETARY OF STATE/UCC DIVISION, DOVER, DE

UCC Filing - Amendment

Filing Date	01-22-2007
Filing Number	2007 0260017
Received Date	02-26-2007
Original Filing Number	6457277 2
Secured Party	MOORE, TAMMY
Debtors	TD INDUSTRIES LTD
Filing Office	SECRETARY OF STATE/UCC DIVISION, DOVER, DE

UCC Filing - Original

Filing Date	12-29-2006
Filing Number	6457277 2
Received Date	01-25-2007

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

Collateral	Equipment
Secured Party	TOYOTA MOTOR CREDIT CORPORATION, TORRANCE, CA
Debtors	TD INDUSTRIES MANAGEMENT LLC
Filing Office	SECRETARY OF STATE/UCC DIVISION, DOVER, DE

UCC Filing - Original

Filing Date	12-27-2006
Filing Number	6454506 7
Received Date	01-25-2007
Collateral	Equipment
Secured Party	TOYOTA MOTOR CREDIT CORPORATION, TORRANCE, CA
Debtors	TD INDUSTRIES LTD
Filing Office	SECRETARY OF STATE/UCC DIVISION, DOVER, DE

UCC Filing - Original

Filing Date	02-09-2006
Filing Number	060004515566
Received Date	02-24-2006
Collateral	Leased Computer equipment including proceeds and products - Leased Business machinery/equipment including proceeds and products - Leased Equipment including proceeds and products
Secured Party	KIP AMERICA, INC., JACKSONVILLE, FL
Debtors	TD INDUSTRIES MANAGEMENT LLC
Filing Office	SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

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There may be additional UCC Filings in D&B's file on this company available by contacting 1-800-234-3867.

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

TDINDUSTRIES, INC.
Tradestyle(s): -

Track this Company

Special Events

12-19-2016

The Chief Executive Officer is now Paul Minton, CHM.

APPENDIX A: QUESTIONNAIRE

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TDINDUSTRIES, INC.
Tradestyle(s): -

Track this Company

Company Profile

COMPANY OVERVIEW

D-U-N-S 00-736-8780	**Mailing Address** United States	**Employees** 1,600 (900 here)
Legal Form Corporation (US)	**Telephone** (972) 888-9500	**Age (Year Started)** 73 years (1946)
History Record Clear	**Website** www.tdindustries.com	**Named Principal** Paul Minton, CHM
Ownership Not publicly traded	**Present Control Succeeded** 1946	**Line of Business** Plumbing/heating/air cond contractor

Street Address:
13850 Diplomat Dr
Dallas TX 75234
UNITED STATES

BUSINESS REGISTRATION

Corporate and business registrations reported by the secretary of state or other official source as of: -
This data is for informational purposes only, certification can only be obtained through the Office of the Secretary of State.

Registered Name	TDINDUSTRIES, INC.
Corporation Type	Corporation (US)
Business Commenced On	1946

PRINCIPALS

Officers

PAUL MINTON, CHM
HAROLD F. MACDOWELL, CEO

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

MAUREEN UNDERWOOD, EX V PRES
JASON CINEK,SR V PRES
MICHAEL J. KOTUBEY, PRES
ROD JOHANNSEN, V PRES
PHIL CLAYBROOKE, V PRES
BEN HOUSTON, DIR
MICHAEL J FITZPATRICK, CFO

Directors

DIRECTOR(S): THE OFFICER(S)

COMPANY EVENTS

The following information was reported on: 11-24-2018

The Texas Secretary of State's business registrations file showed that TDIndustries, Inc. was registered as a Corporation on June 25, 2007, under the file Registration number 0800834585.

Business started 1946. 100% of capital stock is owned by ESOP.

RECENT EVENTS:.

On September 17, 2010, an inside source stated that TDIndustries, Inc., Dallas, TX, was acquired by JBS Mechanical, Inc., Phoenix, AZ, on September 2, 2010, for $2.2 million. With this transaction TDIndustries, Inc. discontinued its business and its operations were integrated into TDIndustries, Inc., Tempe, AZ. Further details were unavailable.

PAUL MINTON. Antecedents are unknown.

HAROLD F. MACDOWELL born 1961. 1985-present active here.

MAUREEN UNDERWOOD. Antecedents are unknown.

JASON CINEK. Antecedents are unknown.

MICHAEL J. KOTUBEY. Served as president of MMC Contractors.

ROD JOHANNSEN. Antecedents are unknown.

PHIL CLAYBROOKE. Antecedents are unknown.

BEN HOUSTON born 1936. 1961-present active here.

MICHAEL J FITZPATRICK born 1949. 1984-present active here.

AFFILIATES: The following are related through common principals, management and/or ownership: TDIndustries Holdings, Dallas, TX. Started in 2001. Operates as a Delaware limited liability company. TDIndustries Management, Dallas, TX. Started in 2001. Operates as a Delaware limited liability company.

On January 27, 2010, an investigation revealed that the previous telephone number listed for TD Industries Inc (469 374-8733) was incorrect, and appears to have been changed without the company's knowledge. The correct telephone number is now reported as (972) 888-9500.

Former name of the business was TD Industries LTD.

BUSINESS ACTIVITIES AND EMPLOYEES

The following information was reported on: 11-24-2018

Business Information

APPENDIX A: QUESTIONNAIRE

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Business Information

Description	Contractor of heating and air conditioning systems. Contracts call for. Terms are. Has 4000 account(s). Terms are Net 30 days and contractual basis. Sells to commercial concerns. Territory : United States.
Employees	1,600 which includes officer(s). 900 employed here.
Financing Status	Secured
Seasonality	Nonseasonal.
Tenure	Owns
Facilities	Owns 120,000 sq. ft. in a two story steel building.
Location	Suburban business section on well traveled street.

SIC/NAICS Information

SIC Codes	SIC Description	Percentage of Business
1711	Plumbing/heating/air cond contractor	-
17110400	Heating and air conditioning contractors	-

NAICS Codes	NAICS Description
238220	Plumbing, Heating, and Air-Conditioning Contractors

GOVERNMENT ACTIVITY

Activity Summary

Borrower(Dir/Guar)	No
Administrative Debt	No
Contractor	Yes
Grantee	No
Party excluded from federal program(s)	No

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TDINDUSTRIES, INC.
Tradestyle(s): -

Track this Company

Financials

Source: D&B | Currency: All figures shown in USD unless otherwise stated

KEY BUSINESS RATIOS

Statement date	Based on Number of Establishments
12-31-2000	25

	Ratio for the business	Industry Median	Industry Quartile
Profitability			
Return On Assets	-	3.1	-
Return on Net Worth	-	13.3	-
Return on Sales	-	1.4	-
Short Term Solvency			
Current Liabilities to Inventory	999.9	948.3	1
Current Liabilities Over Net Worth	212.2	158.1	1
Current Ratio	1.7	1.5	1
Quick Ratio	1.4	1.2	1
Efficiency			
Accounts Payable to Sales	-	10.3	-
Assets Over Sales	-	49.7	-
Collection Period	-	82.5	-
Sales to Inventory	-	64.3	-
Sales Over Net Working Capital	-	8.6	-
Utilization			
Total Liabilities Over Net Worth	362.0	237.1	1

APPENDIX A: QUESTIONNAIRE

2. Company's Dun & Bradstreet (D&B) number.

TDINDUSTRIES, INC.

Tradestyle(s): -

Track this Company

Financials

Source: D&B | Currency: All figures shown in USD unless otherwise stated

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Assets Over Sales	-	49.7	-
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Sales to Inventory	-	64.3	-
Sales Over Net Working Capital	-	8.6	-
Utilization			
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APPENDIX A: QUESTIONNAIRE

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TDINDUSTRIES, INC.

Tradestyle(s): -

Track this Company

Web & Social

The information in this section is gathered using sophisticated search algorithms to identify relevant stories about this business. Please note that on occasion WWW and Twitter information may be erroneously matched to articles that may also contain similar terminology. Readers should ensure article applicability prior to making risk decisions.

LATEST NEWS

Powered By FirstRain

- Texas & Louisiana People: Construction business updates for February 2019 ENR 05-Feb-2019
- Satori Capital Invests in Able Machinery Movers Business Wire 11-Jan-2019
- TDIndustries Promotes Sheri Tillman to General Counsel CONTRACTOR Magazine 18-Dec-2018
- Pace of Work Holds Steady for Region's Subcontractors ENR 12-Dec-2018
- Silicon Valley?s Radical New Idea: Treat Employees Well AFKInsider 07-Dec-2018
- Big project, big time and cost savings Building Design & Construction 14-Nov-2018
- TDIndustries Wins Safety, Project Awards from ABC Contracting Business Magazine 09-Oct-2018
- CRE Opinion: Why Internships Matter For Our Industry's Future SideDish 02-Oct-2018
- See who's getting hired, promoted at Crescent Real Estate, Haynes and Boone and more for the first week of September. Biz Beat Blog 10-Sep-2018

TOP BUSINESS TWEETS

Powered By FirstRain

There are no recent tweets to show.

MANAGEMENT CHANGES

Powered By FirstRain

There are no management changes to show.

EVENT TIMELINE

Powered By FirstRain

DEC-2018

- TDIndustries Promotes Sheri Tillman to General Counsel 18-Dec-2018

NOV-2018

- Big project, big time and cost savings 14-Nov-2018

OCT-2018

- TDIndustries Wins Safety, Project Awards from ABC 09-Oct-2018

SEP-2018

- See whos getting hired, promoted at Crescent Real Estate, Haynes and Boone and more for the first week of September. 10-Sep-2018

AUG-2018

- How ABC Members Are Working Together to Include Women on the Jobsite 27-Aug-2018

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APPENDIX A: QUESTIONNAIRE

3. What is/are your corporate office location(s)?

Headquarters: 13850 Diplomat Drive, Dallas, TX 75234

TD also provides services out of the following office locations.

- Fort Worth, TX
- Richardson, TX
- Lubbock, TX
- San Antonio, TX
- Austin, TX
- Houston, TX
- Phoenix, AZ
- Tucson, AZ
- Denver, CO
- Midland, TX
- Amarillo, TX

4. Please provide a brief history of your company, including the year it was established.

TDIndustries - A Partnership of the Spirit

Established in 1946, TDIndustries has developed into one of America's premier facilities service and specialty construction companies. We are among the top 60 specialty Environmental / Mechanical/ Plumbing and Service companies in the United States and among the top 3 in Texas.

By creating a partnership with you, our customers, we are able to fulfill all your indoor environment needs through our diverse mix of life-cycle services and value-based solutions. TDIndustries is also among the most experienced facility construction companies in Texas. We know how to stage a project in an occupied building/campus setting, plan and implement the work with minimal disruption to the business at hand. In addition, our large pool of experienced technicians and installers gives TDIndustries the ability to deliver large-scale construction projects all at once on multiple campuses or at individual locations.

TDIndustries customers and employees work to fulfill our mission: We are committed to providing outstanding career opportunities by exceeding our customers' expectations through continuous aggressive improvement.

In-House Capabilities and Services – Our goal is to help you make the most of your investment in a facility. TDIndustries capably provides self-performed construction, installation, service and operations for the following systems that serve Government Entities existing facilities or ground-up construction projects.

- Energy Savings Performance and Management Solutions
- Facilities Maintenance and Operations / Facilities Management Services
- Building Automation Systems / Systems Integration Services
- Heating, Ventilation and Air Conditioning
- Plumbing / Electrical / Refrigeration
- Process and High Purity Piping
- Life Safety Systems
- Site-based Facilities Management Services

We believe that having more in-house capabilities than our traditional competitors adds tremendous benefit to Government Entities.

5. Who is your competition in the marketplace?

We are among the top 60 specialty Environmental / Mechanical / Plumbing, Building Automation, Energy Services and Mechanical Systems Service companies in the United States and among the top 3 in Texas. We consider the following as our competitors in our major markets:

- Letsos
- EcoLab
- Trane
- Brandt (Dallas)
- DSI
- Neva Corporation

6. What are your overall annual sales for last three (3) years?

- 2019 - $694,000,000
- 2018 - $630,992,356
- 2017 - $604,187,137

7. What are your overall public sector sales, excluding Federal Government, for last three (3) years?

- 2019 - $33,518,446
- 2018 - $52,876,388
- 2017 - $44,467,692

8. What is your strategy to increase market share in the public sector?

TDIndustries will steadily build market share by generating new, high quality leads through the strategic leveraging of tradeshows, marketing campaigns, and networking events. These leads will be appraised and the highest valued ones will be pursued with the full force of our marketing and sales teams. Our performance on these new and current projects in the market will lend to better leads and more references which in turn will increase our volume and value of opportunities and leads.

9. What differentiates your company from competitors in the public sector?

What makes TDIndustries stand out from our competitors is our in-house capabilities. We have the ability to perform Design/Build improvements with Government Entities to reduce utility and operating costs on both sides of the utility meter. The majority of the trade contracting work is performed by TD Partners, eliminating markup on trade subcontractor markup - providing unmatched value per dollar invested.

TDIndustries is wholly owned by employees and all employees have the ability to own stock. More than 70% of our employees own stock. Employees with an ownership stake have a greater incentive to provide value to customers and keep them with TD. We do not take shortcuts or take a short term view of our relationships with our customers. We thrive because our customers see this value and know that TD is the best place in the market to find it.

10. Please provide your company's environmental policy and/or sustainability initiative.

We are committed to helping to build a cleaner future! As our business grows, we want to make sure we minimize our impact on the Earth's climate. So we are taking every step we can to implement innovative and responsible environmental practices throughout Region 10 ESC to reduce our carbon footprint, reduce waste, promote energy conservation, ensure efficient computing, and much more. We would like vendors to partner with us in this enterprise. To that effort, we ask respondents to provide their companies environmental policy and/or green initiative.

TDIndustries believes in doing our part to make the world a greener place. By providing recycling bins at every desk and every trash location, reducing unnecessary printing of documents and eliminating the use of Styrofoam products in our offices, Partners eliminate tons of recyclables from ending up in landfills. Furthermore, we do our part to recycle as much waste as possible on worksites by providing a separate bin for items that can be re-purposed or recycled. TDIndustries is also committed to the environment in the projects we work on. We have completed over 50 LEED certified projects and employ over 40 LEED Accredited Professionals.

11. Diversity program - Do you currently have a diversity program or any diversity partners that you do business with?

☐ Yes

☒ No

a. If the answer is yes, do you plan to offer your program or partnership through Equalis Group?

☐ Yes ***N/A***

☐ No

(If the answer is yes, attach a statement detailing the structure of your program, along with a list of your diversity alliances and a copy of their certifications.)

b. Will the products accessible through your diversity program or partnership be offered to Equalis Group members at the same pricing offered by your company?

(If answer is no, attach a statement detailing how pricing for participants would be calculated.)

12. Diversity Vendor Certification Participation - It is the policy of some entities participating in Equalis Group to involve minority and women business enterprises (M/WBE), small and/or disadvantaged business enterprises, disable veterans business enterprises, historically utilized businesses (HUB) and other diversity recognized businesses in the purchase of goods and services. Respondents shall indicate below whether or not they hold certification in any of the classified areas and include proof of such certification with their response.

a. Minority Women Business Enterprise

Respondent certifies that this firm is an MWBE ☐ Yes ☒ No

List certifying agency: _____

b. Small Business Enterprise (SBE) or Disadvantaged Business Enterprise (DBE)

Respondent certifies that this firm is a SBE or DBE ☐ Yes ☒ No

List certifying agency: _____

c. Disabled Veterans Business Enterprise (DVBE)

Respondent certifies that this firm is an DVBE ☐ Yes ☒ No

List certifying agency: _____

d. Historically Underutilized Businesses (HUB)

Respondent certifies that this firm is an HUB ☐ Yes ☒ No

List certifying agency: _____

e. Historically Underutilized Business Zone Enterprise (HUBZone)

Respondent certifies that this firm is an HUBZone ☐ Yes ☒ No

List certifying agency: _____

f. Other

Respondent certifies that this firm is a recognized diversity certificate holder ☐ Yes ☒ No

13. Please summarize all products and services being offered.

Please see the pages 33-188 for the products and services that TD provides.

Air Handling

Type (e.g., central station-manufactured or custom makeup air, fan filter, coil sections):	Virtually unlimited Mixed Air Single Path, Mixed Air Dual Path, 100% outside air Single Path, 100% outside air Duct Path, Variable-Speed, Drives, Heat Pipes, Heat Wheels, Fixed-plate Heat, Exchangers, High R-Value Insulation, High-Efficiency Motors, Preheat Coil, Heating Coil Cooling Coil, Supply Fan, Air Flow Station, Humidifier Discharge Static Pressure sensors, Exhaust, Mixed Air Damper, Airflow Stations
Brand Name(s):	Ex. Johnson Controls/York
Fan Types (e.g., Backward incline, Forward curve, Airfoil):	Fan Coil/Blower Coils, Package AHUs, Modular AHUs, Custom AHUs, Fan Wall, Backward incline, Forced, Pull Through, Airfoil
Capacity Range (CFM):	0 to 100,000 CFM
Heating Medium (Electric, Gas, Steam, Hot Water):	Electric, Gas, Steam, Hot Water, Re-Heat
Cooling Medium (DX, Chilled Water):	DX, Chilled Water
Standard Warranty (Parts and Labor):	One year parts and labor
Optional Warranty (components covered and labor):	Up to 10 years parts and labor
Estimated Lead/Delivery Time:	6-8 Weeks
Location of Manufacturing (City, State, or Country):	Waynesboro, Pennsylvania
Range of Efficiencies:	Motors - 98% Efficiency
Estimated Market Share (North America):	30%
Provide example data on each type of product provided:	Please see Attachment A starting on page 74
Detail Features and Benefits:	**Mass Customization** - AHUs deliver custom-like performance and flexibility as well as being faster and more economical than was previously possible **Design Flexibility** - Offers variable-aspect-ratio sizing, plus a wide range of component/material choices **Faster Delivery** - Sophisticated computer engines speed-up the custom-manufacturing process of Johnson Controls AHUs **Flexible Factory-Packaged Controls** - No more limited control configurations: designers can now customize them to meet application requirements
Other Manufacturers:	Carrier, McQuay, Rheem, Ruud, Goodman, Lennox, Magic Aire, York, Johnson Controls, etc.

Air Terminal Devices and Heating Products

Type (e.g., VAV, Fan coils, Unit ventilators, Unit heaters, Fin tube radiation/convectors):	Virtually unlimited Electronic Variable-Speed Drive, Fan Coil Units, Heating and Cooling Coils, FlexSys Underfloor Air Systems, Unit, Ventilators, Variable-Air-Volume Terminals, Airside Technical Services, Single Duct Terminal
Brand Name(s):	Ex. Johnson Controls/York
Capacity Range (CFM):	0-6.000
Heating Medium (Electric, Gas, Steam, Hot Water):	Electric, Gas, Steam, Hot Water
Cooling Medium (DX, Chilled Water):	DX, Chilled Water
Standard Warranty (Parts and Labor):	One year parts and labor
Optional Warranty (components covered and labor):	Up to 10 years parts and labor
Estimated Lead/Delivery Time:	6-8 Weeks
Location of Manufacturing (City, State, or Country):	Waynesboro, Pennsylvania
Estimated Market Share (North America):	30%
Provide example data on each type of product provided:	Please see Attachment B starting on page 82
Detail Features and Benefits:	**Precise Zone Control** **Design Flexibility** **Lasting Components and Low Cost Operation** **A Variety of Controls** **Patented Flow Star Sensor Control** **Unique Electric Heat Design**
Other Manufacturers:	Carrier, McQuay, Rheem, Ruud, Goodman, Lennox, Magic Aire, Johnson Controls, Greenheck, Trane, etc.

Boilers & Water Heaters

Type (e.g., modulating, condensing, cast iron, water tube, packaged, other):	Virtually unlimited
Brand Name(s):	Ex. AERCO, Condensing Unit
Capacity Range (CFM):	Boilers 750-Mb h to 6000 Mb h; Water Heaters - 600 Mb h - 1350 Mb h
Heating Medium (Electric, Gas, Steam, Hot Water):	Gas, Propane, Dual Fuel
Standard Warranty (Parts and Labor):	Parts only-pressure vessel/heat exchanger is 10 years non-prorated, Control panel is 2 years. 18 months all other components
Optional Warranty (components covered and labor):	As per customer needs. Can create a customized optional warranty.
Estimated Lead/Delivery Time:	4 Weeks
Location of Manufacturing (City, State, or Country):	Vlauvelt, NY USA
Range of Efficiencies:	94-99%
Estimated Market Share (North America):	40%
Provide example data on each type of product provided:	Please see Attachment C starting on page 112 and Attachment D starting on page 122
Detail Features and Benefits:	Reliability: » Superior Construction Materials » Advanced Design and Components » Warranty Installation Advantages: » Venting Versatility » Space-Saving Design » Zero Side Clearance Environmental Advantages » O2 Monitoring System » Low NOx burner Advanced Controls: » C-More » Remote Data Collection » Boiler Management System
Other Manufacturers:	Hydro Therm, Precision Boilers, RBI Water Heaters, Superior Boilers, etc.

Building Automation Systems

Building Automation Systems **Please see Attachment "G-2"**	Type: Building Automation Systems/Systems Integration Services (BPSI Anti-Terrorism Facility Protection, Intelligent Irrigation Matters, Lighting, Metering, Security/Access Controls, System Integration)
	Personnel: All work performed by TD Partners
	Detailed Features and Benefits: TDIndustries develops, deploys, and supports the entire spectrum of intelligent automation and sustainability technologies because they save our customers money. Not only reducing energy costs, but maintenance and emergency costs as well. At the same time, smart systems increase overall efficiency and tenant satisfaction, and extend the life of your building. Our processes dramatically affect long-term planning and your bottom line. They drive efficiencies that, in the end, pay for themselves, including: » Total integration of the systems in your building » Reduce operating expenses » You get to make better system choices » A centralized location for all facility data » Web-based interface and open systems architecture » Real-time measurement » Increased tenant satisfaction » Increased employee productivity » Increased property value

ATTACHMENT "G-2"

BUILDING AUTOMATION SYSTEMS

EXECUTIVE SUMMARY

TD knows and deeply understands how seamlessly, efficiently and optimally buildings operate when they have the right automation and controls. And the truth is, these days you can't afford not to have them.

ENERGY AUDITING

That's why having automation and controls are so critical. They dramatically affect long-term planning and your bottom line. Plus they drive efficiencies that, in the end, pay for themselves, including:

- Total integration of the systems in your building
- Reduce operating expenses
- You get to make better system choices
- A centralized location for all facility data
- Web-based interface and open systems architecture
- Real-time measurement
- Increased tenant satisfaction
- Increased employee productivity
- Increased property value

Benefit to the Agency Members of Equalis Group— can make a dramatic difference in how intelligently your business operates. We're here to enhance your facility and guide you toward economies in all areas of your business. However, these days the one area in which you can get the most cost savings is in energy consumption. At the heart of energy savings is automation and controls.

BPSI ANTI-TERRORISM FACILITY PROTECTION

TD has an exclusive agreement with BPSI, the developers of the first complete chemical, biological, radiological, nuclear (CBRN) detection system that actively and reliably protects buildings, mass transit stations, stadiums and public events from airborne toxins. It's a breakthrough, mission-critical detection solution no building should be without.

INTELLIGENT IRRIGATION MATTERS

A number of technologically astute irrigation systems are available to help you manage your grounds. Should you need sprinkler systems with automatic sensors, we can provide them. Should you need a sustainable solution, we offer a system that captures and uses rainwater and gray water. But these are just a couple of the many innovative irrigation services available. You can rely on TD professionals' in-depth knowledge and understanding to guide you in determining which systems will be best for your facility.

BUILDING AUTOMATION SYSTEMS

EXECUTIVE SUMMARY

LIGHTING

Better lighting control increases productivity. That's why TD is ready with high-level conceptual solutions. We do it all – from design and implementation of new lighting systems to retrofits with existing operations. Either way, we make sure they are properly integrated with other critical building systems.

Sustainability is also paramount in terms of using energy efficiently, which is why TD offers clever daylight strategies to extend light in the workplace. Another unique offering is the manipulation and modulation of artificial lighting to reflect daylight availability.

METERING

TD enables you to have real-time knowledge about utility consumption. When you know what's going on, you save.

The industry-defining solution we offer is utiliVisor, a well-known Continuous Commissioning™ application. Our Web-based, continuous oversight process measures, presents and analyzes key facility indicators – 24/7. It calculates real-time operating cost, and monitors and archives critical building data. You can't afford not to use it.

TD can install meters and sub-meters, or even integrate with existing meters. Beyond savings on metering solutions, this can also improve your tenant billing accuracy.

SECURITY / ACCESS CONTROLS

Safeguarding your building is an area of expertise for us. That's why TD offers the most sophisticated systems available that include CCTV Camera Systems, Video Badging, Access Control and more. You can feel confident and secure that TD is watching out for you in every way.

SYSTEM INTEGRATION

Superior system integration means receiving one intelligent, comprehensive solution that provides effective streamlining of operations, lower installation costs and optimized energy efficiency. It also reduces operating costs, offers multiple protocol management, and gives you something that everybody wants: increased comfort and productivity in the workplace. At TD, you get all this and more, from the following specialized services:

- Custom Integration Solutions
- HVAC Control Systems
- Lighting Control Systems
- Direct Digital Controls
- Electronic Access Controls
- Video Badging
- CCTV Camera Systems
- Power Distribution
- Elevator Controls
- Planned Maintenance
- Emergency Systems and Services
- Software and Programming Support
- Operator Support and Training
- Remote Monitoring and Support
- Multi-Building Campus Integration
- Utility Metering Solutions
- Energy Use and Consumption Analysis
- Design Specification Consulting

Cooling Towers

Type (e.g., open, closed, evaporative, other):	Open, closed, evaporative, air cooled, hybrid
Brand Name(s):	Ex. Evapco
Capacity Range (tons):	Up to 5,000 Tons
Standard Warranty (Parts and Labor):	One year parts and labor
Optional Warranty (components covered and labor):	Up to 10 years parts and labor
Estimated Lead/Delivery Time:	10 Weeks
Location of Manufacturing (City, State, or Country):	Taneytown, Maryland
Range of Efficiencies:	493 to 21,960 kw
Estimated Market Share (North America):	20%
Provide example data on each type of product provided:	Please see Attachment E starting on page 136
Detail Features and Benefits:	Principle of operation IBC Compliant Easy Field Rigging Efficient Drift Wliminators EVAPAK® Fill Superior Air Inlet Louver and Screen Design Reduced Piping Costs Pressurized Water Distribution System Optimum Design for Freezing Climates Fast, On-Time Shipments
Other Manufacturers:	Delta cooling, Armstrong, Evaptech, Marley, Kemrock, Paltech

DDC Controls

Type (e.g., core components, end devices, lighting, panels):	Tridium Niagara AX Web-based Multi-protocol Building Management Platform with Distech, Vykon or Siemens Talon equipment controllers
Brand Name(s):	Ex. Tridium
System Protocol (BACnet, LonWorks, Proprietary or Combo):	BACnet LonWorks
LAN Communication Structure (Peer-to-peer, Polling):	MSTP I/P Peer to peer
Human Machine Interface (HMI) types (PC, Notebooks, Handheld terminals):	All systems installed by TDIndustries are web accessible using most popular browsers Access via mobile devices
Third Party Interface (Drivers and Gateways):	All building automation systems installed by TDIndustries utilizes open protocols In retrofit applications, integration to existing proprietary automation systems is done using protocol drivers and hardware gateways
Remote Alarm and Message Capabilities:	Remote alarming available via email or text message
Standard Warranty (Parts and Labor):	One year parts and labor
Optional Warranty (components covered and labor):	Up to 5 years parts and labor
Estimated Lead/Delivery Time:	6-8 weeks
Location of Manufacturing (City, State, or Country):	Tridium primary manufacturing facility Richmond, VA, USA
Estimated Market Share (North America):	40%
Provide example data on each type of product provided:	Please see Attachment F starting on page 142
Detail Features and Benefits:	Full integration capability for BACnet, LonWorkds, Modbus and other widely used protocols Distributed digital controls for HVAC, lighting and mechanical window shades Energy management programs, utility metering, data management UL864 rated smoke controls
Other Manufacturers:	Trane, Johnson Controls, ABB, BAC, Liebert, York, Distech, Siemens Talon

Energy Services

Type (e.g., Energy Tracking, Energy Analysis, Evaluation for Potential Upgrades, Demand Response, Rebates and others):	Energy Savings Performance & Management Solutions. » Energy auditing and facility assessment » In-house Design Engineering and Specification » Construction Project Management » Continuous Commissioning » Ongoing Maintenance and Support Services » Guaranteed Savings Performance Monitoring and Verification » Facility Staff and Occupant Training » Financing Procurement Support » Surge Protection
Define Processes for each type of energy services:	Energy Auditing and Facility Assessment » Preliminary Audit-Expert modeling and analysis of baseline energy usage and savings » Detailed Energy Audit-Project development and economic analysis • In-house Design Engineering and Specification • Construction Project Management » Procurement of materials and trade labor » Safety coordination by our in-house Certified Safety Professional and OSHA-Authorized Trainer • Continuous Commissioning • Ongoing Maintenance and support Services • Guaranteed Savings Performance Monitoring and Verification » Performance guarantee backed by a history of financial strength, organizational longevity • Facility Staff and Occupant Training • Financing Procurement Support Including Identifying and securing all available grants, rebates, and incentives available to offset Project costs.
Certifications of Personnel:	Certified Energy Manager - Association of Energy Engineers
List key personnel (factory, subcontract, others):	All work is performed internally Ken Scheepers - Project Manager III Chuck Swallow - VP of National Accounts Randy Heidrich - Sr. Manager Operations
References (public sector only): **Additional References and details available upon request**	University of Texas at Arlington Guaranteed Savings: $11,480,960 / 10 years Bobby Kirby, Director of Energy and Mechanical Ops 817.272.9392 Denton Independent School District Actual Savings: $3,928,625 / 3 years & 38 M Gallons of Water Paul Andress Director of Operations 940.369.0230
Case Studies describing benefits of services:	Please see the following pages.

ENERGY MANAGEMENT AT TEXAS TECH

Growing energy footprint requires improved monitoring

Texas Tech University has big energy needs. The university has a growing student population exceeding 36,000 and a campus spanning 1,839 acres. To rein in its energy costs, Texas Tech turned to TDIndustries to tackle this challenge through smart data tracking technology.

In 2000, Texas Tech began tracking its energy consumption in an effort to understand how and where energy was being used. Throughout the years, the university has developed a broad energy management program, which is aligned with Texas Government Code, Chapter 447.

In 2013, Texas Tech contracted with TDIndustries and utiliVisor, an energy management firm, to analyze the real-time operating data gathered from the various university energy plants and provide recommendations for energy efficiency. In 2017, TD began campus utility metering services, providing meter installation, monitoring and reporting for a wide range of energy sources including electricity, steam, steam condensate, chilled water, irrigation and domestic water.

TD works in partnership with Texas Tech's Building & Construction Department, which oversees the metering program, to identify upgrades or new meters needed on a building-by-building basis. TD installs the meters and runs the electrical supply and energy source to the meter. The meters are tied into data drops provided by Texas Tech. During a meter installation, the energy supply must be completely shut down, which requires close coordination with all affected departments to minimize any impacts to campus operations.

The TDIndustries Difference

- Metering installation, monitoring, and reporting for a wide variety of energy sources
- Smart data collection technology to understand and control energy consumption
- Dedicated Partners who take ownership of campus energy performance
- System troubleshooting to quickly identify issues with timely solutions
- Continuous quality service and access to specialty knowledge that would be too expensive to maintain internally

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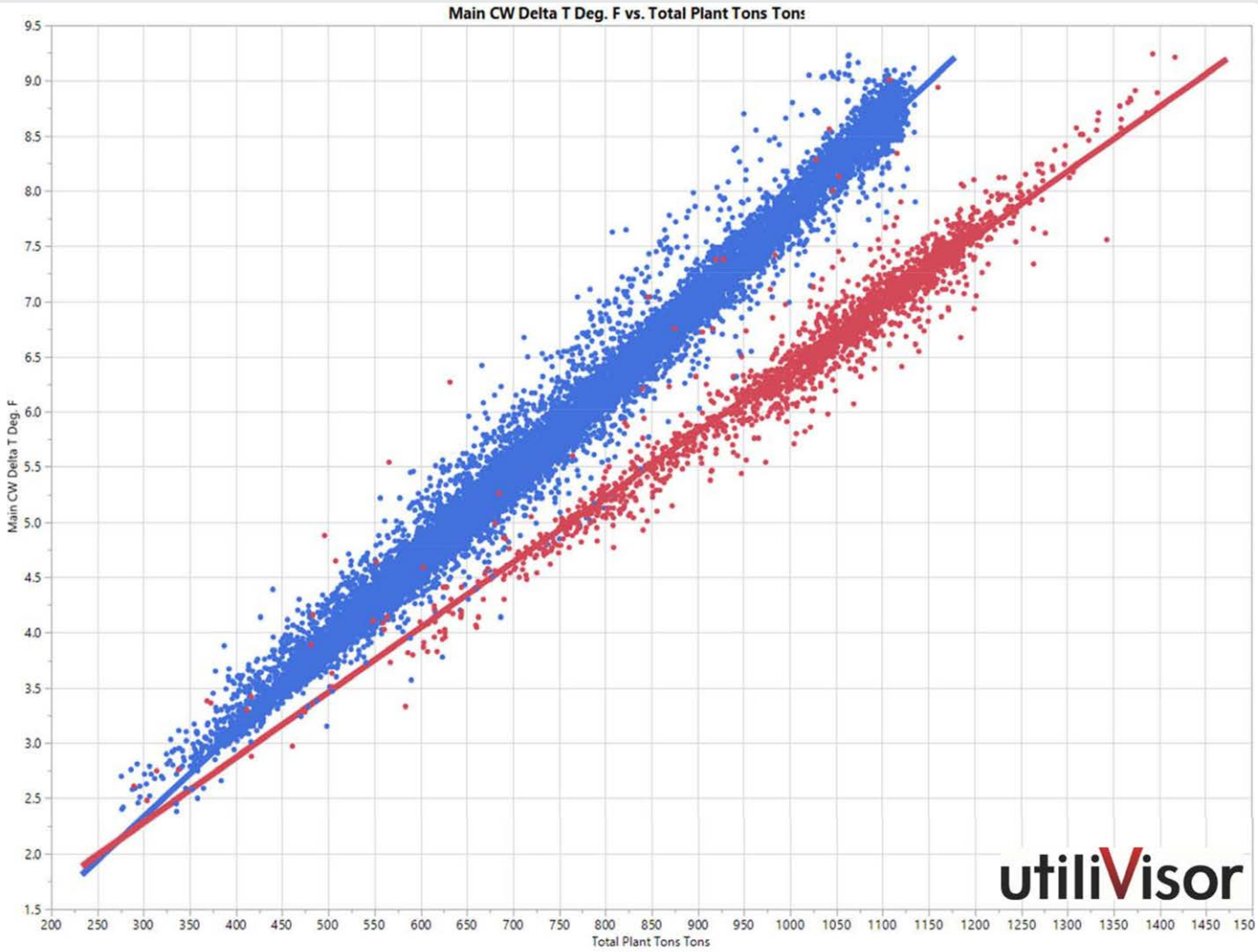
TDIndustries
At the Heart of Your Building



TD uses utiliVisor software to analyze real-time operating data from Texas Tech's mechanical plants. Many of the reports are similar to this example, which compare the plant's efficiency against industry benchmarks.

Once the meter is complete, the meter is integrated into the utiliVisor database for data collection. Using the different views of this versatile, state-of-the-art system, TD provides regular reports on:

- Consumption per meter
- Consumption per building
- Consumption throughout the campus

In addition, TD closely monitors campuswide energy systems to alert the university of any usage spikes or trends that may indicate a potential problem or risk.

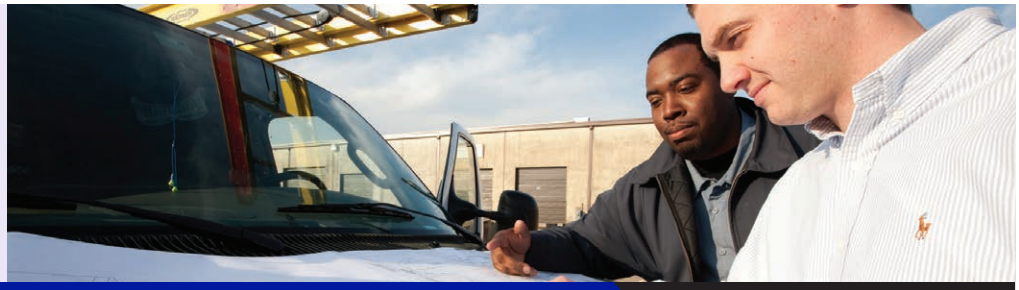
Texas Tech uses the collected information to balance the energy plant loads and integrate the data into its eSight Energy Accounting System. This specially designed system is used for campuswide monitoring and billing for non-educational buildings and common spaces, such as the student union. The information helps the university understand its energy consumption and costs and aids in the development of new energy saving initiatives.

Since 2000, Texas Tech's overall Energy Use Index (EUI), which tracks all energy used on campus, has shown a 37 percent decrease in energy usage, and from 2008 through 2018, the university reported $18 million in energy savings and an 18 percent reduction in the university's overall carbon footprint. Through close monitoring and analysis of its energy consumption metrics, Texas Tech has significantly reduced its energy consumption while expanding campus facilities to meet the needs of the increasing student population. Today, Texas Tech is recognized as a leader in energy efficiency, providing mentorship and lessons learned for other universities.

TDIndustries is proud to support Texas Tech and work in partnership to provide innovative solutions to help meet their energy performance goals.

TDIndustries

Attachment B-6.1



Energy Solutions

"Our commitment to innovation and sustainability in all aspects of energy-efficient planning and implementation ultimately means one thing for you: extended life for your plant and facilities with an optimal environment – and minimized environmental impact."

The TDIndustries Difference

- *Guaranteed reduced operating costs*
- *Tenant comfort and satisfaction grow exponentially*
- *TDLINKS Energy Audit pays back every cent+*
- *Extend the life of systems you already have*
- *Attain and retain your energy accreditation*
- *Empower highly accurate predictive budgeting*

The Face of Sustainability

TDIndustries (TD) is able to offer the most energy-efficient and environmentally sound solutions in the industry today because we've been committed to learning, adapting and applying new technologies as they are developed for a long time. Innovation drives our company. And a commitment to increasing sustainability drives every project we undertake for you.

Combine our commitment to sustainability and expanding innovation with powerful new means of collecting and analyzing data in real time. That's what we've done over the past 10 years, and we've worked tirelessly to exponentially increase the extent of our customers' control over facilities – all to reduce energy consumption and operating costs.

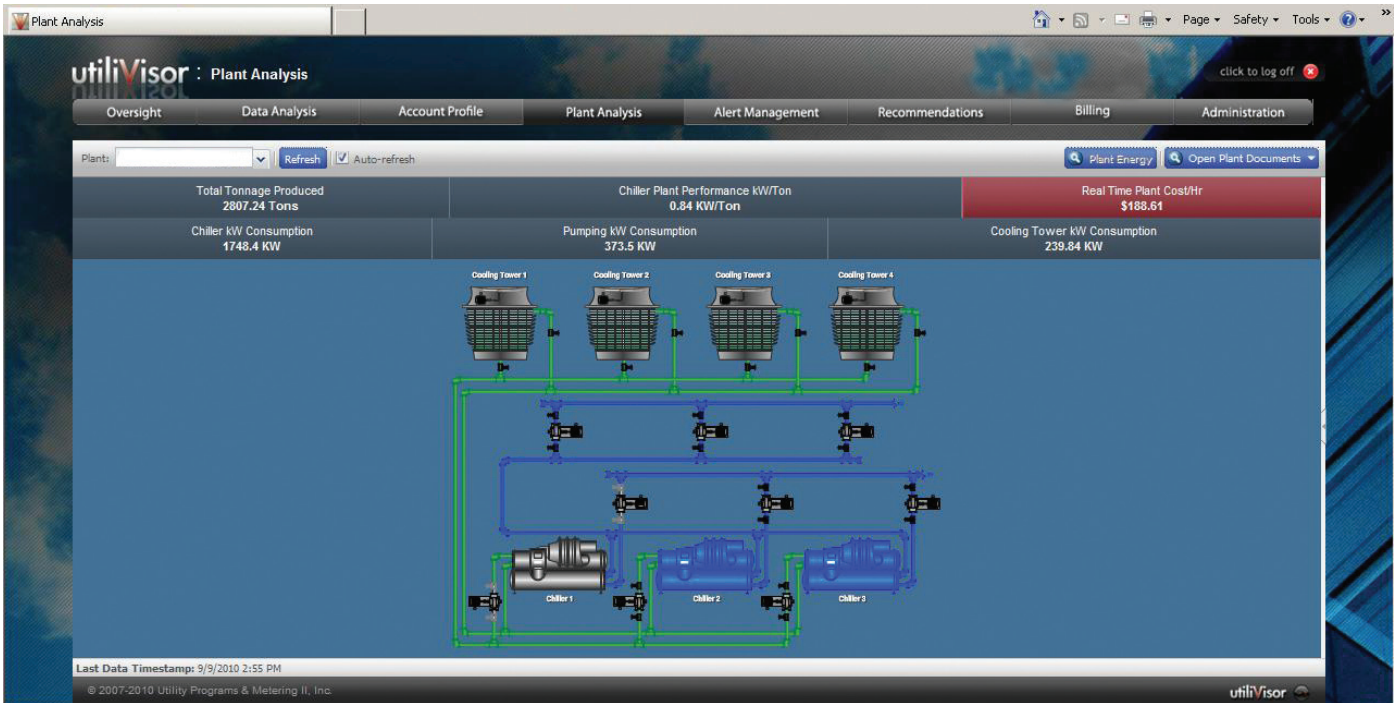
TD offers a full arsenal of energy solutions that includes a powerful array of energy audits and assessments, energy engineering, retrofitting, continuous commissioning, measurement and verification, building management systems and controls, and even financing to help your facility run cost effectively. It is in the optimal integration of all these initiatives that the sustainability of any building is maximized.

Energy Retrofits

If you operate an older building, you know how they can waste energy and burn capital. TD offers excellent services to modernize older, inefficient equipment operations, reduce utility, maintenance and operating costs, improve comfort, safety and compliance, and redirect capital to other needs.

THE FACE OF INNOVATION

tdindustries.com



New Buildings

Maximizing sustainability from the inception of a new building demands broad expertise and a singular focus on quantifiable ROI in all areas – cost, energy, time and more. Our goal is to offer our new building customers a no-risk business proposition with guaranteed savings, and verifiable results against worldwide standard protocols. Any shortfall can be made up by TD.

With our dedicated team of Certified Energy Managers, LEED-Accredited Professionals, Registered Professional Engineers and analysts, boasting memberships in EPA Green Light and Energy Star programs, we keep green objectives front and center when working on your project.

Building Oversight

For large, mission-critical chiller plants and CHP (Combined Heating and Power) environments, our utiliVisor™ building oversight strategy yields exponential savings and performance benefits related to the most complex and critical components of a facilities infrastructure. An expert team of operating engineers works with your staff to coordinate and manage this web-based, continuous oversight tool that:

- *Monitors, presents and analyzes key facility indicators – 24/7*
- *Leverages TD's extensive operations expertise*
- *Offers utility cost reductions of 5 to 25 percent*
- *Rescues and redeploys funds from inefficiencies back to your business*

Green Solutions That Mean Green Savings

For many customers, a determination to pursue green solutions begins with a routine maintenance or emergency service call that reveals a significant energy "challenge."

With precision metrics, and thorough data collection and analysis, we identify potential systemic and operational improvements to your sustainability. Better still, we have the depth of expertise necessary to ensure sensible, cost-effective implementation of those solutions.

Our commitment to innovation and sustainability in all aspects of energy-efficient planning and implementation ultimately means one thing for you: extended life for your plant and facilities with an optimal environment – and minimized environmental impact.

TDLINKS "Clicks" for You

No matter how big, small, new or old your systems might be, odds are you just don't know exactly what is driving your energy usage. How could you? With TDLINKS Energy Audit, you'll find out and be given a choice of actions to improve your efficiency. Our audit can chart the exact performance of your current or planned facility and then spell out how to optimize.

We start with an ASHRAE Level II audit, where we assess all controls and intelligent integrated systems. We report our findings to you, along with good/better/best optimization recommendations. Then our service teams implement the energy-efficiency and cost-saving measures accordingly. And all can be realized at no or low cost as operating expense or self-funded capital expense enhancements. Because the optimizations pay for themselves in reduced energy costs!

Contact us today to explore just how green your operations can be with our full range of energy solutions.

Count on TD to give you the sustainable advantage for the good of your building – and the planet.

TD SUPPORTS HIGH-IMPACT GROWTH AT DENTON ISD

Background

Founded in 1882, Denton Independent School District sits roughly 30 miles north of Dallas. One of the fastest-growing school districts in the nation, Denton ISD has grown its campus space from 3.5 million sf to more than 6 million sf since 2007. With 45 K-12 schools and educational facilities, it has counted on TDIndustries to maintain and operate these facilities for 29 years.

Challenges

Denton ISD's growth has been great for development, but also has come with growing pains. The school district has additional utility and energy costs, as well as increases in energy monitoring costs. With so many new buildings rising every year, the district quickly became overwhelmed with its manual monitoring method. One Denton ISD employee was calling every campus each month, then sending the bills to TD's engineering team to plug into a spreadsheet. Through this inefficient process, data was often 6-8 months behind.

Benefits of IFM for Denton ISD

- Cost reduction/mitigation
- Improved efficiency
- Right-sized support
- Utility monitoring
- Predictable cost structure
- Minimize backlog
- Single point of contact
- Growth options for employees

Solutions

TDIndustries provided two ways to combat these challenges:

Growing its facility maintenance team: As the district grew, TD's commitment did as well. TD flexed its labor and monitoring services to adequately fit the district's growing needs. With trained, onsite maintenance personnel, TD could control costs more efficiently than relying on service agreements. Currently, 25 Partners maintain and operate Denton ISD facilities.

Provide energy monitoring services: Using TD's energy tracking platform, TD automated the energy usage data and easily identified potential savings, problematic outliers, and improvements.

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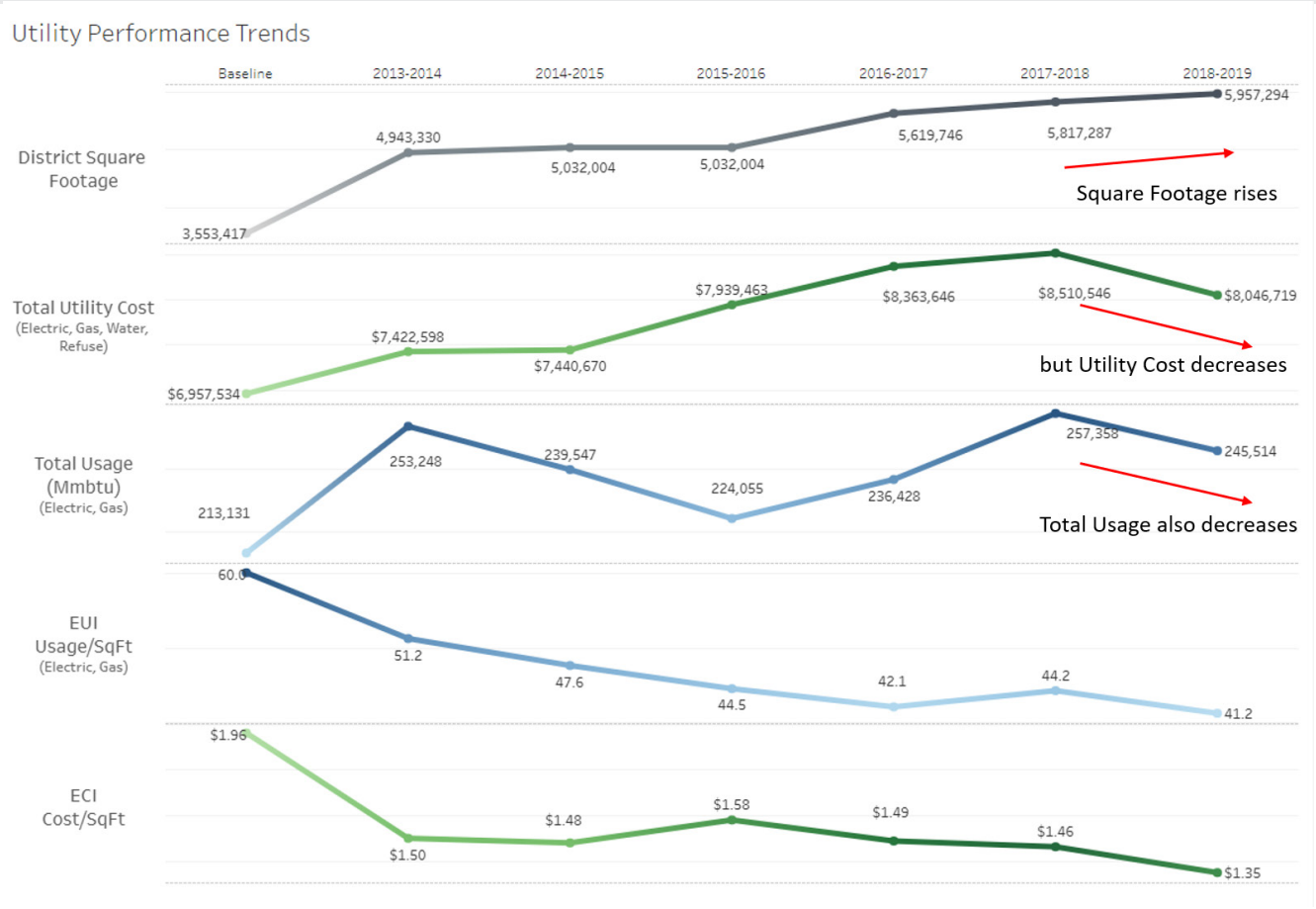
TD PROVIDES SAVINGS OPPORTUNITIES FOR DENTON ISD



Between 2018 and 2019, total square footage rose, but utility costs and total energy usage decreased.

Results

In 2018, TDIndustries saved Denton ISD almost $130,000 in utility bill savings – enough to hire two additional teachers, Superintendent Jamie Wilson said. These savings occurred while the total portfolio size increased from 5.8 million sf in 2018, to 5.95 in 2019. In that same time frame, total utility cost decreased from $8.5 million to $8 million, and total usage decreased from 257,358 million btu to 245,514.

Additionally, TD's energy monitoring service reduced natural gas costs by 25 percent.

Beyond energy monitoring, TD's energy tracking program helped to identify a water usage spike. TD identified this data outlier as a water leak and promptly fixed it. Without the software, the utility company estimated that 10,000 gallons of water would have leaked before the problem would have been identified.

"We really work hard to find as many innovative ways as possible to get resources in the classroom," Wilson said.

"One of the ways you do that is by having good partners who can help you do the different pieces that aren't necessarily educating students, but they're important for the work we do."

Energy Management Products and Systems

Energy Management Products and Systems **Please see Attachment "G-3"**	Type: Energy Auditing and Facility Assessment » Preliminary Audit-Expert modeling and analysis of baseline energy usage and savings » Detailed Energy Audit-Project development and economic analysis
	Personnel: All work performed by TD Partners
	Detailed Features and Benefits: » In-house Design Engineering and Specification » Construction Project Management » Procurement of materials and trade labor » Safety coordination by our in-house Certified Safety Professional and OSHA-Authorized Trainer » Continuous Commissioning » Ongoing Maintenance and Support Services » Guaranteed Savings Performance Monitoring and Verification » Performance guarantee backed by a history of financial strength, organizational longevity » Facility Staff and Occupant Training » Financing Procurement Support » Including identifying and securing all available grants, rebates, and incentives available to offset project costs

ATTACHMENT "G-3"

ENERGY MANAGEMENT PRODUCTS AND SYSTEMS

EXECUTIVE SUMMARY

Thank you for giving TDIndustries the opportunity to provide our proposal for Energy Savings Performance Contracting (ESPC). We are excited by the opportunity to serve The Cooperative Purchasing Network.

TDIndustries offers a full range ESPC Services. The need for innovation and continuous improvement methods has never been greater. With our leadership and training programs, we will put in place highly trained personnel to provide a turnkey project performing all key technical, management, and financial functions.

ENERGY AUDITING

TDIndustries uses a holistic approach that combines visual inspection, technical analysis, and interviews with facility staff in order that we may provide Equalis Group with an Investment Grade Energy. This approach enables our engineers to construct a detailed model that will provide the highest capacity for improvement and the best value to Equalis Group.

Benefit to the Agency Members of Equalis Group—Successful energy efficiency and infrastructure improvement programs resulting in realistic savings.

DESIGN ENGINEERING

The design engineering process emphasizes minimization of cost while providing quality designs. The same engineers that participated in the audits will complete the project design, create bid specifications, assist with construction management, and consult on operations. TDIndustries refers to this approach as the "closed-loop" management strategy, which insures consistency and a high degree of quality control throughout the project life cycle and is essential in providing Equalis Group with an integrated best value solution.

Benefit to the Agency Members of Equalis Group —Allows for a smooth transition from the development stage through the operations stage.

CONSTRUCTION MANAGEMENT

TDIndustries construction management team will inspect the work of all subcontractors for compliance with the design documents and ECM intent and will develop specific project acceptance criteria, startup, commissioning, and retro-commissioning processes. TDIndustries will focus intently on scheduling work in a manger that minimizes disruption while maintaining a safe environment.

Benefit to the Agency Members of Equalis Group —TDIndustries construction strategy will provide for fast payback items with short construction timelines to be installed first so that the customer will begin to realize savings early in the project.

ATTACHMENT "G-3"

ENERGY MANAGEMENT PRODUCTS AND SYSTEMS

EXECUTIVE SUMMARY

OPERATION AND MAINTENANCE

TDIndustries will provide a maintenance program for all or part of the contract term, as desired by Equalis Group, for all equipment installed under the project. Our role as one of the nation's most experienced Truck and Site-based Services provider and as an operator of central energy plants for a variety of facilities, has enabled us to become expert at developing maintenance plans that will help provide reliable operation with minimal downtime and operational disruption.

Benefit to the Agency Members of Equalis Group —You will receive a maintenance strategy that will be based on cost-effectiveness while ensuring that equipment remains in optimal operating condition through the application of sound preventative and predictive maintenance programs.

MEASUREMENT AND VERIFICATION PLAN DEVELOPMENT

TDIndustries places a great emphasis on the measurement of results and takes great pride in the performance of our projects. We will develop an annual Measurement & Verification (M&V) plan that best meet the requirements of Equalis Group and which will be in compliance with International Performance Measurement and Verification Protocols and with the Texas Energy Assessment Monitoring and Verification Guidelines.

Benefit to the Agency Members of Equalis Group —An agreed upon M&V plan that will clearly measure the results and protect Equalis Group from the potential of an under-performing project.

TRAINING

TDIndustries primary focus for education will be to ensure that the impacted people understand why changes are being made, the proper use of new equipment, and procedures for reporting equipment not performing properly. Technical training for facility personnel will be to provide comprehensive instruction on the operation, troubleshooting, maintenance, and repair of equipment and systems modified or installed.

Benefit to the Agency Members of Equalis Group —All parties working together to ensure improved comfort, reliability, and guaranteed energy savings on a sustained basis.

"TDIndustries has a team of dedicated professionals ready to support all of Equalis Group facility needs".

Equipment Parts and Supplies

Type (e.g., Manufactured parts, emergency parts, miscellaneous material and supplies and other):	Manufactured parts, emergency parts, miscellaneous material and supplies
Brand Name(s) stocked:	Virtually unlimited. As specified by Customer or Customer Preference
Location of stocking parts:	Various
Standard Warranty (Parts and Labor):	One year labor and parts
Optional Warranty (Components covered and Labor):	Up to 10 years labor and parts
Estimated Lead/Delivery Time:	Varies depending on equipment parts/supplies selected
Percentage of locally stocked parts to delivered parts:	TDIndustries does not keep on hand parts or supplies. We utilize JIT supply chain management and are able to utilize our purchasing power to obtain parts in a timely manner.
Detail Features and Benefits:	Varies depending on equipment parts/supplies selected.

Financial Services

Type (e.g., Leasing, prompt and pre-payment discounts, guaranteed savings and other):	» Pre-payment/prompt payment discounts » Guaranteed Savings as required by State Statutes » As required by Customers
Describe type of each funding and availability:	TDIndustries offers pre-payment/prompt payment discounts as well as Guaranteed Savings as required by State Statutes (Energy Savings Performance Contracting) or as required by Customers.
Funding Sources (internal and/or external):	Internal and external
List key personnel (internal and/or external):	Evelyn Miller - CFO 13850 Diplomat Drive Dallas, TX 75234
References (public sector only):	Bonding Agent: Ward & Moore Insurance Services 12700 Park Central Drive Suite 1440 Dallas, TX 75251 Contact: Doug Moore 214-221-8300 Bank (since 1989): JPMorgan Chase Bank N.A. 2200 Ross Avenue, 8th Floor TX 1-2939 Dallas, TX 75201 Contact: Credit Department Bank Officer: Andra Phillips Andra.S.Phillips@Chase.com 214-965-3959
Case studies describing benefits of services:	Please see the Denton ISD case study starting on page 31.

Fire Safety Products & Services

	Type: Code Compliance, Auditing, Design Engineering, Construction Management, Operation and Maintenance, Training Fire Suppression Systems and Services
Fire Safety Products & Services	Personnel: All work performed by TD Partners
Please see Attachment "G-4"	Detailed Features and Benefits: TDIndustries offers a full range of Fire/Life Safety and Fire Suppression Systems and Services. The need for innovation and continuous improvement methods has never been greater. With our leadership and training programs, we will put in place highly trained personnel to provide a turnkey project performing all key technical, management, and financial functions.

ATTACHMENT "G-4"

FIRE SAFETY PRODUCTS & SERVICES

EXECUTIVE SUMMARY

Thank you for giving TDIndustries the opportunity to provide our proposal for Fire/Life Safety and Fire Suppression Systems. We are excited by the opportunity to serve The Cooperative Purchasing Network.

TDIndustries offers a full range of Fire/Life Safety and Fire Suppression Systems and Services. The need for innovation and continuous improvement methods has never been greater. With our leadership and training programs, we will put in place highly trained personnel to provide a turnkey project performing all key technical, management, and financial functions.

CODE COMPLIANCE AUDITING

TDIndustries uses a holistic approach that combines visual inspection, technical analysis, and interviews with facility staff in order that we may provide Equalis Group with a detailed review of the current state of buildings fire alarm and fire suppression systems and current code issues that may impact the building and its occupants. This approach enables our engineers to construct a detailed report and a current code compliance matrix that will provide the highest capacity for improvement and the best value to Equalis Group.

Benefit to the Agency Members of Equalis Group—Successful life safety system and infrastructure improvement programs resulting in increased building occupant safety and current code compliance.

DESIGN ENGINEERING

The design engineering process emphasizes minimization of cost while providing quality designs. The same engineers that participated in the audits will complete the project design, create bid specifications, assist with construction management, and consult on operations. TDIndustries refers to this approach as the "closed-loop" management strategy, which insures consistency and a high degree of quality control throughout the project life cycle and is essential in providing Equalis Group with an integrated best value solution.

Benefit to the Agency Members of Equalis Group —Allows for a smooth transition from the development stage through the operations stage.

CONSTRUCTION MANAGEMENT

TDIndustries construction management team will inspect the work of all subcontractors for compliance with the design documents and project intent and will develop specific project acceptance criteria, startup, commissioning, and retro-commissioning processes. TDIndustries will focus intently on scheduling work in a manner that minimizes disruption while maintaining a safe environment.

Benefit to the Agency Members of Equalis Group —TDIndustries construction strategy will provide for fast implementation and short construction timelines while minimizing disruptions to the building occupants so that the customer will begin to realize life safety system improvements early in the project while minimizing disruption.

ATTACHMENT "G-4"

FIRE SAFETY PRODUCTS & SERVICES

EXECUTIVE SUMMARY

OPERATION AND MAINTENANCE

TDIndustries will provide a maintenance program for all or part of the contract term, as desired by Equalis Group, for all equipment installed under the project. Our role as one of the nation's most experienced Truck and Site-based Services provider and as an operator of facilities for a wide variety of clients, has enabled us to become expert at developing maintenance plans that will help provide reliable operation with minimal downtime and operational disruption.

Benefit to the Agency Members of Equalis Group —You will receive a maintenance strategy that will be based on cost-effectiveness while ensuring that equipment remains in optimal operating condition through the application of sound preventative and predictive maintenance programs.

TRAINING

TDIndustries primary focus for education will be to ensure that the impacted people understand why changes are being made, the proper use of new equipment, and procedures for reporting equipment not performing properly. Technical training for facility personnel will be to provide comprehensive instruction on the operation, troubleshooting, maintenance, and repair of equipment and systems modified or installed.

Benefit to the Agency Members of Equalis Group —All parties working together to ensure improved safety, reliability, and peace of mind on a sustained basis.

"TDIndustries has a team of dedicated professionals ready to support all of Equalis Group facility needs".

HVAC Refrigeration

Type (e.g., rotary, centrifugal, scroll, reciprocating, absorption):	Frick Compressors, Centrifugal, Scroll & Rotary Screw Compressor with 3 Step volume ration and continuous capacity control, Models 12-101
Cooling medium (e.g., air, water):	Air cooled & Water cooled
Brand Name(s):	Johnson Controls, Inc. / York
Capacity Range (tons):	210 to 6,000 Tons
Standard Warranty (Parts and Labor):	One year parts and labor
Optional Warranty (components covered and labor):	Up to 10 years parts and labor on all components
Estimated Lead/Delivery Time:	Depends on sizes and configurations
Location of Manufacturing (City, State, or Country):	Waynesboro, Pennsylvania USA
Range of Efficiencies (KW/Ton):	(740-21, 100 KW)
Estimated Market Share (North America):	60%
Provide example data on each type of product provided:	Please see Attachment G starting on page 123.
Detail Features and Benefits:	Quality, Satisfaction, and Reliability Energy Efficiency Engineered Control Systems Feature Q-Net Technology Guaranteed overall plant efficiency for cooling/heating
Other Manufacturers:	York, Copeland, Drake, Johnson Controls-Frick, TECUMSEH

HVAC Specialty Products

Type (e.g., modular, outside/inside, S&T heat recovery, humidity control, heat wheel, heat pipe, heat exchangers):	Heat Exchangers, Humidity Control, Heat Wheel, *Energy Recovery Units, Geothermal Heat Pump System, Ductless Systems, Oil Furnaces, Boilers
Brand Name(s):	Ex. Carrier
Heating Medium (electric, gas, steam, hot water):	Electric, Gas, Steam, Hot Water
Cooling Medium (e.g., DX Chilled Water):	DX, Chilled Water
Capacity Range (CFM and/or MBH):	1.5 to 2.5 MBH per 100 square Feet of total Building Feet 45 CFM to 7100 CFM
Standard Warranty (Parts and Labor):	One year parts and labor
Optional Warranty (components covered and labor):	Up to 10 years parts and labor
Estimated Lead/Delivery Time:	6-8 Weeks
Location of Manufacturing (City, State, or Country):	Collierville, Tennessee
Range of Efficiencies (KW/Ton):	9 SEER to 21 SEER
Estimated Market Share (North America):	35%
Provide example data on each type of product provided:	Please see Attachment G starting on page 123 and Attachment H starting on page 158.
Detail Features and Benefits:	Type: Wheel Nominal Airflow: 350 cfm Tilt Angle (Heating/Cooling): N/A Degrees Pressure Drop: 0.38 Inches
Other Manufacturers:	Mitsubishi, McQuay, Reem Ruud, Goodman, Lennox, Copeland, Magic Aire, TECUMSEH, Tecscoma, York, Johnson Controls

Installation and Turnkey Contracting

Type (e.g., retrofit, new construction, energy retrofit, controls new - and upgrade and other):	All types of Turnkey Contracting, Design/Build and Design Assist across all of TDIndustries specialties
Define Processes for each type install of the system or the equipment:	We take a lifecycle view in planning, designing, specifying and installing our mechanical construction solutions. Whether it's a new design-build project, an expansion or retrofit, our long-range perspective, balanced with your priorities, creates the optimal solution. Through our experience, we have focused a great deal of effort in key areas of our mechanical construction to ensure safe, on-time, on-budget completion of systems that work, and work well. These advances include our deep resources, which enable us to self-perform all of our jobs; our pre-fabrication/ manufacturing; our tools; and our startup process, which ensure successful commissioning.
Bonding and licensing capabilities:	Virtually unlimited
List key personnel (factory, sub-contract, other):	Use Organizational Chart located on page 210-211.
References (Public sector only):	Denton ISD Paul Andress Director of Operations 940.369.0230 Texas State University Destiny Llamas HUB Specialist 512.245.6243. City of Maricopa Dan Leonard Facilities Manager 520.316.6949 City of Houston Eric Alexander Senior Procurement Specialist 832.393.8704
Case studies describing benefits of services:	Please see the following pages for a recent design-build project TD completed.

RAYTHEON CONTINUES THRIVING WITH DESIGN-BUILD METHOD

Located in Richardson, TX at the upscale CityLine mixed-use development, Raytheon's new facility consists of three campus-style buildings designed to accommodate future expansion. With ideal security and privacy, a training room, full-service cafeteria, fitness center, an extensive data center, and a prime location near public transit and major freeways, Raytheon continues to thrive as a $24 billion defense contractor in the LEED-certified facility.

The Situation

When Raytheon was looking to relocate nearly 2,000 employees from its original campus built in the 1950s, they envisioned a state-of-the-art facility that would include high security, diverse workspace options, flexible meeting rooms, an abundance of windows, aesthetic designs, and satisfying dining options to attract and retain top-notch engineers. Raytheon needed to be out by the time their lease ended in 15 months.

The owner, KDC, sought to provide a new home impeccably tailored to Raytheon's culture, talent acquisition, and mission-critical needs. However, going from design to construction on a fast schedule wasn't feasible through the conventional plan-spec method. Due to Raytheon's nature of work, an expertise in working around sensitive compartmented information facilities (SCIFs) and other restricted areas was critical.

Raytheon
by the Numbers

- (2) three-story buildings
- (1) four-story building
- 500,000 sf approximate total
- (1) modular CUP
- Finished in six months

The Solution

By collaborating early through the design-build method, KDC and TD were able to tackle the aggressive timeline and later alterations with reliability and ingenuity. Weekly meetings with decision-makers, trusting relationships, and transparency played a pivotal role in streamlining the process. Constructability engineering, adequate manpower, minimal RFIs, and a no change-order guarantee were essential to completing the project on time and within budget.

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TACKLING AGGRESSIVE TIMELINES WITH RELIABILITY AND INGENUITY

TD provided mechanical and plumbing engineering design and construction for the three buildings including two three-story buildings and one four-story building. The facility included a fully prefabricated modular central utility plant (CUP) measuring 45 feet by 20 feet. The plant was manufactured offsite and installed within one day of delivery. By utilizing modular construction of the CUP, critical savings included one month of labor, as well as, significantly reduced equipment costs. Additional work included chilled water serving building A with DX rooftops serving buildings B and C.

Some of the cost saving and value-added innovations provided by TD's constructability engineers included spiral duct instead of rectangular duct, plug and play reduced pressure zone (RPZ) device in wall connect manifolds in each breakroom, and therma-fusers with a grill for huddle rooms. TD's expertise in building data centers, healthcare facilities, offices, and government facilities provided the best in security throughout the project.

The Success

The conventional plan-spec route would have taken at least a year to complete Raytheon's new home, but KDC's decision to pursue the design-build method with TD resulted in a 500,000 sf facility being finished in six months. TD's LEED-accredited professionals collaborated with KDC and Raytheon to meet necessary standards and criteria, and delivered a sustainable, innovative facility without compromising on quality and performance.

Raytheon is a prime example of TD's turnkey capabilities. Our Controls and Service Teams were awarded the contract to complete the full life-cycle of the building. TD Controls' knowledge of the project from their early involvement, with budgeting and designing the building controls, was key to the project's success – bridging the gap between our construction group and service as they began their service agreement for HVAC, electrical, fire/life safety, and automation.

"The performance of TD has not only met but surpassed our expectations for the Design-Build implementation. The D-B approach and the level of team work between TD and Walker Engineering has been key to the success of the project, allowing the team to be nimble, flexible and responsive to Raytheon's ever-evolving needs and still meet our contractual commitments."

– Mike Rosamond, KDC Executive VP

Invertors

Brand Name(s):	Ex. Carrier
Capacity Range (HO):	2.5 to 4Hz or 10 to 14HP on a 200HP Motor
Standard Warranty (Parts and Labor):	One year parts and labor
Optional Warranty (components covered and labor):	Up to 10 years parts and labor
Location of Manufacturing (City, State, or Country):	Collierville, Tennessee
Estimated Lead/Delivery Time:	Currently in stock for standard compressor needs and 3-5 days on specialty needs for inverters. The quantity of invertors could also result in a delay of lead time as well.
Estimated Market Share (North America):	35%
Provide example data on each type of product provided:	Special Magnetic flux vector control VFDs Power Range: Single phase 1.5kw to 2.2kw 3 Phase Integrated RS485, Modbus-RTU communication Protocol 32 Bit high speed CPU special for ac motor controlling Built in braking unit the VFD Braking, 15kw Power to Lower Please see Attachment I starting on page 166 for more information.
Detail Features and Benefits:	High Performance Optimized voltage space Vector V/F algorithm and high efficiency VFD low Noise and low electromagnetic interference. Motor Speed monitor function allow smooth start for various loads such as centrifuges and de-watering machines anytime.
Other Manufacturers:	ABB, Emerson, Liebert, Johnson Controls, York

Professional Services

Type (e.g., Engineering, Design, Drafting, Architectural, Project Management and other):	Engineering, Design, Drafting, Architectural, Data Management
Describe type of each professional service and availability:	In terms of our Design-Build capabilities, out theory is that your mechanical system is the engine-the-heart of your facility. When your system is running smoothly and seamlessly, your business hums along. That's why you can rely on TDIndustries to deliver superior results with anything you can hand us new systems, expansions or change-outs. We bring several innovations to the table including: Mechanical Engineering services for Design Build HVAC/ Plumbing and DDC Controls, Building Information Modeling for HVAC/Plumbing design/duct/pipe fitting/prefabrication. LEED certification for Design/Build & Assist Projects.
Licensing and certification capabilities:	TDIndustries has several licensed registered Engineers and LEED accredited professionals. Certified Energy Manager (CEM)
List key personnel (internal and/or external):	All work performed by TDIndustries Engineering Group
References (public sector only):	Lone Star: Greene's Point Campus - Houston, TX Wendy Hipes: 713-996-2799
Case studies describing benefits of services:	Please see the following pages.

TDIndustries

At the Heart of Your Building

Lone Star College

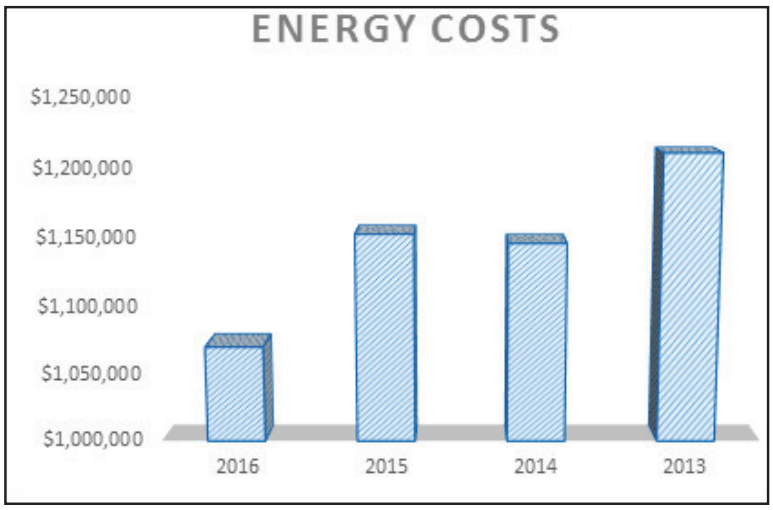
Case Study

Facilities Management & Energy Solutions

PARTNERS PROVIDE SOLID FACILITIES MANAGEMENT AND ENERGY SOLUTIONS AT THE NORTH HARRIS CAMPUS

Situation

Lone Star College is a higher education system based in Texas that serves the local communities of Houston, Conroe and The Woodlands. TDIndustries (TD) provides Facility Management Services to five of Lone Star College's campuses, encompassing more than 1 million square feet of campus space. Before TD began work, the Lone Star College System was managing the maintenance operations with their own employees. The operations at these North Harris campuses were outsourced to TDIndustries Facilities Partners to allow the Lone Star managers the ability to focus on their business of educating the 18,000 students that attend these campuses.



Solution

TD brought its industry-leading capabilities with critical systems and technician management. Using a hybrid staffing model, TD was able to bolster Lone Star College's existing facilities team. Through continued efforts with safety training, efficient scheduling in the equipment maintenance and work order system, TD's onsite team has been a renewed asset to the campus staff.

Success

The total facilities management approach employed at the Lone Star College System, has allowed TD to do more with less. The existing Lone Star facilities personnel are key to the daily campuses deliverables. TD has provided ancillary management of this team to control daily operations, allowing the TD staff the ability to build additional value offerings for the customer.

An initial water savings project at the North Harris Campus was started within the first six months of the contract starting. TD invested an additional $17,250 annually to upgrade the water treatment control, monitoring, and chemical feed equipment. Experienced TDPartners also saw an opportunity to reduce costs by correcting and metering the blowdown from the cooling tower. TD capitalized on water treatment recommendations to change the make-up water feed to the cooling tower and use less total water for cooling. All of these program changes and upgrades aided in removing mineral deposition from the equipment in the central plant. The efforts improved the efficiency of the campus HVAC equipment and uncovered a healthy operations cost savings for the Lone Star North Harris Campus. These gained efficiencies lead to a total utility cost reduction of $59,643, in the 2016 fiscal year.

Savings aside, the customer is pleased with TD's ability to provide full facilities management with an impeccable safety record – 100% no incidents – and both parties look forward to a long and prosperous relationship.

www.tdindustries.com

From maintaining aesthetics to management of Lone Star College's staff, the full range of services includes:

Mechanical, electrical and plumbing (MEP) services

Landscaping

Elevator maintenance

Housekeeping and related paper products

Pest control

Fire, life and security systems

Specialized roofing

Building automation systems

TDIndustries

Health & Biomedical Sciences Center Case Study

The University of Houston Accelerates Biomedical Center Construction

TDIndustries Establishes Milestones and Meets Them

The University of Houston's (UH) Health and Biomedical Sciences Center Building is an approximate 172,000 square foot, six-story building with a mechanical penthouse connected to UH's College of Optometry. The $68 million research and patient eye-care facility was designed using green/ sustainable principles and includes an ambulatory surgical center, The Laser Center, specialized research laboratories, animal care facilities, offices, seminar spaces, a new conference facility, and classrooms. The project also includes the construction of a 16,000 square foot satellite central plant to support the new facility.

THE FACE OF INNOVATION

tdindustries.com

The Situation

In its trek to achieve Tier One status, UH has embarked upon a major capital projects initiative. The Health and Biomedical Sciences Center (HBSC) Building represents a bold step toward becoming an integrated, cross-disciplinary research facility necessary for a Tier One university.

UH engaged Tellepsen Builders as the Construction Manager at Risk for the project. Tellepsen turned to TDIndustries to construct the central plant that will support the new facility.

UH set an aggressive construction schedule with a start date of November 2010 and an expected completion in late 2012. One of the major milestones was for the structure to be "air on" within six months of the start date.

The Solution

TD quickly focused on the schedule and developed its plans to meet milestones while working on a restricted jobsite connected to an occupied facility. Expectations were for an extremely fast schedule, beginning with 80% documents and having the majority of the rough-in completed with "air on" by the six month deadline.

TD's scope included:

- Building a completely independent 2, 250 ton central plant with cooling tower and associated pumps and pipe valve fittings, and
- Installing high pressure steam boilers that provide steam to water heat exchangers, steam to clean steam heat exchangers and clean steam to the Vivarium on Level 6.

Elements of TD's processes and technologies to meet scope deliverables included:

- Building Information Modeling (BIM) to provide 3-D coordination in the planning phase, and
- Prefabrication of central plant and skid mounted systems along with air handling unit hookups.

These tactics proved invaluable in accelerating the pace of work and TD's ability to meet the client's milestones.

The Success

TD met the "air on" date and the project is on schedule for its 2012 completion date. Tellepsen has been impressed with TD's ability to respond to changing situations in a timely and professional manner, its attention to precision work and its commitment to safety.

Pumps

Type (e.g., single stage, split case, end suction, inline, circulator, turbines):	Single stage, Split Case, End Suction, Inline, Circulator, Turbines, Domestic Cold Water, Waste Water Dosing and Disinfection, Multi Stage*, Systems Chill Water, Systems Hot Water, Centrifugal Pumps, Screw Pump, Gear Pump, Vacuum Pump, Any Type pump for application needs
Brand Name(s):	Ex. Sulzer
Capacity Range (GPM):	Any GPM can be manufactured as required for Job/Project
Standard Warranty (Parts and Labor):	One year parts and labor
Optional Warranty (components covered and labor):	Up to 10 years parts and labor
Estimated Lead/Delivery Time:	6-8 Weeks or unless pump is in stock
Location of Manufacturing (City, State, or Country):	Easley, South Carolina Portland, Oregon Houston, Texas
Range of Efficiencies (KW/Ton):	65% Minimum 85% for motors up to 15kw 90% for motors above 15kw
Estimated Market Share (North America):	20%
Provide example data on each type of product provided:	Please see Attachment J starting on page 177.
Detail Features and Benefits:	Multiphase Pumps: » Helicoaxial stages axially compress the effluent to avoid separation and gas binding » Stage design changes to compensate for gas compression through the pump » Horizontal (onshore) or vertical (subsea) configurations to fit the application » Subsea qualification testing and JIP projects welcomed » Variety of sizes available from 1 to 10 MW to suit the field development, production and decline Main Applications » Remote or subsea multiphase pressure boosting Main Design Features » Helicoaxial stages » Cartridge construction for retrofitting ease as field conditions change » Sulzer pressure boundary design experience to 1000 bar » Variety of performances: single-phase, multiphase or hybrid » Variety of performances: Motor, GT, high-speed permanent magnet motor, etc.
Other Manufacturers:	Myers, Gundfos, Sta-Rite, Hydroflo, Bell & Gossett, Pumps, Goulds

Service & Maintenance

Type (e.g., Preventative and full maintenance contracts, man-at attendance, remote monitoring, annuals, emergency services, regulatory compliance, cleaning) (e.g., duct, coils, and filters):	(Oil, refrigerant, vibration, chemical analysis, annuals, full maintenance, preventative maintenance) We offer complete HVAC, Plumbing, and Electrical scheduled maintenance services
Define Processes for each type of services and/or maintenance of the system or the equipment:	Service, Repair, Replacement and Maintenance of HVAC equipment (including but not limited to Air Cooled and Water Cooled Chilled Water Systems, Split Systems, Package Units, Computer Room Air Conditioners, Variable Frequency Drives, Fan Powered Boxes, and VAV boxes). Maintenance includes performing, at designated intervals, annual and routine planned maintenance inspections of HVAC equipment per manufacturer's specifications and requirements with the goal of extending the equipment's useful life through proper operating conditions. Inspections will include a combination of assessments and cleaning of condensers, evaporators, coils, condensate lines and drains, filters, belts, electrical connections and safeties, refrigerant systems, heaters, blowers, bearings, and motors. Equipment will also be inspected for proper airflow, pressures, temperatures, and operating issues such as short cycling, vibrations and noises.
List of key personnel (factory, sub-contract, other):	Please see Org Chart on pages 210 and 211.
References (public sector only):	Please refer to proposal references on page 284.
Case Studies describing benefits of services:	Please see below.

Lake Dallas ISD – Lake Dallas, Texas

TD services a variety of schools in Lake Dallas ISD to make sure that their HVAC and refrigeration equipment is highly functional and passes inspection. Our technicians are on call to help ensure that equipment is operating efficiently and reliably, especially during peak seasons. Scheduled maintenance includes HVAC preventative measures, commercial refrigeration, filters, building automation control systems support, rooftop units, ice machines, split systems, and air unit planned maintenance tasks.

Site Surveys

Type (e.g., equipment, system analysis, operational, architectural and other):	(Equipment, system analysis, operational architectural) Equipment, system analysis, lifecycle cost analysis, design-build/assist, preparation of as built diagrams, 3D modeling of plant, piping, ductwork, etc.
Describe type of survey:	In-house capabilities, complete building modeling for System Analysis/Energy use modeling, etc.
Licensing and certification capabilities:	Certified Energy Managers - Association of Energy Engineers. Licensed Engineers
Advanced technology uses for each type of survey:	With new, and existing facilities, generating ongoing energy savings can be achieved through a comprehensive monitoring-based commissioning (MBCx) process to ensure that all building systems remain "in tune". It is common knowledge that buildings rarely perform as intended.
List key personnel (internal and/or external):	TDIndustries Engineering Group
References:	» Texas Women's University, Denton Campus » George Bush Intercontinental Airport, Houston » University of Texas, Arlington » Fountain Place, Dallas » City Place, Dallas
Case studies describing benefits of services:	**UT Arlington:** » Chiller efficiency caused by evaporator approach which is never a part of the commissioning agents scope repaired by the Mfg. under warranty » Cooling Tower VFDs had issues repaired by the Mfg. representative under warranty » Cooling Tower performance issues and improper flow meter installation issues identified **TWU Denton:** » TWU Denton has 3 chillers, 115 data points with a service cost of $27,400/year » The average plant operating cost avoidance is 15.5% or $44K annually

Startup and Commissioning

Define process for validation of system or equipment operation to design:	Commissioning is a systematic documented process to ensure that facilities, systems, and equipment meet established design requirements and operation design intent. The Commissioning process verifies the following: » The equipment that was specified for installation was properly installed per engineer design and the manufacturer's recommendation. » Functions within designed airflow, design pressures and performance and functions per purpose. » The operation and design criteria was meet and performance is demonstrated to the engineer and owner. » Demonstration to the owner on proper preventive maintenance requirements per the manufacturer's recommendation to maintain warranty requirements and are performed to train the owner of the equipment.
Type (e.g., equipment startups, system checkouts, control verification, retro commissioning, M&V verifications, rebate auditing, other):	Start-up Prior to starting equipment or systems, obtain and review manufacturer's installation, starting and operating instructions Use manufacturer and supplier's trained personnel where necessary to maintain validity of manufacturer's warranty Compare actual installation with manufacturer's recommended installation. Correct deviations detrimental to equipment performance prior to starting equipment. Refer to the contract regarding the requirement of pre-existing and/or owner furnished equipment System Checkouts: Air Handling Units, Chilled Water Coils, Chiller(s), Cooling Tower(s), Boiler(s), Deaerator(s), Condensate Pumping Unit(s), VAV/CT Terminal Box(es), Chilled Water, Cold Water, Heating Hot Water Pump(s), Steam and Condensate piping, Heating Water Piping, Steam and Condensate Piping. Control Verification: The commissioning process starts with verifying the control inputs and outputs on a point-to-point basis. Calibration of each analog input and output using an independent and certified measurement device for temperature, pressure, and accurate readings on the graphics. The test will also include the sequences of operation in all normal modes and verify the points against the intended functionality of the system as a whole. Retro Commissioning: Retro commissioning is a process that seeks to improve how building equipment and systems function together. Depending on the age of the building, retro commissioning can often resolve problems that occurred during design or construction, or address problems that have developed throughout the building's life.

List key personnel (factory, sub-contract, other):	Tasos Banos Sr. Vice President TDIndustries Peyton Hill Operations Manager
References (Public sector only):	Memorial Hermann Pavilion II 6411 Fannin Street Houston, Texas 77030 Chris Barrow - Project Manager 713.996.2459 Memorial Hermann Katy 23900 Katy Freeway Katy, Texas 77494 Chris Barrow - Project Manager 713.996.2459 University of St. Thomas Chase Morris - Project Manager 832-309-2646
Case studies describing benefits of services	Scott White Hospital Dollar value of the Agreement to date: $27,168,746 Dollar value received relative to the Cx: $1,245,000 MD Anderson Cancer Hospital Dollar value of the agreement to date: $350,000,000 Dollar value received relative to the Cx: $2,500,000 Performed commissioning tasks and acted at the commissioning agent, performing design document and submittals reviews, oversaw the development of the commissioning plan, start-up, and pre-functional, and functional test procedures. Witnessed the pre-functional and functional tests of the MEP systems, and developed a detailed corrective action log which the contractor was required to implement. Witnessed the retesting of deficient systems, and observed and verified owner training was successfully completed, no delays were on this project.

Unitary

Type (e.g., rooftops, split systems, VRFs, heat pumps, PTACs, water-source, mini splits):	Rooftops, *Split Systems, DX, VRFs, Heat Pumps, PTACs, Chill/ Hot Water
Brand Name(s):	Johnson Controls / York
Capacity Range:	RTUs 25, 30, and 40 Tons RTUs 50 through 65 Tons Series 100 Single Package Units
Heating Medium (Electric, Gas, Steam, Hot Water):	Electric, Gas, Steam, Hot Water
Cooling Medium (DX, Chilled Water):	DX, Chilled Water
Standard Warranty (parts & labor):	One year parts and labor
Optional Warranty (components covered & labor):	Up to 10 years parts and labor
Estimated Lead/Delivery Time:	6-8 Weeks
Location of Manufacturing (City, State, or Country):	Collierville, Tennessee
Range of Efficiencies (EER, SEER, COP):	Up to 16 SEER, Energy Star Qualification
Estimated Market Share (North America):	40%
Provide example data on each type of product provided:	Please see Attachment K starting on page 181. 1.5 to 5 Ton 208-230 Volts Heavy Gauge Galvanized Steel Construction Single Stage Scroll Compressor
Detail Features and Benefits:	Models meets the Department of Energy's higher EER rating required to meet the region's minimum efficiency.
Other Manufacturers:	Carrier, Mitsubishi, Rudd, McQuay, Reem, Goodman, Lennox, Trane, Greenheck

Warranty

Type (e.g., Extended parts & labor, define maximum number of years available, delayed start-up and other):	Extended parts & labor up to 10 years, delayed start-up
Define processes for each type of warranty:	Priced as an option to Customer-lowest lifecycle cost at time of purchase. All equipment warranties on all products installed by TDIndustries are captured in a master database - New Construction/Retrofit, & Service replacements. Should a warranty claim arise, the database provides the feedback loop to our Project Managers to initiate the warranty claim with the appropriate manufacturer, dealer or distributor. Turnaround time is dependent on the Supplier, but TDIndustries will leverage our size and buying power to help Suppliers prioritize our replacement delivery and if necessary, we will provide temporary heating/colling if the problem leaves our Customer without comfort in the meantime.
List key personnel (factory, subcontract, other):	Please refer to Org Chart on pages 210 and 211.
References (public sector only):	Denton Independent School District - 2 years parts and labor Richardson Independent School District - 2 years parts and labor Fr. Stockton Independent School District - 5 year parts and labor
Case studies describing benefits of services:	Lone Star College Woodlands, a customer on Facilities Preventive Maintenance agreement, found five IT rooms were not cooling. This caused the door to stay open and dependent on the building cooling system to remove the heat load from the equipment rooms. After investigating, it was found that the liquid line set was not installed per manufacturer's requirements and was missing a Freon trap system. This caused all the oil to relocate in the evaporator coil instead of the compressor, which is required for lubrication, causing the compressor to fail as well as several electrical safety devices in the system. TDIndustries acting as the warranty administrator for the project was able to order all five compressors which were no longer manufactured and locate several electrical safety devices for the system and install the trap system required fore proper colling to the IT areas in the building.

Indoor Air Quality Products and Devices

Type (e.g., rooftops, split systems, VRFs, heat pumps, PTACs, water-source, mini splits):	TDIndustries does not utilize active polarization, non-ionizing, and electronic air cleaning systems due to their harmful nature. We utilize Foster products 4030 & 4020 for microbial remediation.
Brand Name(s):	Foster
Capacity Range:	N/A
Standard Warranty (parts & labor):	One year labor and materials
Optional Warranty (components covered & labor):	Up to 10 years parts and labor on all components
Estimated Lead/Delivery Time:	1-5 days
Location of Manufacturing (City, State, or Country):	Houston, Texas
Range of Efficiencies (EER, SEER, COP):	N/A
Estimated Market Share (North America):	60%
Provide example data on each type of product provided:	Attachment L starting on page 185
Detail Features and Benefits:	The outstanding Foster® product line of surface coatings and accessory products are designed for air handling systems and for walls and ceilings to promote and/or maintain excellent indoor air quality (IAQ). Foster IAQ products are scientifically proven to be effective in worst case scenarios through extensive ASTM D-5590 testing.

YORK® SOLUTION® AIR-HANDLING UNITS

ATTACHMENT A

Design without limits

YORK
BY JOHNSON CONTROLS

TDIndustries

Solution® air-handling units experience and flexibility

We've built Solution units for all types of commercial, institutional, and industrial facitlities.

Names you know and trust

YORK® Solution® air-handling units (AHUs) by Johnson Controls – the only names you need to know for an AHU line that has no limits, ranging from basic indoor units up to penthouse mechanical-equipment rooms. And whatever the air-handling challenge – IAQ, acoustics, energy, controls, you name it – Johnson Controls has the experience to build a Solution AHU that will meet your needs.

In the air-handling business, the reputation and experience of the manufacturer is as important as the product. Johnson Controls has been manufacturing air-handling equipment since the 1950s. Then, in the 1990s, we acquired two of the most well-known and respected AHU companies in the business: the PACE Company and the Miller-Picking Corporation. Their 100-plus years of experience have now been joined with the worldwide engineering, manufacturing, service, and support of Johnson Controls, a Fortune 80 firm with a 125-year legacy in HVACR technology. The result is a company dedicated to providing uncompromising solutions for your air-handling needs.

For commercial and institutional facilities, for industrial manufacturing and process operations, and for critical hygienic applications in hospitals and cleanrooms, Solution AHUs can be built to handle any requirement – no limits.

Design it your way, every time, every way

Dimensional flexibility: Space constraints are a reality on most construction projects. Why be constrained by fixed AHU sizes? Solution AHUs offer variable aspect-ratio, so you can design the unit to fit the application and the space. And if rectangular-shaped units can't fit the space, units can be configured to fit within just about any existing space or around any obstacle. L-shaped and T-shaped units, stacked units, notched units – we can do it.

Material flexibility: We offer a complete line of construction materials, including galvanized steel, pre-painted steel, stainless steel, and aluminum.

Component flexibility: To enable you to meet any AHU requirement, Solution units offer every available air-handling component. And as technology creates new capabilities, Johnson Controls will apply these to our Solution line.

EXPERIENCE? WE'VE BUILT AHUs FOR ALL THESE

- Commercial space: office buildings, theaters, performance halls
- Institutional space: schools, universities, churches
- Industrial manufacturing: automotive, aerospace, chemical, petrochemical
- Hygienic systems: hospitals, life sciences, R&D facilities, food processing, cleanrooms
- Process manufacturing: pharmaceutical, electronics, semiconductor

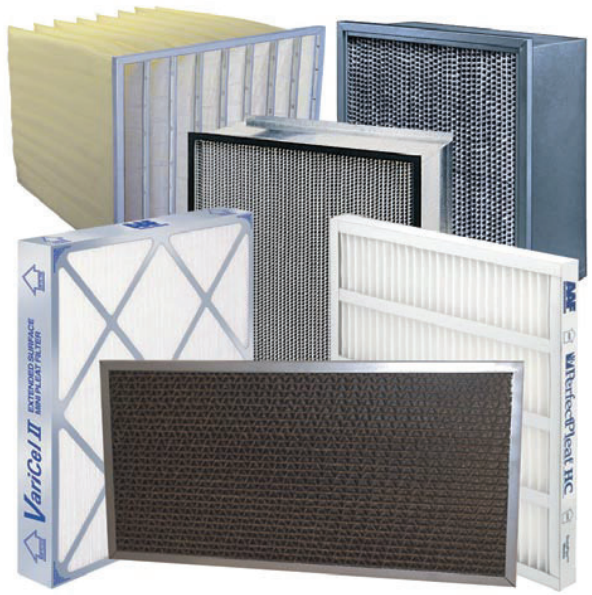
The smart way to raise your IAQ

Superior casing performance

Because indoor air quality (IAQ) is now vital to your project's success, your AHU's performance is absolutely critical. That's why Solution AHUs offer advanced features that can meet any IAQ challenge you face. It all begins with casing performance. Casing leakage can deteriorate the quality of the air supplied to the occupants by allowing dirty,unfiltered air to leak into the airstream downstream of the filters. To minimize leakage, all Solution AHUs employ superior casing construction. As a minimum, air leakage is limited to a miniscule 1% at ±8" w.g. If needed, the leakage can be limited to only 0.5% at as high a design pressure as required.

Filter out impurities

A complete line of filters is available for all Solution AHUs. For light- or prefiltering duty, use our pleated and extended-surface filters. For more stringent requirements, 60% to 95% efficient rigid or bag filters can be specified. HEPA filters are available to trap particles as small as 0.3 microns with 99.97% effectiveness. Ultra-HEPA filters can remove particles as small as 0.1 microns. Activated-carbon filters are excellent at removing odors and volatile-organic compounds from the airstream.



A complete line of filters is available, including pleated, rigid, bag, HEPA and carbon.

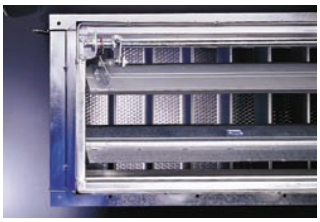
Hygienic drain-pan design

Micro-organisms can flourish in drain pans when cooling-coil condensate remains there during "off" or "heating" cycles. Solution AHUs move that condensate out of the unit with multi-sloped drain pans that ensure positive drainage. All pan designs also offer accessibility for periodic cleaning, now required by ASHRAE Standard 62-2001.

Multi-sloped drain pans ensure positive drainage.

Ensure adequate ventilation

An adequate supply of ventilation air is critical for the health of facility occupants. However, having to condition too much outside air can drive up energy costs. The solution is the AMS-60 damper, which incorporates an airflow-measuring station. The AMS-60 damper simultaneously measures and controls the volume of ventilation air, making sure it's neither too little nor too much.

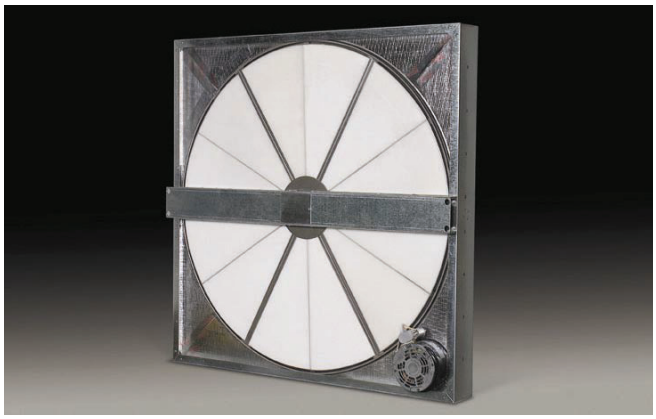


The AMS-60 damper measures and controls ventilation-air volume.

IAQ FEATURES TO HELP YOU CLEAR THE AIR

- Double-wall construction
- IAQ drain pans
- AMS-60 dampers
- Perforated liners
- Low-leak dampers
- P-cone fan monitoring
- All filter types (flat, angle, carbon, HEPA, etc)

Put your AHUs on an energy diet



Heat-recovery wheels reduce the cost of conditioning ventilation air.

Variable-speed drives offer dramatic fan-energy savings.

FEATURES THAT SAVE DOLLARS AND MAKE SENSE

- Variable-speed drives
- Heat wheels
- Fixed-plate heat exchangers
- Heat pipes
- High R-value insulation
- High-efficiency motors

Designed to save energy

Our industry has taken a leadership role by creating energy-performance guidelines, such as ASHRAE 90.1. Solution AHUs are designed with ASHRAE 90.1 in mind and can help you curb your energy intake.

Stretch your dollars with energy recovery

The exhaust airstream represents an energy-saving opportunity. An energy-recovery wheel can economically transfer heat and moisture between the exhaust-air and fresh-air paths, reducing the cost of conditioning the fresh air.

Take advantage of "free" cooling with an economizer section. During spring and fall operation, cool/dry outside air cools and dehumidifies the facility, reducing the need for mechanical refrigeration.

Keep heat where it belongs

Superior casing performance affects more than just indoor air quality. In extreme ambient conditions, heat transfer through the casing must be controlled. All Solution casings offer a minimum of R-7 to R-14 insulation in the floors, walls and roof. Higher R-value insulations are also available. To prevent energy-robbing air leaks, units are designed for a maximum casing leakage of 1%, or even 0.5%.

Reduce fan operating costs

In an AHU, the fan is the largest energy consumer. Solution fans offer a range of energy-saving options. High- or premium-efficiency motors can be specified. Direct-drive plenum fans eliminate belt-and-pulley energy losses.

If the air system is designed for variable-air volume VAV), Solution AHUs offer the most efficient method of VAV fan control. Factory-mounting a Johnson Controls variable-speed drive reduces jobsite labor costs and provides single-source responsibility.

Increase fans – decrease energy

Critical applications, such as life-science facilities or process operations, demand efficient and redundant air-handling operations. Solution AHUs meet this need by offering fan arrays ranging from 2 to 6 fans. When the fan array is optimized, the design can also increase efficiency by operating the fans at their most efficient points.

Reduce noise complaints

When noise matters
Applications such as theaters, performance halls and churches consider acoustics to be as critical as occupant comfort. That's why Solution AHUs ensure your success with a wide range of noise-reducing technologies that will quiet any complaint.

Fans that whisper
Since the fan is the primary moving part in an air-handling system, it's the first place to look when reducing noise. Solution AHUs are available with a variety of low-noise fans. Plenum fans generate less ductwork noise than do standard DWDI fans. Varying the number of blades in a fan wheel can also improve its sound characteristics.

Minimize vibration noise
Solution AHUs offer an array of construction and isolation techniques to help control vibration noise and its transmission. All fans are mounted on an isolated steel base. The entire fan assembly is dynamically balanced to ensure vibration-free operation. Direct-drive plenum fans can further reduce vibration by eliminating the belt-and-pulley mechanism.

Attenuate remaining sounds
What little noise is left can be further reduced with direct methods of sound attenuation. Using sound-absorbing walls, and sound traps in the fan and discharge-plenum sections, Johnson Controls sales engineers can design a Solution AHU to meet your critical sound requirements.

Tested sound levels
Being able to reliably predict the sound performance of an AHU is an engineering challenge. Our acousticians have created ARI-260-compliant, acoustical-calculation tools based on thousands of hours of real-world testing on hundreds of units.

Theatres, performance halls, and churches often consider acoustics as critical as occupant comfort.

Solution AHUs offer a variety of techniques to improve fan acoustics.

SOUND TECHNIQUES TO IMPROVE ACOUSTICS

- Standard low-noise fans
- Direct-drive plenum fans
- Vane-axial fans
- Sound attenuators
- Sound-absorptive panels
- Inertia bases
- Special balancing and vibration-isolation options

Take control of your application

Factory-mounted controls increase reliability

When AHU controls are installed at the jobsite, costs can go up and reliability can go down. To eliminate these problems, Solution AHUs can be equipped with Metasys® controls which are engineered, installed, and tested in the factory.

Solution AHUs can be equipped with factory-packaged Metasys controls.

Factory-installation improves quality, saves time

While a Solution AHU is being manufactured, Johnson Controls technicians can easily access all its segments. So, there are no accessibility problems to cramp the quality of the controls installation, which can occur on the jobsite. Also, all sensing probes have been pre-engineered to determine their best mounting location, ensuring accurate and reliable readings.

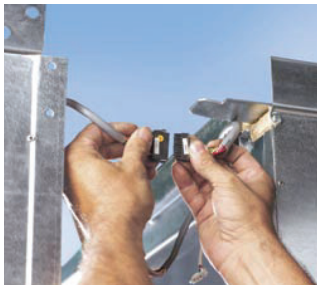
Factory-testing ensures accurate operation

Factory-mounted Metasys controls undergo a detailed testing process at the factory. The testing ensures that all wiring is installed correctly, and that all control panels and end devices work appropriately before the AHU is shipped. It also means that Solution AHUs can be up-and-running faster when they arrive on-site.

Factory-testing ensures that all controls work appropriately.

Factory-engineering speeds field connections

Solution AHUs are factory-engineered to simplify field connection of the controls. For example, coil valves are shipped uninstalled, but pre-wired with a flexible conduit with quick-connects. In some instances, the AHU is too large to ship in one piece, and must be split. To ensure fast and easy jobsite assembly of the Metasys controls, labeled quick-connects come standard on all shipping splits.



Labeled, quick-connect wiring makes split units easy to reassemble.

YOU ARE IN COMMAND WITH METASYS® CONTROLS

- Field equipment controllers
- Input/Output modules
- Damper actuators
- Differential-pressure sensors
- Temperature sensors
- Valves and actuators
- Static-pressure transducers
- Differential-pressure switches
- Fan start/stop relays
- Humidity sensors
- Variable-speed controls
- Safety switches/resets

Support when you need it

Johnson Controls has the experience and support you demand

To unburden specifiers from the time-consuming task of system layout, we employ powerful design tools. The System Selection Tool is available to all qualified systems designers to assist in the development of plans and specifications for standard HVAC equipment and controls. Systems contained in the tool provide the user with flow diagrams, points lists and sequence of operations. Additionally, the software provides an output to the YORKworks™ program, the design tool that configures the Solution AHU and prepares the necessary specifications, schedules and drawings. For highly complex configurations or performance requirements, a team of factory engineers are available to support our sales professionals.

Support after the sale

As assurance that your Solution AHUs will meet your performance expectations, Johnson Controls offers validation- and witness-testing at our factory for a variety of parameters: airflow, sound, vibration, and air-leakage, to name a few. We can provide certified technicians for jobsite installation and commissioning, drawing on a force of more than 5,000 technicians in over 500 locations worldwide. Project-management services are also available.

For air-handling units designed to meet your demanding requirements, call your nearby Johnson Controls representative.

Powerful design tools are available to aid system designers.

SOLUTION AHUS ARE AN EASY CHOICE

- Worldwide support and resources
- Powerful design tools
- Backed by factory-engineering team
- Factory validation- and witness-testing
- Project-management services can be provided
- Maintenance and repair services are also available

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ENGINEERING GUIDE

ATTACHMENT B

TSS Single-Duct VAV Terminals

Johnson Controls

TDIndustries

TABLE OF CONTENTS

NOTES:

- All data is subject to change without notice. Drawings in this guide are not for installation purposes.
- Some drawings are not shown in this catalog. Construction drawings and performance data contained herein should not be used for submittal purposes.
- ETL Listing Number 492864.
- Visit www.johnsoncontrols.com for current literature and submittal drawings or contact your local sales representative for more information.

AHRI CERTIFIED® www.ahridirectory.org VAV Terminals AHRI Standard 880

INTERTEK ETL CM LISTED C US

FEATURES AND BENEFITS

PRECISE ZONE CONTROL

Model TSS terminals provide variable air volume (VAV) control beyond the typical single duct box. They are specifically designed for precise air delivery throughout the entire operating range, regardless of the installed inlet conditions. They also offer improved space comfort and flexibility for a wide variety of HVAC applications. TSS terminals take advantage of typical benefits provided by single duct units, while performing at extremely low sound levels. This is critical in today's buildings, where occupants are placing more emphasis on indoor acoustics.

The ability to provide comfort to the occupant is the measurement of quality for any VAV terminal. Comfort is achieved through quiet and precise control of airflow to the occupied space.

The TSS terminal provides the ultimate in airflow control with the patented FlowStar™ airflow sensor. No other sensor in the industry can match the FlowStar's ability to quietly and precisely measure airflow. Accurate airflow measurement is the basis for airflow control.

DESIGN FLEXIBILITY

Selection and Layout. The TSS provides flexibility in system design. The compact cabinet design and quiet operation give the system designer the versatility to place units directly above occupied spaces. It is not necessary to locate the unit in the crowded space above a hall or corridor. This will reduce lengthy and expensive discharge duct runs. The FlowStar sensor ensures accurate control, even when space constraints do not permit long straight inlet duct runs to the terminal.

Sizes. Model TSS terminals are available in ten unit sizes to handle airflow capacities between 45 and 8000 CFM.

A Windows® based Computer Selection Program is available on CD-ROM to facilitate the selection process. Contact your representative to obtain a copy of this powerful and time-saving program.

CONVENIENT INSTALLATION

Quality. All TSS terminals are thoroughly inspected during each step of the manufacturing process, including a comprehensive "pre-ship" inspection, to maintain the highest quality product available. All TSS terminals are packaged to minimize damage during shipment.

Quick Installation. A standard single point electrical main power connection is provided with all electronic controls and electrical components located on the same side of the casing, for quick access, adjustment, and troubleshooting. Installation time is minimized with the availability of factory calibrated controls and a low profile compact design.

The FlowStar sensor ensures accurate airflow measurement, regardless of the field installation conditions. A calibration label and wiring diagram is located on the terminal for quick reference during start-up.

The terminal is constructed to allow installation with standard metal hanging straps. Optional hanger brackets for use with all-thread support rods or wire hangers are also available.

LASTING COMPONENTS AND LOW COST OPERATION

Quality. All metal components are fabricated from galvanized steel. Unlike most manufacturers' terminals, the TSS is capable of withstanding a 125 hour salt spray test without showing any evidence of red rust.

Energy Efficiency. In addition to quiet and accurate temperature control, the building owner will benefit from lower operating costs. The highly amplified velocity pressure signal from the FlowStar inlet sensor allows precise airflow control at low air velocities.

The FlowStar sensor's airfoil shape provides minimal pressure drop across the terminal. This allows the central fan to run at a lower pressure and with less brake horsepower.

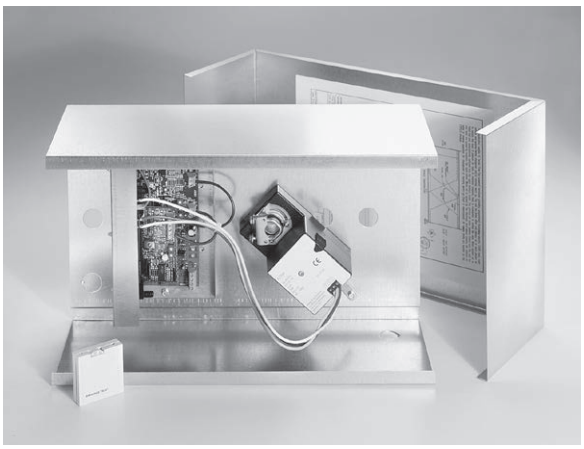
Agency Certification. Model TSS terminals with electronic controls and/or electric heat are listed with ETL as an assembly, and bear the ETL label.

TSS terminals and accessories are wired in compliance with all applicable NEC requirements and tested in accordance with AHRI Standard 880.

Maintenance and Service. TSS terminals require no periodic maintenance and provide trouble-free operation. Controls are located on the outside of the unit casing for easy access by maintenance personnel.

A VARIETY OF CONTROLS

Model TSS terminals are available with analog electronic, consignment DDC, pneumatic controls and Johnson Controls DDC for BACnet, Lon or N2 specifically designed for use with TSS terminals. These controls are designed to accommodate a multitude of control schemes.



From the most basic to the most sophisticated sequence of operation, the controls are designed by experts in VAV single duct terminal operation. Refer to the Electronic Controls Selection Guide, and the Pneumatic Controls Selection Guide for a complete description of the sequences and schematic drawings that are available.

Available Control Types:
- Analog Electronic (shown above)
- Pneumatic
- Factory mounted consignment DDC
- Johnson Controls DDC for BACnet, Lon or N2

Standard Control Features:
- Patented FlowStar Airflow Sensor
- ETL Listing
- NEMA 1 Enclosure
- 24 Volt Control Transformer
- Floating Modulating Actuator
- Balancing Tees and Plenum Rated Tubing

FEATURES AND BENEFITS

PATENTED FLOWSTAR SENSOR CONTROL

The air valve features the FlowStar airflow sensor which has brought new meaning to airflow control accuracy. The multi-axis design utilizes between 12 and 20 sensing points that sample total pressure at center points within equal concentric cross-sectional areas, effectively traversing the air stream in two planes. Each distinct pressure reading is averaged within the center chamber before exiting the sensor to the controlling device.

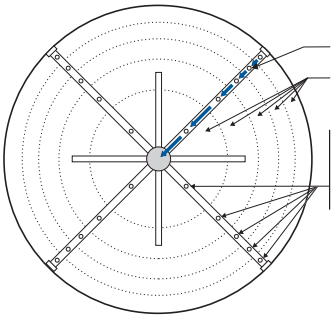
This sensor adds a new dimension to signal amplification. Most differential pressure sensors provide a signal equal to 1.5 times the equivalent velocity pressure signal. The FlowStar provides a differential pressure signal that is 2.5 to 3 times the equivalent velocity pressure signal. This amplified signal allows more accurate and stable airflow control at low airflow capacities. Low airflow control is critical for indoor air quality, reheat minimization, and preventing over cooling during light loads.

Unlike other sensors which use a large probe surface area to achieve signal amplification, the FlowStar utilizes an unprecedented streamline design which generates amplified signals unrivaled in the industry. The streamlined design also generates less pressure drop and noise.

The VAV schedule should specify the minimum and maximum airflow setpoints, maximum sound power levels, and maximum air pressure loss for each terminal.

The specification for the VAV terminal must detail the required performance of the airflow sensor. For maximum building occupant satisfaction, the VAV system designer should specify the airflow sensor as suggested in the Guide Specifications of this catalog.
Using FlowStar sensing to amplify the airflow signal allows you to use lower minimum airflow setpoints. Many VAV controllers require a minimum differential pressure signal of 0.03 inch W.G. The airflow sensor should be able to generate this signal with only 400 to 450 FPM air velocity through the inlet collar.

Conventional airflow sensors without amplification capabilities require approximately 700 FPM to generate a 0.03 inch W.G. signal. If 700 FPM represents a 20% minimum condition, the inlet velocity would be 3500 FPM at the maximum airflow setpoint. This results in extremely noisy conditions. In addition, the airflow sensor should generate a differential pressure range of at least one inch W.G. over the operating range of the terminal unit.



FlowStar™ Airflow Sensor
Patent #5,481,925

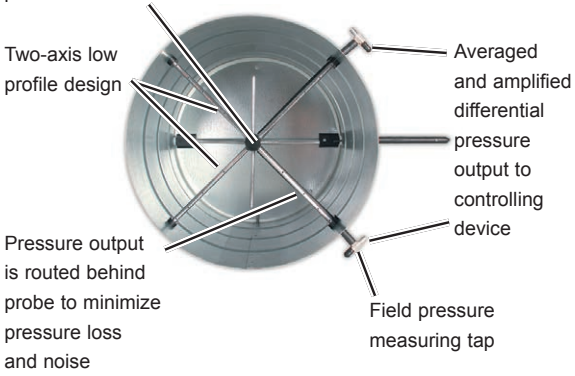
Each pressure input signal is routed to the center averaging chamber

Equal concentric circular areas

Sizes 6 & 8:	3 Circles
Sizes 10 & 12:	4 Circles
Sizes 14 & 16:	5 Circles (shown)

Total pressure measured at the center of each concentric circle for maximum accuracy, as outlined in ASHRAE Fundamentals Handbook.

Sizes 6 & 8:	12 Sensing Points
Sizes 10 & 12:	16 Sensing Points
Sizes 14 & 16:	20 Sensing Points



UNIQUE ELECTRIC HEAT DESIGN

Model TSS-EH models are unique in that they correct common industry heating problems. Historically, heater elements placed downstream of a VAV damper have experienced two major problems:

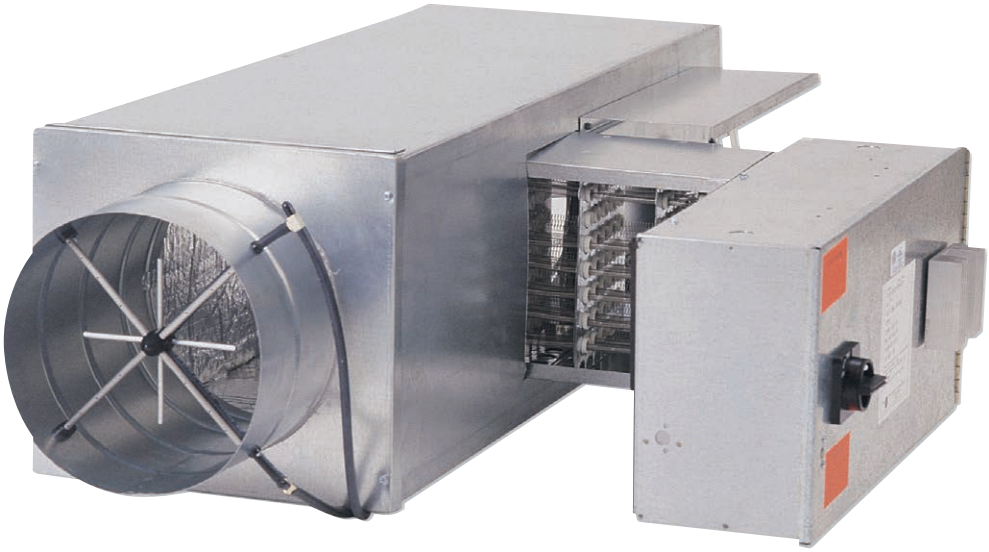
- Elements fail prematurely due to hot spots resulting from an uneven air velocity profile over the heater face
- Heaters suffer rapid nuisance cycling of the contactors and elements because the airflow switch probe is located on the low pressure (downstream side) of the VAV damper

Our unique electric heat VAV terminal, the TSS-EH, solves these problems. The heater elements are located midway between the air inlet and the damper. (See photo below.) This design provides uniform airflow over the face of the electric heater at all damper positions. Element life is extended, reducing repair cost and inconvenience.

With the heater elements located on the high pressure side of the VAV damper, the airflow pressure switch receives a reliable pressure signal even at minimum damper positions. This arrangement provides greater safety, as well as enhanced reliability.

The TSS-EH design permits tremendous flexibility when selecting KW, voltage, phase, balanced or unbalanced circuits and method of control.

The TSS-EH breaks new ground in single duct VAV electric heater design. The patented FlowStar sensor permits modulation to lower airflow levels than all other sensors in the industry. This minimizes the energy expended for heat in many applications.

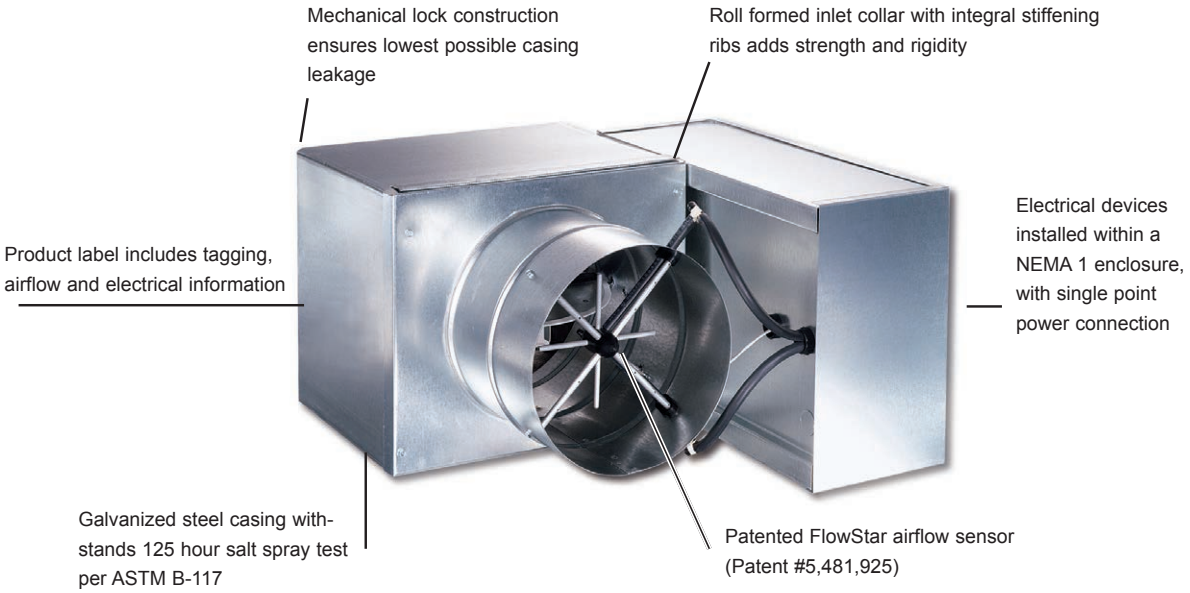


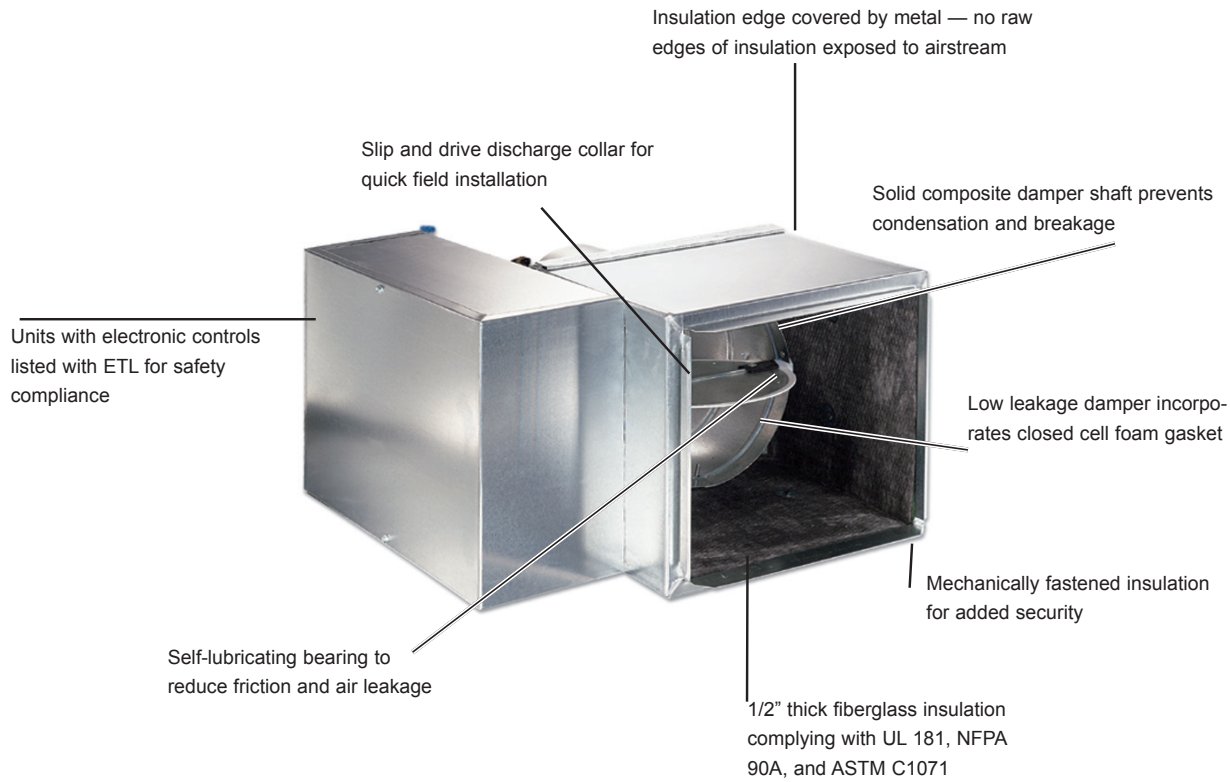
The FlowStar probe is visible in the inlet of the TSS-EH. The elements, partially removed for this photo, are midway between the inlet and the damper.

STANDARD CONSTRUCTION

MODEL TSS

The TSS terminal incorporates many standard features that are expensive options for other manufacturers.

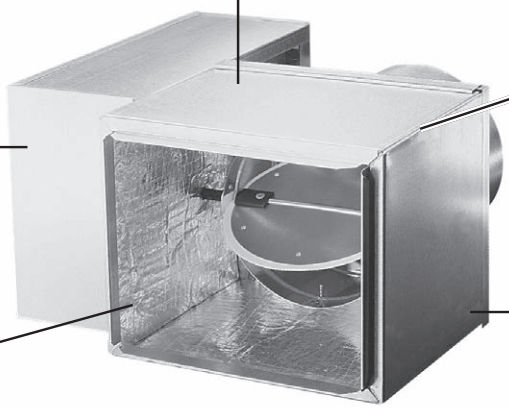




OPTIONAL CONSTRUCTION

MODEL TSS

The TSS single duct terminal is available with many optional features to meet any project requirement.



Double wall construction (not shown)

Factory piping packages (refer to Piping Packages catalog)

Factory control options:
- Analog Electronic
- DDC Electronic
- Pneumatic

For more information, see corresponding Control Selection Guides

Mounting brackets (not shown) to accept all-thread hanging rods or wire hangers

Low temperature construction for use in thermal storage applications, includes:
- Thermally isolated primary air inlet
- Composite damper shaft

Scrim reinforced foil faced insulation meeting ASTM C1136 for mold, mildew and humidity resistance or 1/2” thick elastomeric closed cell foam insulation

STANDARD AND OPTIONAL FEATURES

STANDARD FEATURES

Construction
- AHRI 880 certified and labeled
- 22 gauge galvanized steel casing and valve
- 1/2" thick fiberglass insulation, mechanically fastened for added security

Primary Air Valve
- Embossed rigidity rings
- Low thermal conductance damper shaft
- Position indicator on end of damper shaft
- Mechanical stops for open and closed position
- FlowStar™ center averaging airflow sensor
- Balancing tees
- Plenum-rated sensor tubing

Hot Water Coil
- Designed and manufactured by Johnson Controls
- AHRI 410 certified and labeled
- 1, 2, 3 or 4 rows
- Left or right hand connections
- Tested at a minimum of 450 PSIG under water and rated at 300 PSIG working pressure at 200°F

Electrical
- cETL listed for safety compliance with UL 1996
- NEMA 1 wiring enclosure

Electric Heat
- cETL listed as an assembly for safety compliance
- Automatic reset primary and back-up secondary thermal limits
- Airflow switch
- Single point power connection
- Hinged electrical enclosure door
- Fusing per NEC

OPTIONAL FEATURES

Construction
- 20 gauge galvanized steel construction
- 3/4" and 1" insulation
- Foil faced scrim backed insulation
- 1/2" thick elastomeric closed cell foam insulation
- Double wall construction with 22 gauge liner

Hot Water Coil
- Coil access plate for cleaning coil

Electrical
- Toggle disconnect switch
- Primary and secondary transformer fusing

Electric Heat
- Proportional SSR heater control
- Mercury contactors
- Door interlocking disconnect switches

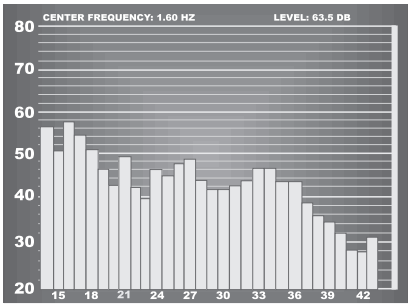
Controls
- Factory provided controls include:
  - Analog electronic
  - Pneumatic
- Factory mounted JCI DDC controls (factory mount and wire)

Piping Packages
- Factory assembled – shipped loose for field installation
- 1/2" and 3/4", 2 way, normally closed, two position electric motorized valves
- Isolation ball valves with memory stop
- Fixed and adjustable flow control devices
- Unions and P/T ports
- Floating point modulating control valves
- High pressure close-off actuators

APPLICATION AND SELECTION

ACOUSTICAL CONCEPTS

The focus on indoor air quality is also having an effect on proper selection of air terminal equipment with respect to acoustics.



Sound. At the zone level, the terminal unit generates acoustical energy that can enter the zone along two primary paths. First, sound from the primary air valve can propagate through the downstream duct and diffusers before entering the zone (referred to as Discharge or Airborne Sound). Acoustical energy is also radiated from the terminal casing and travels through the ceiling cavity and ceiling system before entering the zone (referred to as Radiated Sound).

To properly quantify the amount of acoustical energy emanating from a terminal unit at a specific operating condition (i.e. CFM and static pressure), manufacturers must measure and publish sound power levels.

The units of measurement, decibels, actually represent units of power (watts). The terminal equipment sound power ratings provide a consistent measure of the generated sound independent of the environment in which the unit is installed. This allows a straight forward comparison of sound performance between equipment manufacturers and unit models.

Noise Criteria (NC). The bottom line acoustical criteria for most projects is the NC (Noise Criteria) level. This NC level is derived from resulting sound pressure levels in the zone. These sound pressure levels are the effect of acoustical energy (sound power levels) entering the zone caused by the terminal unit and other sound generating sources (central fan system, office equipment, environment, etc.).

The units of measurement is once again decibels; however, in this case decibels represent units of pressure (Pascals), since the human ear and microphones react to pressure variations.

There is no direct relationship between sound power levels and sound pressure levels. Therefore, we must predict the resulting sound pressure levels (NC levels) in the zone based in part by the published sound power levels of the terminal equipment. The NC levels are totally dependent on the project specific design, architecturally and mechanically. For a constant operating condition (fixed sound power levels), the resulting NC level in the zone will vary from one project to another.

AHRI 885. A useful tool to aid in predicting space sound pressure levels is an application standard referred to as AHRI Standard 885. This standard provides information (tables, formulas, etc.) required to calculate the attenuation of the ductwork, ceiling cavity, ceiling system, and conditioned space below a terminal unit. These attenuation values are referred to as the “transfer function” since they are used to transfer from the manufacturer’s sound power levels to the estimated sound pressure levels resulting in the space below, and/or served by the terminal unit. The standard does not provide all of the necessary information to accommodate every conceivable design; however, it does provide enough information to approximate the transfer function for most applications. Manufacturers use different assumptions with respect to a “typical” project design; therefore, it is impossible to compare product performance simply by looking at the published NC values.

GENERAL DESIGN RECOMMENDATIONS FOR A QUIET SYSTEM

The AHU. Sound levels in the zone are frequently impacted by central fan discharge noise that either breaks out (radiates) from the ductwork or travels through the distribution ductwork and enters the zone as airborne (discharge) sound. Achieving acceptable sound levels in the zone begins with a properly designed central fan system which delivers relatively quiet air to each zone.

Supply Duct Pressure. The primary factor contributing to noisy systems (including single duct applications) is high static pressure in the primary air duct. This condition causes higher sound levels from the central fan and also higher sound levels from the terminal unit, as the primary air valve closes to reduce the pressure. This condition is compounded when flexible duct is utilized at the terminal inlet, which allows the central fan noise and air valve noise to break out into the ceiling cavity and then enter the zone located below the terminal. Ideally, the system static pressure should be reduced to the point where the terminal unit installed on the duct run associated with the highest pressure drop has the minimum required inlet pressure to deliver the design airflow to the zone. Many of today’s

APPLICATION AND SELECTION

HVAC systems experience 0.5" w.g. pressure drop or less in the main trunk. For systems that will have substantially higher pressure variances from one zone to another, special attention should be paid to the proper selection of air terminal equipment.

To date, the most common approach has been to select (size) all of the terminals based on the worst case (highest inlet static pressure) condition. Typically, this results in 80% (or higher) of the terminal units being oversized for their application. This in turn results in much higher equipment costs, but more importantly, drastically reduced operating efficiency of each unit. This consequently decreases the ability to provide comfort control in the zone. In addition, the oversized terminals cannot adequately control the minimum ventilation capacity required in the heating mode.

A more prudent approach is to utilize a pressure reducing device upstream of the terminal unit on those few zones closest to the central fan. This device could simply be a manual quadrant type damper if located well upstream of the terminal inlet. In tight quarters, perforated metal can be utilized as a quiet means of reducing system pressure. This approach allows all of the terminal units to experience a similar (lower) inlet pressure. They can be selected in a consistent manner at lower inlet pressure conditions that will allow more optimally sized units.

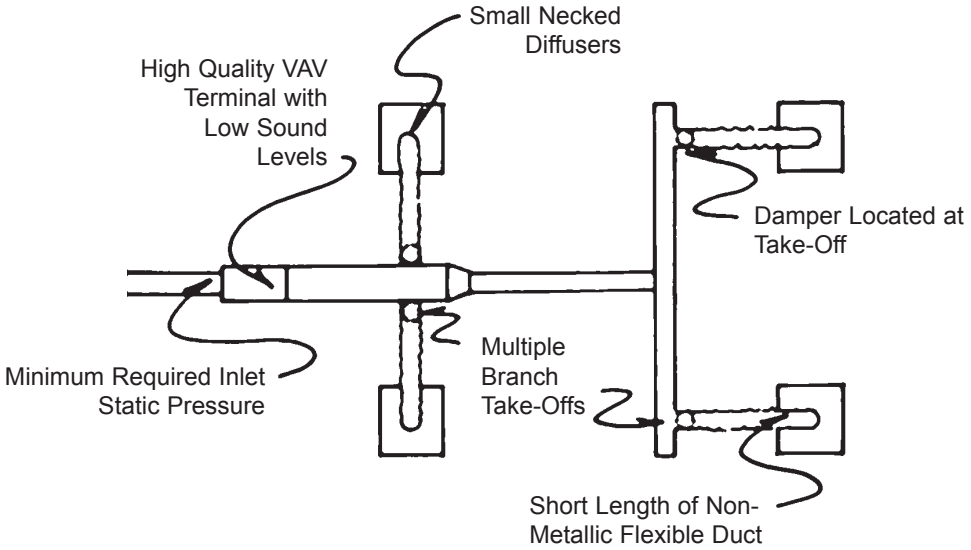
Inlet duct that is the same size as the inlet collar and as straight as possible will achieve the best acoustical performance. For critical applications, flexible duct should not be utilized at the terminal inlet.

Zoning. On projects where internal lining of the downstream duct is not permitted, special considerations should be made to obtain acceptable noise levels. In these cases, a greater number of smaller zones will help in reducing sound levels. Where possible, the first diffuser takeoff should be located after an elbow or tee and a greater number of small necked diffusers should be utilized, rather than fewer large necked diffusers.

The downstream ductwork should be carefully designed and installed to avoid noise regeneration. Bull head tee arrangements should be located sufficiently downstream of the terminal discharge to provide an established flow pattern downstream of the fan. Place diffusers downstream of the terminal after the airflow has completely developed.

Downstream splitter dampers can cause noise problems if placed too close to the terminal, or when excessive air velocities exist. If tee arrangements are employed, volume dampers should be used in each branch of the tee, and balancing dampers should be provided at each diffuser tap. This arrangement provides maximum flexibility in quiet balancing of the system.

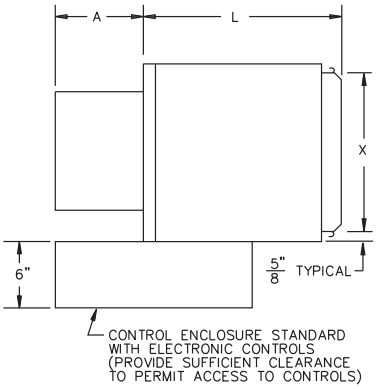
IDEAL DUCT DESIGN



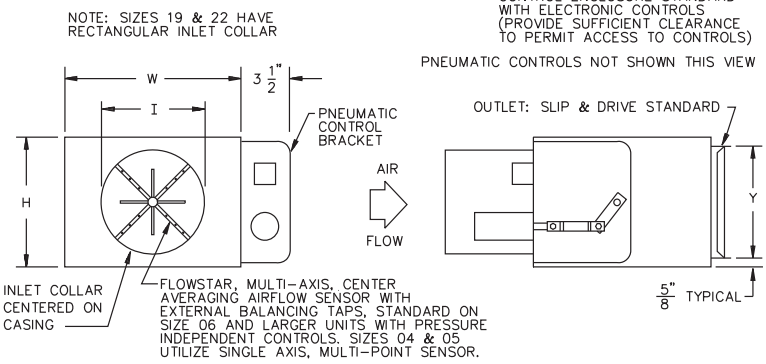
DIMENSIONAL DATA

UNIT SIZE	DIMENSIONS						
	W	H	L	A	I	X	Y
4	10 [254]	10 [254]	11 [279]	10 1/2 [267]	3 7/8 [98]	8 3/4 [222]	8 3/4 [222]
5	10 [254]	10 [254]	11 [279]	10 1/2 [267]	4 7/8 [124]	8 3/4 [222]	8 3/4 [222]
6	10 [254]	10 [254]	11 [279]	6 1/2 [165]	5 7/8 [149]	8 3/4 [222]	8 3/4 [222]
8	12 [305]	10 [254]	11 [279]	6 1/2 [165]	7 7/8 [200]	10 3/4 [273]	8 3/4 [222]
10	14 [356]	12 1/2 [318]	13 [330]	6 1/2 [165]	9 7/8 [251]	12 3/4 [324]	11 1/4 [286]
12	16 [406]	15 [381]	13 [330]	6 1/2 [165]	11 7/8 [302]	14 3/4 [375]	13 3/4 [349]
14	20 508]	17 1/2 [445]	17 1/2 [445]	6 1/2 [165]	13 7/8 [352]	18 3/4 [476]	16 1/4 [413]
16	24 [610]	17 1/2 [445]	17 1/2 [445]	6 1/2 [165]	15 7/8 [403]	22 3/4 [578]	16 1/4 [413]
19	30 [762]	17 1/2 [445]	11 [279]	8 [203]	28 1/4 [718] x 13 7/8 [352]	28 3/4 [730]	16 1/4 [413]
22	34 [864]	17 1/2 [445]	11 [279]	8 [203]	32 1/4 [819] x 15 7/8 [403]	32 3/4 [832]	16 1/4 [413]

NOTES:
1. All dimensions are in inches [mm] with a tolerance of ±1/8" [3mm].
2. Sizes 19 and 22 have rectangular inlet collar.



PNEUMATIC CONTROLS NOT SHOWN THIS VIEW



ELECTRONIC CONTROLS NOT SHOWN THESE VIEWS

UNIT SIZE	DIMENSIONS				
	W	H	L	A	I
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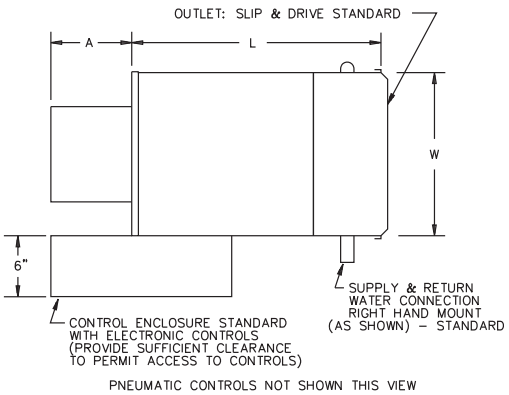
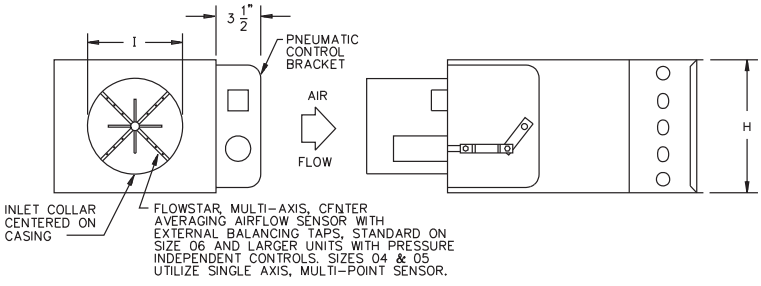


PNEUMATIC CONTROLS NOT SHOWN THIS VIEW



ELECTRONIC CONTROLS NOT SHOWN THESE VIEWS

DIMENSIONAL DATA

MODEL TSS - EH

UNIT SIZE	DIMENSIONS						
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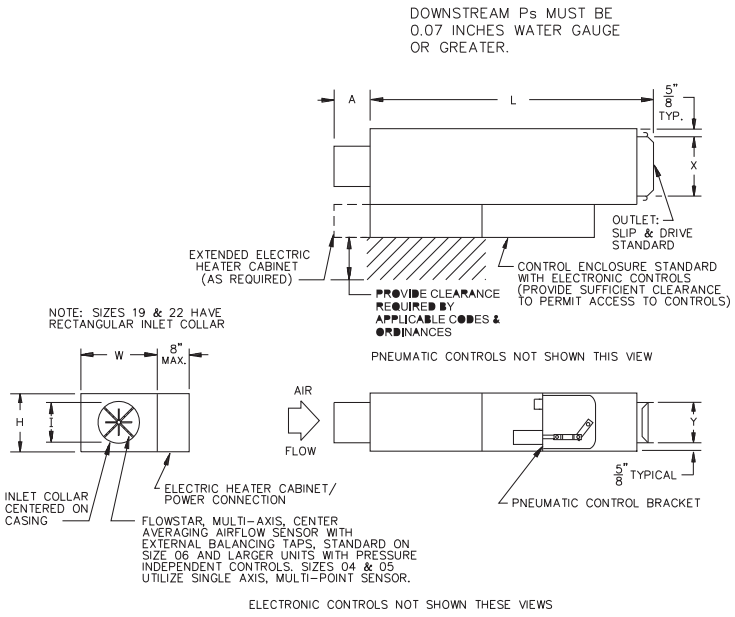
22	34 [864]	17 1/2 [445]	44 1/2 [1130]	32 1/4 [819] x 15 7/8 [403]	32 3/4 [832]	16 1/4 [413]	1 1/2 [38]

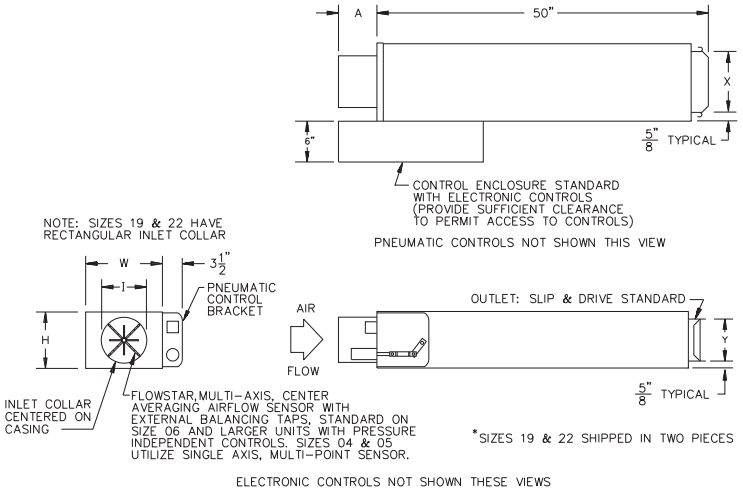
NOTE: All dimensions are in inches [mm] with a tolerance of ±1/8" [3mm].



MODEL TSS - SA

UNIT SIZE	DIMENSIONS					
	W	H	A	I	X	Y
4	10 [254]	10 [254]	10 1/2 [267]	3 7/8 [98]	8 3/4 [222]	8 3/4 [222]
5	10 [254]	10 [254]	10 1/2 [267]	4 7/8 [124]	8 3/4 [222]	8 3/4 [222]
6	10 [254]	10 [254]	6 1/2 [165]	5 7/8 [149]	8 3/4 [222]	8 3/4 [222]
8	12 [305]	10 [254]	6 1/2 [165]	7 7/8 [200]	10 3/4 [273]	8 3/4 [222]
10	14 [356]	12 1/2 [318]	6 1/2 [165]	9 7/8 [251]	12 3/4 [324]	11 1/4 [286]
12	16 [406]	15 [381]	6 1/2 [165]	11 7/8 [302]	14 3/4 [375]	13 3/4 [349]
14	20 [508]	17 1/2 [445]	6 1/2 [165]	13 7/8 [352]	18 3/4 [476]	16 1/4 [413]
16	24 [610]	17 1/2 [445]	6 1/2 [165]	15 7/8 [403]	22 3/4 [578]	16 1/4 [413]
19*	30 [762]	17 1/2 [445]	8 [203]	28 1/4 [718] x 13 7/8 [352]	28 3/4 [730]	16 1/4 [413]
22*	34 [864]	17 1/2 [445]	8 [203]	32 1/4 [819] x 15 7/8 [403]	32 3/4 [832]	16 1/4 [413]

NOTE: All dimensions are in inches [mm] with a tolerance of ±1/8" [3mm].

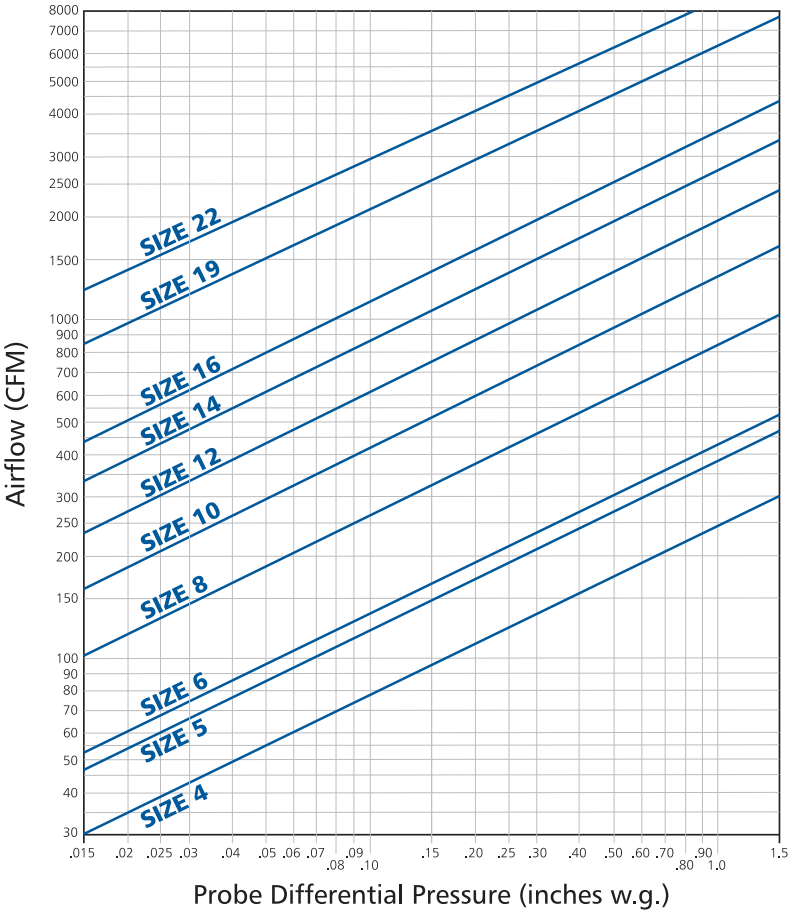


AIRFLOW CALIBRATION

FLOWSTAR CALIBRATION CHART

(For dead-end differential pressure transducers)

NOTE: Maximum and minimum CFM limits are dependent on the type of controls that are utilized. Refer to the table below for specific values. When DDC controls are furnished by others, the CFM limits are dependent on the specific control vendor that is employed. After obtaining the differential pressure range from the control vendor, the maximum and minimum CFM limits can be obtained from the chart above (many controllers are capable of controlling minimum setpoint down to .015" w.g.).



AIRFLOW RANGES (CFM)

UNIT SIZE	400 SERIES (PNEUMATIC) STANDARD CONTROLLER		7000 SERIES ANALOG ELECTRONIC		DDC CONSIGNMENT CONTROLS (See Notes Below)				
					MIN.			MAX.	
	MIN.	MAX.	MIN.	MAX.	MIN. TRANSDUCER DIFFERENTIAL PRESSURE (IN. W.G.)			MAX. TRANSDUCER DIFFERENTIAL PRESSURE (IN. W.G.)	
					0.015	0.03	0.05	1.0	≤1.5
4	43	250	35	250	30	43	55	250	250
5	68	350	50	350	48	65	88	350	350
6	75	490	60	550	53	75	97	435	530
8	145	960	115	1000	105	145	190	840	1000
10	235	1545	185	1600	165	235	305	1355	1600
12	340	2250	285	2300	240	340	440	1975	2300
14	475	3100	390	3100	335	475	615	2750	3100
16	625	4100	520	4100	440	625	805	3595	4100
19	1180	6500	1025	6500	845	1180	1510	6375	6500
22	1730	8000	1450	8000	1260	1730	2200	8000	8000

NOTES:
1. Minimum and maximum airflow limits are dependent on the specific DDC controller supplied. Contact the control vendor to obtain the minimum and maximum differential pressure limits (inches W.G.) of the transducer utilized with the DDC controller.
2. Maximum CFM is limited to value shown in General Selection Data.

SELECTION DATA

TERMINAL SIZE	CFM	MINIMUM ΔPs			DISCHARGE NOISE CRITERIA (NC)						RADIATED NOISE CRITERIA (NC)		
					0.5" ΔPs		1.0" ΔPs		3.0" ΔPs		0.5" ΔPs	1.0" ΔPs	3.0" ΔPs
		Model SDR / SDR-SA	Model SDR-WC 1 Row	Model SDR-WC 2 Row	Model SDR	Model SDR-SA	Model SDR	Model SDR-SA	Model SDR	Model SDR-SA	Model SDR & SDR-SA	Model SDR & SDR-SA	Model SDR & SDR-SA
4	100	0.01	0.02	0.03	--	--	--	--	20	--	--	--	20
	150	0.01	0.03	0.04	--	--	24	--	29	21	--	--	24
	200	0.01	0.04	0.07	23	--	29	23	34	28	--	22	29
	250	0.01	0.05	0.09	26	20	31	28	38	33	23	25	33
5	100	0.01	0.02	0.03	--	--	--	--	--	--	--	--	--
	200	0.01	0.04	0.07	--	--	24	--	28	--	--	--	24
	300	0.01	0.07	0.13	23	--	28	--	31	21	--	23	31
	350	0.01	0.09	0.16	24	--	30	21	33	24	21	25	33
6	200	0.02	0.05	0.08	--	--	--	--	25	--	--	--	29
	250	0.03	0.07	0.11	--	--	--	--	28	--	--	--	31
	300	0.04	0.10	0.16	--	--	--	--	28	20	--	20	33
	350	0.06	0.14	0.21	--	--	21	--	30	23	--	21	35
	450	0.10	0.22	0.33	--	--	24	--	33	25	--	24	36
	550	0.14	0.30	0.46	20	--	28	24	35	30	23	28	37
8	300	0.01	0.05	0.10	--	--	--	--	24	--	--	--	26
	400	0.01	0.08	0.15	--	--	--	--	26	--	--	--	29
	500	0.01	0.11	0.22	--	--	--	--	29	--	--	20	30
	600	0.01	0.15	0.30	--	--	--	--	30	20	--	21	32
	800	0.03	0.25	0.46	--	--	21	--	33	24	20	24	34
	1000	0.04	0.35	0.66	21	--	25	21	35	28	23	26	37
10	600	0.01	0.08	0.16	--	--	--	--	30	--	--	--	32
	800	0.01	0.13	0.26	--	--	--	--	30	20	--	--	32
	1000	0.02	0.20	0.39	--	--	20	--	31	24	--	21	32
	1200	0.02	0.25	0.47	--	--	23	--	34	28	--	23	34
	1400	0.03	0.32	0.61	--	--	25	20	35	29	20	24	35
	1600	0.04	0.40	0.76	20	--	28	24	36	31	24	26	37
12	800	0.01	0.08	0.15	--	--	--	--	26	--	--	21	33
	1100	0.01	0.13	0.26	--	--	--	--	28	--	--	22	34
	1400	0.02	0.21	0.40	--	--	20	--	30	24	--	24	35
	1700	0.02	0.26	0.50	--	--	21	--	33	28	--	25	36
	2000	0.03	0.34	0.65	--	--	23	--	35	30	20	26	37
	2300	0.04	0.43	0.82	20	--	25	20	36	31	22	28	38
14	1100	0.01	0.07	0.14	--	--	--	--	26	--	--	--	30
	1500	0.02	0.13	0.24	--	--	--	--	29	23	--	--	31
	1900	0.03	0.20	0.36	--	--	--	--	30	25	--	21	33
	2300	0.05	0.26	0.47	--	--	21	--	33	28	--	23	34
	2700	0.07	0.34	0.62	--	--	24	20	34	29	20	25	35
	3100	0.09	0.43	0.77	21	--	26	21	35	31	22	28	37
16	1600	0.01	0.10	0.19	--	--	--	--	24	--	--	--	33
	2100	0.02	0.17	0.31	--	--	--	--	29	23	--	20	35
	2600	0.03	0.24	0.45	--	--	20	--	34	29	--	21	35
	3100	0.04	0.29	0.55	--	--	23	20	35	30	--	24	36
	3600	0.05	0.37	0.70	20	--	25	21	37	34	21	26	37
	4100	0.06	0.46	0.86	23	--	28	23	39	36	24	29	38
19	2500	0.06	0.19	0.32	23	20	29	21	38	26	29	35	43
	3000	0.09	0.27	0.45	24	21	30	25	39	30	30	36	44
	3500	0.13	0.37	0.61	26	24	31	26	40	33	31	37	45
	4500	0.21	0.53	0.86	26	24	31	28	40	36	34	40	48
	5500	0.32	0.77	1.22	29	25	33	29	43	39	38	44	53
	6500	0.44	1.03	1.62	31	28	33	29	45	41	41	48	56
22	4000	0.06	0.30	0.55	28	24	33	26	41	33	31	37	48
	5000	0.09	0.46	0.83	28	24	34	29	41	36	34	39	50
	6000	0.14	0.56	0.99	29	26	34	31	43	38	36	41	53
	7000	0.18	0.72	1.27	30	28	36	33	44	40	39	45	56
	8000	0.24	0.91	1.59	33	29	37	34	45	41	41	47	58

NOTES:

- Min. ΔPs is the static pressure difference between the terminal inlet and discharge with the damper wide open.
- Performance data obtained from tests conducted in accordance with AHRI Standard 880.
- Dash (-) indicates NC level less than 20.
- NC values calculated based upon the 2002 Addendum to AHRI Standard 885 Appendix E Typical Sound Attenuation Values (shown at right) using Ceiling Type 2 for calculating Radiated NC.
- NC (sound pressure) levels predicted by subtracting appropriate values at right from published sound power levels (following pages).

DISCHARGE ATTENUATION VALUES	OCTAVE BAND					
	2	3	4	5	6	7
Small Box (< 300 CFM)	24	28	39	53	59	40
Medium Box (300-700 CFM)	27	29	40	51	53	39
Large Box (> 700 CFM)	29	30	41	51	52	39

RADIATED ATTENUATION VALUES	OCTAVE BAND					
	2	3	4	5	6	7
Type 2 - Mineral Fiber Ceiling	18	19	20	26	31	36

SOUND DATA

DISCHARGE SOUND POWER DATA - MODEL TSS

TERMINAL SIZE	CFM	OCTAVE BAND NUMBER																							
		0.5" ΔPs						1.0" ΔPs						1.5" ΔPs						3.0" ΔPs					
		2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
4	100	57	55	46	42	36	35	61	59	50	46	43	43	61	61	52	48	45	45	62	61	56	53	52	52
	150	62	60	50	46	41	39	66	64	54	50	46	45	68	67	58	54	49	48	68	68	60	57	56	56
	200	66	63	53	49	44	42	71	67	57	53	48	48	72	69	59	55	50	50	73	72	64	60	58	58
	250	69	65	55	53	46	45	73	70	59	55	51	49	74	71	61	57	53	52	77	76	67	62	60	59
5	100	55	53	44	40	35	33	58	57	48	43	42	43	59	58	50	46	44	45	59	59	54	50	50	51
	200	63	60	51	46	41	39	66	64	54	50	45	44	67	66	57	52	47	47	66	67	61	57	55	55
	250	65	62	53	48	43	41	69	67	56	52	47	45	70	68	59	55	51	50	69	69	63	59	56	56
	300	68	64	54	50	45	43	71	68	58	54	49	47	72	70	60	56	51	50	71	71	64	60	58	56
	350	69	65	55	51	47	45	73	70	59	55	50	49	74	71	62	57	53	51	73	72	66	62	60	57
6	200	54	51	48	44	39	36	59	56	52	48	44	42	60	59	55	51	47	45	65	65	62	57	54	53
	250	59	53	49	46	40	37	63	58	53	49	45	43	64	61	56	52	48	47	66	67	63	59	56	55
	300	61	55	51	47	41	39	64	60	54	51	46	44	65	63	57	54	50	48	68	68	64	60	57	55
	350	62	57	52	48	42	40	65	63	55	52	47	46	66	64	58	55	51	50	70	70	65	62	58	57
	400	63	58	53	50	43	41	66	64	57	53	48	48	69	67	60	57	52	52	71	71	66	63	59	58
	450	64	59	54	51	44	42	68	65	58	54	49	48	70	68	60	57	52	52	73	72	67	64	59	60
	550	67	62	55	53	46	45	70	68	61	56	50	50	72	70	63	59	54	53	76	74	69	66	61	63
8	300	55	50	47	44	41	37	58	55	52	47	47	45	60	58	55	50	50	48	65	65	65	60	60	59
	400	58	53	49	46	43	39	61	58	53	50	48	46	63	61	56	53	51	49	67	67	66	60	60	59
	500	60	55	51	48	44	41	64	60	54	52	49	47	65	63	57	55	53	50	69	69	67	61	61	60
	600	62	57	52	50	46	42	66	61	56	53	50	48	67	65	59	56	54	52	71	70	68	63	61	60
	700	64	58	54	51	47	43	68	63	57	55	52	49	69	67	62	60	57	55	73	72	68	64	62	60
	800	66	60	55	52	48	44	69	64	59	56	53	50	71	67	63	60	57	55	74	73	68	65	63	61
	1000	70	63	57	54	50	46	72	67	62	58	55	52	74	70	64	61	58	56	78	75	70	67	65	62
10	600	57	53	49	46	44	40	63	59	56	50	49	46	64	62	59	53	51	50	69	70	68	63	59	57
	800	60	55	52	49	46	42	64	61	57	52	51	48	67	63	60	55	54	52	71	71	69	64	61	59
	1000	63	58	54	51	48	44	67	63	59	54	52	50	69	65	61	57	56	53	74	72	69	64	63	60
	1100	64	58	55	52	48	45	68	64	59	55	53	50	70	67	63	60	57	54	74	73	69	65	64	61
	1200	65	59	55	53	49	45	69	65	60	56	54	51	71	67	63	61	57	55	75	74	70	66	64	62
	1400	67	61	57	54	50	47	70	67	62	58	55	52	73	69	64	61	58	56	77	75	71	67	65	63
	1600	69	63	59	56	51	48	74	69	65	60	56	53	76	71	67	62	60	57	80	76	73	69	67	64
12	800	57	52	49	45	43	40	61	59	58	54	52	50	63	61	61	56	54	52	68	68	68	63	60	59
	1100	61	55	52	48	46	42	65	61	60	55	53	52	67	63	62	58	56	54	71	69	68	65	63	61
	1400	63	57	54	51	48	44	67	63	61	56	54	52	70	65	63	59	56	54	74	71	71	67	64	62
	1600	65	58	56	52	49	45	69	64	62	57	55	52	71	67	64	61	59	57	75	72	72	68	65	63
	1700	66	59	56	53	49	46	69	64	62	58	55	52	72	67	65	61	59	57	76	73	72	69	66	64
	2000	68	61	58	54	51	47	71	65	64	60	57	53	74	68	66	62	60	57	78	75	73	70	67	66
	2300	69	63	61	56	52	49	73	67	65	61	58	55	75	70	67	63	60	58	80	76	75	70	68	67
14	1100	58	51	49	46	43	40	63	58	54	53	52	52	64	61	57	56	54	54	69	68	67	64	62	62
	1500	61	54	52	48	46	42	65	59	56	54	53	52	67	62	59	57	56	55	72	70	68	65	63	63
	1900	64	57	55	51	47	44	68	62	58	55	54	53	70	64	61	58	56	56	74	71	69	66	64	63
	2100	65	58	56	52	48	45	69	63	59	56	54	54	71	67	64	60	58	57	76	72	69	67	65	64
	2300	66	59	57	53	49	46	70	63	60	56	55	54	73	67	65	60	58	57	77	73	70	68	66	64
	2700	68	60	59	54	50	47	72	65	62	58	56	55	74	68	65	61	59	58	79	74	72	69	67	65
	3100	70	62	61	56	52	48	74	66	64	60	57	56	76	69	67	62	60	59	80	75	74	70	68	67
16	1600	60	52	51	46	43	41	63	57	54	54	52	51	66	59	57	56	54	53	70	65	64	62	62	60
	2100	63	55	54	49	46	43	67	60	57	55	54	51	69	63	60	58	56	54	73	70	67	65	64	62
	2600	65	57	56	51	47	45	69	63	59	56	54	53	71	66	62	59	57	56	76	74	69	68	67	65
	2800	66	58	57	52	48	45	70	64	60	56	54	53	74	68	65	60	58	57	76	74	70	68	67	65
	3100	67	59	58	53	49	46	71	65	61	57	55	54	75	69	65	60	58	57	78	75	71	69	67	66
	3600	69	61	59	54	50	47	73	67	63	58	56	54	75	69	66	61	59	57	80	77	73	70	68	67
	4100	71	63	62	56	51	49	75	68	67	60	57	55	77	71	69	62	60	58	81	79	74	70	68	68
19	2500	69	65	59	57	57	51	72	70	67	63	63	59	73	73	71	68	65	62	77	78	77	76	74	71
	3000	70	66	60	59	58	52	73	71	69	65	64	60	74	74	73	69	66	62	78	79	78	77	74	71
	3500	71	68	61	61	60	55	74	72	70	66	66	61	75	75	74	70	68	63	79	80	79	78	75	72
	4500	72	68	63	63	62	58	75	72	72	69	68	64	77	76	76	72	70	66	82	80	81	80	78	74
	5400	73	70	66	65	65	61	76	73	73	71	70	67	77	78	79	75	70	68	84	82	83	83	79	76
	5500	73	70	66	65	65	61	76	73	73	71	70	67	78	78	79	75	72	69	84	82	83	83	79	76
	6500	75	72	71	68	67	63	78	73	74	72	71	69	80	79	80	77	73	71	87	84	85	85	80	78
22	4000	71	69	64	60	56	54	75	73	70	66	62	60	77	76	74	70	65	63	82	81	81	79	75	72
	5000	72	69	66	63	59	57	77	74	74	68	64	62	79	76	76	72	67	65	84	81	83	80	76	73
	6000	74	70	69	66	62	60	79	74	76	71	67	65	81	77	78	74	70	68	85	82	85	82	77	75
	7000	77	71	71	68	64	63	80	76	77	73	69	67	81	78	79	75	71	69	86	83	86	83	79	76
	7100	77	71	71	68	64	63	80	76	77	73	69	67	82	80	82	76	71	69	86	83	86	83	79	76
	8000	79	72	74	70	66	65	81	77	78	75	71	69	83	80	82	77	73	71	87	84	88	84	80	77

- Performance data obtained from tests conducted in accordance with AHRI Standard 880.
- Sound levels are expressed in decibels, dB re: 1 x 10^{-12} watts
- Duct end corrections included in sound power levels per AHRI Standard 880.
- Certified AHRI data is highlighted blue. Application data (not highlighted blue) is outside the scope of the certification program.

SOUND DATA

RADIATED SOUND POWER DATA - MODEL TSS

TERMINAL SIZE	CFM	OCTAVE BAND NUMBER																							
		0.5" ΔPs						1.0" ΔPs						1.5" ΔPs						3.0" ΔPs					
		2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
4	100	46	43	35	29	26	27	49	44	39	32	27	24	49	46	42	34	29	26	48	50	46	38	33	31
	150	49	47	40	33	29	28	52	48	44	36	31	28	53	53	46	38	33	30	53	55	50	43	37	34
	200	52	51	44	37	32	29	56	52	48	40	35	31	56	54	50	42	37	33	58	59	54	47	41	38
	250	54	54	47	40	36	32	58	55	51	43	38	34	59	57	53	45	40	37	61	62	58	50	45	41
5	100	42	36	33	27	23	20	45	40	37	29	25	22	46	42	40	32	27	24	47	47	44	36	32	30
	200	46	44	40	33	28	28	49	48	44	36	31	28	50	49	46	38	33	29	52	53	50	43	37	34
	250	49	47	43	36	31	28	51	51	47	39	33	29	53	52	49	41	35	32	54	54	53	45	40	36
	300	51	49	45	38	34	30	54	53	49	41	36	32	55	55	51	43	38	34	56	57	56	48	42	39
	350	54	52	47	40	36	32	57	55	51	43	38	35	57	57	54	45	40	37	58	59	58	50	45	41
6	200	43	38	38	37	33	23	47	44	45	44	40	29	48	46	49	47	43	32	51	52	54	51	47	37
	250	46	41	39	36	32	23	48	46	45	44	41	30	49	49	51	49	46	34	53	54	56	55	51	40
	300	48	43	40	36	31	24	50	48	46	44	41	30	51	51	51	49	46	35	55	56	58	57	54	42
	350	50	46	42	37	31	26	53	50	47	43	40	30	52	52	51	49	46	36	57	58	60	58	55	43
	400	52	47	43	37	32	27	55	52	48	44	40	31	56	54	52	49	46	36	58	59	61	59	56	44
	450	54	48	45	38	32	28	57	53	50	45	40	32	58	55	53	49	46	36	60	60	61	59	56	45
	550	60	53	49	43	36	30	64	58	53	46	41	34	58	56	56	50	46	38	63	63	62	57	55	46
8	300	46	37	38	33	28	24	49	46	42	38	33	29	50	48	45	41	37	30	53	53	52	47	43	35
	400	49	40	40	35	30	24	52	47	44	39	35	30	54	49	47	43	38	32	58	56	54	49	44	37
	500	50	42	41	36	32	25	53	48	46	41	37	31	54	50	49	44	40	33	57	57	55	51	46	40
	600	53	44	43	38	33	26	56	50	47	42	38	31	57	52	50	46	41	34	60	58	57	52	47	41
	700	56	45	44	39	34	27	58	52	48	44	39	32	58	56	52	47	42	35	62	60	58	53	48	42
	800	58	47	45	40	35	28	60	53	50	45	40	33	61	56	53	48	43	36	64	61	59	54	50	43
	1000	60	52	48	42	37	30	62	56	52	46	42	35	63	58	55	50	45	38	67	63	62	56	51	45
10	600	49	40	38	32	27	28	53	47	43	37	31	29	54	50	46	40	34	31	58	58	57	49	42	36
	800	51	42	40	34	28	29	55	49	45	38	33	30	56	52	48	42	37	32	60	59	57	50	43	38
	1000	53	44	43	36	30	29	56	51	47	40	35	30	58	53	50	44	38	33	62	60	57	50	45	40
	1100	54	45	44	37	31	29	56	52	48	41	36	31	59	55	53	44	39	34	63	60	58	51	45	40
	1200	55	46	45	37	32	29	57	53	49	42	37	31	59	55	53	45	40	35	64	61	59	52	46	41
	1400	57	48	46	39	33	29	59	54	50	43	38	33	60	56	54	47	42	36	65	62	60	53	48	43
	1600	61	51	48	40	34	29	63	56	52	45	40	34	64	58	55	48	43	38	67	63	62	54	49	44
12	800	47	41	39	33	30	29	51	49	47	40	37	33	52	52	50	43	40	36	54	60	58	52	47	43
	1100	49	44	41	34	31	29	54	51	48	42	38	33	55	54	51	45	40	36	58	61	59	53	48	45
	1400	51	46	42	35	32	29	56	52	50	43	39	34	57	54	52	46	42	37	60	62	60	54	49	46
	1600	52	47	44	37	33	29	56	53	51	44	39	34	59	56	53	44	40	35	62	63	61	55	49	46
	1700	53	48	44	37	33	29	56	53	51	44	39	34	59	56	54	47	42	37	63	63	61	55	49	46
	2000	54	49	46	39	33	29	58	54	52	45	40	34	60	56	54	48	42	37	64	64	62	56	50	46
	2300	55	50	48	40	35	30	59	55	53	46	41	35	62	58	56	49	44	39	66	65	63	57	51	47
14	1100	47	42	36	34	34	30	53	49	42	39	40	36	55	52	45	42	42	38	60	60	54	50	47	45
	1500	49	44	39	36	34	30	54	51	45	40	41	36	56	54	48	43	43	39	62	61	55	52	48	47
	1900	51	46	42	37	34	30	56	53	47	43	43	37	58	55	49	46	45	40	63	62	56	53	51	48
	2100	52	47	43	38	34	30	56	54	48	43	43	37	60	58	51	46	46	41	64	62	57	54	52	49
	2300	53	48	44	38	34	30	57	54	48	43	43	37	60	58	52	46	46	41	65	63	58	54	53	50
	2700	55	50	46	40	35	31	59	56	50	45	43	37	61	58	54	48	46	41	66	64	60	55	54	50
	3100	56	53	48	42	37	32	61	58	52	46	43	38	63	60	55	49	46	41	67	65	62	57	55	50
16	1600	48	44	37	35	30	30	53	49	43	40	36	33	55	52	46	42	38	35	60	62	56	50	46	41
	2100	50	46	40	36	33	30	55	52	46	41	39	34	57	55	48	44	41	37	61	64	56	52	47	44
	2600	53	48	43	39	35	31	57	53	47	43	40	36	59	56	50	46	43	39	63	64	58	53	49	46
	2800	54	48	44	39	36	31	58	54	48	44	41	37	60	59	52	47	44	40	64	64	58	54	50	46
	3100	55	49	45	41	37	32	59	55	49	45	42	38	61	59	52	48	45	41	65	65	59	55	51	47
	3600	56	51	47	42	38	34	61	57	51	47	43	39	63	59	54	50	47	43	67	66	61	56	53	49
	4100	58	53	50	44	40	35	62	59	53	48	45	40	65	61	56	51	48	44	69	67	63	58	54	50
19	2500	59	57	54	47	41	33	65	60	60	52	46	39	66	63	63	55	50	42	70	67	67	63	57	50
	3000	59	58	55	47	41	34	65	61	61	52	46	39	66	63	64	56	50	43	70	68	68	64	58	50
	3500	60	59	56	48	42	35	66	62	62	53	47	40	67	64	65	57	51	44	71	68	69	64	59	51
	4500	60	61	59	50	45	37	66	64	65	55	50	43	68	66	68	59	53	46	72	70	72	67	61	54
	5400	62	62	62	52	48	40	67	66	68	57	52	45	68	68	71	61	56	49	73	72	75	69	64	57
	5500	62	63	63	53	48	40	67	66	68	58	53	46	68	68	71	62	56	49	73	72	76	70	64	57
	6500	66	65	66	56	51	44	67	68	72	61	56	49	69	70	75	65	60	53	75	75	79	73	67	60
22	4000	59	60	56	48	42	36	65	63	62	53	47	41	66	66	65	57	51	46	70	71	72	67	60	54
	5000	60	61	59	50	44	38	65	64	64	55	48	43	67	67	67	59	53	48	72	72	74	68	62	56
	6000	62	62	61	51	46	40	65	65	66	56	50	45	67	68	70	61	54	49	72	73	76	70	64	58
	7000	64	63	64	53	48	41	66	66	69	58	52	47	68	69	72	63	56	51	74	74	79	72	66	59
	7100	64	63	64	54	48	41	66	66	69	59	53	47	69	69	73	63	57	51	74	74	79	72	66	59
	8000	66	64	66	55	50	43	67	67	71	60	54	48	70	70	75	65	58	53	75	75	81	74	68	61

- Performance data obtained from tests conducted in accordance with AHRI Standard 880.
- Sound levels are expressed in decibels, dB re: 1 x 10^{-12} watts
- Certified AHRI data is highlighted blue. Application data (not highlighted blue) is outside the scope of the certification program.

DISCHARGE SOUND POWER DATA - MODEL TSS - SA

TERMINAL SIZE	CFM	OCTAVE BAND NUMBER																	
		0.5" ΔPs						1.0" ΔPs						3.0" ΔPs					
		2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
4	100	52	47	35	29	21	22	55	51	42	34	24	24	55	54	48	41	30	28
	150	55	52	39	32	23	22	61	57	45	37	27	23	63	62	54	45	35	32
	200	60	56	43	35	24	25	66	61	48	40	29	26	68	67	58	48	37	34
	250	64	59	46	41	28	26	70	63	51	43	32	27	73	71	62	50	39	34
5	100	49	43	35	29	20	20	50	44	39	30	23	24	53	51	45	37	28	27
	200	53	49	39	30	20	21	56	51	44	35	24	23	60	60	54	44	34	31
	300	60	53	43	34	21	22	65	57	48	39	26	24	66	63	58	48	37	32
	350	62	55	45	36	24	21	68	60	50	42	29	25	68	65	60	51	39	32
6	200	49	45	35	28	19	22	54	50	43	32	22	23	59	58	51	43	32	29
	250	56	49	38	30	22	23	59	54	46	35	23	23	61	59	53	45	33	31
	300	59	52	41	32	22	23	61	57	48	37	25	23	64	62	57	46	35	31
	350	59	54	44	35	23	24	62	60	51	40	27	24	65	64	59	48	37	33
	450	60	55	46	37	23	24	65	61	54	42	28	24	69	66	61	50	38	36
	550	64	59	50	42	26	26	67	65	57	46	32	29	73	70	65	52	39	38
8	300	52	45	39	29	22	22	53	50	47	36	28	27	59	56	57	47	38	36
	400	55	46	40	30	23	23	57	51	46	37	28	28	60	57	58	47	38	36
	500	57	50	43	34	24	24	61	54	49	39	30	28	63	60	60	50	41	38
	600	58	52	45	36	26	24	63	56	49	42	30	28	65	62	62	52	41	38
	800	62	55	49	39	29	26	66	60	53	45	34	30	71	66	62	53	43	39
	1000	66	60	53	44	33	29	69	64	57	49	40	32	75	69	65	55	44	40
10	600	54	49	42	34	23	23	58	54	51	40	30	29	64	59	57	49	37	37
	800	56	51	43	35	25	24	61	57	52	42	31	30	66	63	60	53	40	39
	1000	59	54	47	38	28	26	63	59	54	44	34	32	70	66	62	55	43	40
	1200	60	57	49	40	29	27	65	61	56	45	37	33	72	69	64	56	44	42
	1400	62	59	51	43	32	29	67	63	58	48	40	35	74	70	66	58	46	44
	1600	65	61	56	47	35	32	71	66	62	51	43	37	77	72	68	61	48	46
12	800	52	49	44	35	28	26	55	55	54	45	36	33	61	59	58	51	42	40
	1100	54	52	47	37	29	28	59	58	56	46	38	38	65	62	61	55	47	43
	1400	56	54	50	40	32	28	62	60	57	47	40	38	66	66	66	58	49	45
	1700	58	55	52	42	34	31	64	61	58	49	42	38	70	69	67	60	52	48
	2000	61	59	54	45	37	33	66	62	60	51	45	40	74	71	69	61	53	51
	2300	65	61	57	48	40	37	69	63	61	52	47	42	76	72	70	61	55	52
14	1100	53	47	42	38	32	26	60	55	50	44	39	35	65	62	59	53	48	45
	1500	57	50	45	39	34	28	62	57	52	45	41	38	67	65	62	57	51	48
	1900	57	52	48	42	35	29	65	60	54	46	43	41	70	67	65	58	53	49
	2300	60	56	51	45	38	32	66	61	56	47	45	43	72	69	65	60	56	51
	2700	62	57	54	47	40	36	68	63	58	49	47	45	75	70	67	61	57	53
	3100	64	59	56	49	42	37	67	64	60	51	48	46	77	72	68	61	58	56
16	1600	54	48	43	36	32	27	58	54	50	47	39	34	64	59	53	51	48	43
	2100	58	52	47	40	34	29	63	58	52	48	42	37	66	65	59	57	52	47
	2600	59	53	50	43	36	30	66	61	54	49	43	41	70	70	63	62	56	51
	3100	61	57	52	46	39	33	67	63	57	49	45	43	74	71	66	61	57	53
	3600	62	59	56	47	41	36	68	64	60	50	47	44	77	74	68	62	58	55
	4100	64	61	59	50	42	38	68	65	63	52	49	45	79	76	70	62	59	57
19	2500	66	63	54	50	47	38	70	64	60	56	50	42	72	68	65	62	58	51
	3000	67	64	56	53	49	41	71	67	63	58	52	46	74	71	68	66	61	54
	3500	68	66	57	54	50	46	72	68	65	59	55	49	75	73	70	69	63	56
	4500	69	66	59	56	52	49	73	69	68	61	58	53	79	76	75	71	68	61
	5500	70	67	62	58	56	51	74	70	69	63	61	57	82	79	78	75	69	64
	6500	72	69	67	60	58	53	75	70	69	64	63	59	85	81	80	77	71	67
22	4000	68	66	60	53	46	41	73	68	66	58	50	46	78	73	74	69	63	57
	5000	68	66	62	57	49	45	75	70	70	61	53	50	80	76	77	73	65	59
	6000	71	68	65	60	53	49	77	72	73	63	57	54	82	78	79	73	67	62
	7000	74	69	68	62	55	53	78	73	74	65	60	57	84	80	81	74	68	63
	8000	76	70	71	64	57	55	78	74	74	67	63	59	85	81	82	75	70	65

- Performance data obtained from tests conducted in accordance with AHRI Standard 880.
- Sound levels are expressed in decibels, dB re: 1 x 10^{-12} watts
- Duct end corrections included in sound power levels per AHRI Standard 880.

SOUND DATA

RADIATED SOUND POWER DATA - MODEL TSS-SA

TERMINAL SIZE	CFM	OCTAVE BAND NUMBER																	
		0.5" ΔPs						1.0" ΔPs						3.0" ΔPs					
		2	3	4	5	6	7	2	3	4	5	6	7	2	3	4	5	6	7
4	100	46	43	35	29	26	27	49	44	39	32	27	24	48	50	46	38	33	31
	150	49	47	40	33	29	28	52	48	44	36	31	28	53	55	50	43	37	34
	200	52	51	44	37	32	29	56	52	48	40	35	31	58	59	54	47	41	38
	250	54	54	47	40	36	32	58	55	51	43	38	34	61	62	58	50	45	41
5	100	42	36	33	27	23	20	45	40	37	29	25	22	47	47	44	36	32	30
	200	46	44	40	33	28	28	49	48	44	36	31	28	52	53	50	43	37	34
	300	51	49	45	38	34	30	54	53	49	41	36	32	56	57	56	48	42	39
	350	54	52	47	40	36	32	57	55	51	43	38	35	58	59	58	50	45	41
6	200	43	38	38	37	33	23	47	44	45	44	40	29	51	52	54	51	47	37
	250	46	41	39	36	32	23	48	46	45	44	41	30	53	54	56	55	51	40
	300	48	43	40	36	31	24	50	48	46	44	41	30	55	56	58	57	54	42
	350	50	46	42	37	31	26	53	50	47	43	40	30	57	58	60	58	55	43
	450	54	48	45	38	32	28	57	53	50	45	40	32	60	60	61	59	56	45
	550	60	53	49	43	36	30	64	58	53	46	41	34	63	63	62	57	55	46
8	300	46	37	38	33	28	24	49	46	42	38	33	29	53	53	52	47	43	35
	400	49	40	40	35	30	24	52	47	44	39	35	30	58	56	54	49	44	37
	500	50	42	41	36	32	25	53	48	46	41	37	31	57	57	55	51	46	40
	600	53	44	43	38	33	26	56	50	47	42	38	31	60	58	57	52	47	41
	800	58	47	45	40	35	28	60	53	50	45	40	33	64	61	59	54	50	43
	1000	60	52	48	42	37	30	62	56	52	46	42	35	67	63	62	56	51	45
10	600	49	40	38	32	27	28	53	47	43	37	31	29	58	58	57	49	42	36
	800	51	42	40	34	28	29	55	49	45	38	33	30	60	59	57	50	43	38
	1000	53	44	43	36	30	29	56	51	47	40	35	30	62	60	57	50	45	40
	1200	55	46	45	37	32	29	57	53	49	42	37	31	64	61	59	52	46	41
	1400	57	48	46	39	33	29	59	54	50	43	38	33	65	62	60	53	48	43
	1600	61	51	48	40	34	29	63	56	52	45	40	34	67	63	62	54	49	44
12	800	47	41	39	33	30	29	51	49	47	40	37	33	54	60	58	52	47	43
	1100	49	44	41	34	31	29	54	51	48	42	38	33	58	61	59	53	48	45
	1400	51	46	42	35	32	29	56	52	50	43	39	34	60	62	60	54	49	46
	1700	53	48	44	37	33	29	56	53	51	44	39	34	63	63	61	55	49	46
	2000	54	49	46	39	33	29	58	54	52	45	40	34	64	64	62	56	50	46
	2300	55	50	48	40	35	30	59	55	53	46	41	35	66	65	63	57	51	47
14	1100	47	42	36	34	34	30	53	49	42	39	40	36	60	60	54	50	47	45
	1500	49	44	39	36	34	30	54	51	45	40	41	36	62	61	55	52	48	47
	1900	51	46	42	37	34	30	56	53	47	43	43	37	63	62	56	53	51	48
	2300	53	48	44	38	34	30	57	54	48	43	43	37	65	63	58	54	53	50
	2700	55	50	46	40	35	31	59	56	50	45	43	37	66	64	60	55	54	50
	3100	56	53	48	42	37	32	61	58	52	46	43	38	67	65	62	57	55	50
16	1600	48	44	37	35	30	30	53	49	43	40	36	33	60	62	56	50	46	41
	2100	50	46	40	36	33	30	55	52	46	41	39	34	61	64	56	52	47	44
	2600	53	48	43	39	35	31	57	53	47	43	40	36	63	64	58	53	49	46
	3100	55	49	45	41	37	32	59	55	49	45	42	38	65	65	59	55	51	47
	3600	56	51	47	42	38	34	61	57	51	47	43	39	67	66	61	56	53	49
	4100	58	53	50	44	40	35	62	59	53	48	45	40	69	67	63	58	54	50
19	2500	59	57	54	47	41	33	65	60	60	52	46	39	70	67	67	63	57	50
	3000	59	58	55	47	41	34	65	61	61	52	46	39	70	68	68	64	58	50
	3500	60	59	56	48	42	35	66	62	62	53	47	40	71	68	69	64	59	51
	4500	60	61	59	50	45	37	66	64	65	55	50	43	72	70	72	67	61	54
	5500	62	63	63	53	48	40	67	66	68	58	53	46	73	72	76	70	64	57
	6500	66	65	66	56	51	44	67	68	72	61	56	49	75	75	79	73	67	60
22	4000	59	60	56	48	42	36	65	63	62	53	47	41	70	71	72	67	60	54
	5000	60	61	59	50	44	38	65	64	64	55	48	43	72	72	74	68	62	56
	6000	62	62	61	51	46	40	65	65	66	56	50	45	72	73	76	70	64	58
	7000	64	63	64	53	48	41	66	66	69	58	52	47	74	74	79	72	66	59
	8000	66	64	66	55	50	43	67	67	71	60	54	48	75	75	81	74	68	61

- Performance data obtained from tests conducted in accordance with AHRI Standard 880.
- Sound levels are expressed in decibels, dB re: 1×10^{-12} watts

AHRI RATINGS

SIZE	RATED AIRFLOW CFM	MINIMUM OPERATING PRESSURE (IN. W.G.)	STANDARD RATINGS – SOUND POWER LEVEL, dB RE: 1 x 10^{-12} WATTS											
			1.5" WATER STATIC PRESSURE											
			RADIATED						DISCHARGE					
			Hz Octave Band Center Frequency						Hz Octave Band Center Frequency					
			125	250	500	1000	2000	4000	125	250	500	1000	2000	4000
4	150	0.01	53	53	46	38	33	30	68	67	58	54	49	48
5	250	0.02	53	52	49	41	35	32	70	68	59	55	51	50
6	400	0.10	56	54	52	49	46	36	69	67	60	57	52	52
8	700	0.03	58	56	52	47	42	35	69	67	62	60	57	55
10	1100	0.03	59	55	53	44	39	34	70	67	63	60	57	54
12	1600	0.04	59	56	53	44	40	35	71	67	64	61	59	57
14	2100	0.06	60	58	51	46	46	41	71	67	64	60	58	57
16	2800	0.04	60	59	52	47	44	40	74	68	65	60	58	57
19	5400	0.38	68	68	71	61	56	49	77	78	79	75	70	68
22	7100	0.20	69	69	73	63	57	51	82	80	82	76	71	69

- Rated in accordance with AHRI Standard 880
- Duct end corrections included in sound power levels per AHRI Standard 880.

AHRI CERTIFIED®
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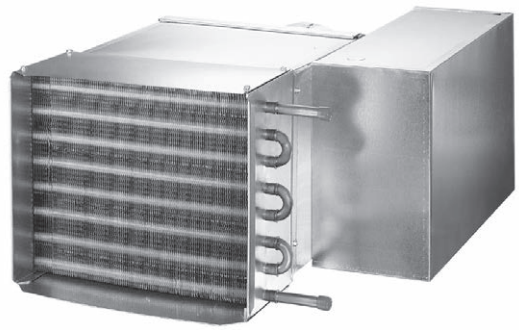
VAV Terminals
AHRI Standard 880

HOT WATER COIL DATA

MODEL TSS-WC



STANDARD FEATURES

- Designed, manufactured, and tested by Johnson Controls
- Aluminum fin construction with die-formed spacer collars for uniform spacing
- Mechanically expanded copper tubes leak tested to 450 PSIG air pressure and rated at 300 PSIG working pressure at 200°F
- Male sweat type water connections
- 1, 2, 3, and 4 row configurations

OPTIONAL FEATURES

- Low pressure steam coils
- Multi-circuit coils for reduced water pressure drop
- Opposite hand water connections
- Bottom and top access plates for cleaning

SELECTION PROCEDURE

TSS-WC Hot Water Coil Performance Tables are based upon a temperature difference of 125°F between the entering water and the entering air. If this ΔT is suitable, proceed directly to the tables for selection. All pertinent performance data is tabulated. **For Variable Air Volume Applications, the static pressure drop must be based on the maximum air volume.**

ENTERING WATER - AIR TEMPERATURE DIFFERENTIAL (DT) CORRECTION FACTORS															
ΔT	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
FACTOR	0.15	0.19	0.23	0.27	0.31	0.35	0.39	0.43	0.47	0.51	0.55	0.59	0.63	0.67	0.71
ΔT	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165
FACTOR	0.75	0.79	0.83	0.88	0.92	0.96	1.00	1.04	1.08	1.13	1.17	1.21	1.25	1.29	1.33

The table above gives correction factors for various entering ΔT's (difference between EWT and EAT). Multiply MBH values obtained from selection tables by the appropriate correction factor above to obtain the actual MBH value. Air and water pressure drop can be read directly from the selection tables. The LAT and LWT can be calculated from the following fundamental formulas:

$$LAT = EAT + \frac{BTUH}{1.085 \times CFM}$$

$$LWT = EWT - \frac{BTUH}{500 \times GPM}$$

DEFINITION OF TERMS

EAT Entering Air Temperature (°F)
EWT Entering Water Temperature (°F)
LWT Leaving Water Temperature (°F)
LAT Leaving Air Temperature
CFM Air Volume (Cubic Feet per Minute)
GPM Water Capacity (Gallons per Minute)
MBH 1,000 BTUH
BTUH Coil Heating Capacity (British Thermal Units per Hour)

MODEL TSS-WC - SIZES 4,5,6

AIRFLOW			WATER FLOW			LAT (°F)		LWT (°F)		CAPACITY (MBH)	
Rate (CFM)	Air PD (IN. W.G.)		Rate (GPM)	Water PD (FT. W.G.)							
				1 Row	2 Row	1 Row	2 Row	1 Row	2 Row	1 Row	2 Row
50	1 Row	0.01	0.5	0.3	0.1	123.7	149.3	164.7	159.1	3.7	5.1
	2 Row	0.01	1.0	1.0	0.3	128.4	155.8	171.8	168.8	4.0	5.5
			2.0	3.4	0.9	131.2	159.3	175.8	174.2	4.1	5.7
			4.0	12.2	3.4	132.7	161.2	177.8	177.0	4.2	5.8
100	1 Row	0.01	0.5	0.3	0.1	105.7	127.4	157.5	147.9	5.5	7.8
	2 Row	0.02	1.0	1.0	0.3	111.2	137.0	167.5	161.8	6.1	8.9
			2.0	3.4	1.0	114.6	142.8	173.4	170.2	6.5	9.5
			4.0	12.2	3.4	116.5	146.2	176.6	174.9	6.7	9.9
150	1 Row	0.02	0.5	0.3	0.1	96.0	114.0	152.7	140.8	6.7	9.6
	2 Row	0.03	1.0	1.0	0.3	101.7	124.7	164.4	156.8	7.6	11.3
			2.0	3.4	1.0	105.3	131.7	171.6	167.2	8.2	12.5
			4.0	12.2	3.4	107.5	135.8	175.6	173.3	8.5	13.1
200	1 Row	0.03	0.5	0.3	0.1	89.8	104.9	149.1	135.8	7.5	10.8
	2 Row	0.06	1.0	1.0	0.3	95.4	115.9	162.0	153.0	8.8	13.2
			2.0	3.4	1.0	99.1	123.5	170.2	164.8	9.6	14.8
			4.0	12.2	3.4	101.4	128.1	174.8	171.9	10.0	15.8
250	1 Row	0.04	0.5	0.3	0.1	85.4	98.4	146.3	132.0	8.2	11.8
	2 Row	0.08	1.0	1.0	0.3	90.9	109.3	160.1	149.9	9.7	14.7
			2.0	3.4	1.0	94.6	117.1	169.0	162.7	10.7	16.8
			4.0	12.2	3.4	96.9	122.1	174.2	170.7	11.3	18.2
300	1 Row	0.06	0.5	0.3	0.1	82.1	93.4	144.0	129.0	8.8	12.5
	2 Row	0.12	1.0	1.0	0.3	87.4	104.1	158.4	147.3	10.5	16.0
			2.0	3.4	1.0	91.1	112.0	167.9	161.0	11.7	18.5
			4.0	12.2	3.4	93.4	117.2	173.6	169.6	12.5	20.2
350	1 Row	0.08	0.5	0.3	0.1	79.5	89.5	142.1	126.6	9.3	13.1
	2 Row	0.15	1.0	1.0	0.3	84.6	99.9	157.0	145.2	11.2	17.0
			2.0	3.4	1.0	88.3	107.8	167.0	159.5	12.6	20.0
			4.0	12.2	3.4	90.6	113.1	173.1	168.7	13.5	22.0
400	1 Row	0.10	0.5	0.3	0.1	77.4	86.4	140.4	124.6	9.7	13.6
	2 Row	0.19	1.0	1.0	0.3	82.4	96.4	155.7	143.3	11.9	17.9
			2.0	3.4	1.0	86.0	104.3	166.2	158.1	13.4	21.4
			4.0	12.2	3.4	88.3	109.6	172.6	167.8	14.4	23.7

MODEL TSS-WC - SIZE 8

AIRFLOW			WATER FLOW			LAT (°F)		LWT (°F)		CAPACITY (MBH)	
Rate (CFM)	Air PD (IN. W.G.)		Rate (GPM)	Water PD (FT. W.G.)							
				1 Row	2 Row	1 Row	2 Row	1 Row	2 Row	1 Row	2 Row
175	1 Row	0.02	0.5	0.3	0.1	95.7	113.1	148.4	135.0	7.7	11.0
	2 Row	0.03	1.0	1.0	0.3	101.7	124.5	161.8	153.0	8.9	13.2
			2.0	3.5	1.0	105.6	131.9	170.1	165.0	9.6	14.6
			4.0	12.7	3.5	107.9	136.2	174.8	172.1	10.0	15.4
250	1 Row	0.03	0.5	0.3	0.1	88.0	101.9	143.4	128.2	8.9	12.7
	2 Row	0.06	1.0	1.0	0.3	94.0	113.5	158.4	147.6	10.6	15.8
			2.0	3.6	1.0	97.9	121.6	168.1	161.5	11.6	18.0
			4.0	12.7	3.5	100.4	126.6	173.7	170.0	12.3	19.4
325	1 Row	0.05	0.5	0.3	0.1	83.0	94.4	139.7	123.5	9.9	13.9
	2 Row	0.10	1.0	1.0	0.3	88.7	105.7	155.7	143.5	11.9	17.9
			2.0	3.6	1.0	92.7	114.1	166.4	158.7	13.3	20.8
			4.0	12.7	3.6	95.2	119.5	172.7	168.3	14.1	22.7
400	1 Row	0.07	0.5	0.3	0.1	79.4	89.0	136.8	119.9	10.6	14.7
	2 Row	0.14	1.0	1.0	0.3	84.9	99.9	153.4	140.2	13.0	19.5
			2.0	3.6	1.0	88.8	108.3	165.0	156.3	14.7	23.1
			4.0	12.7	3.6	91.3	113.9	171.9	166.9	15.7	25.5
475	1 Row	0.09	0.5	0.3	0.1	76.7	85.0	134.4	117.1	11.2	15.4
	2 Row	0.19	1.0	1.0	0.3	82.0	95.4	151.6	137.6	13.9	20.8
			2.0	3.6	1.0	85.8	103.7	163.7	154.3	15.9	25.1
			4.0	12.7	3.6	88.3	109.4	171.2	165.6	17.1	28.0
550	1 Row	0.12	0.5	0.3	0.1	74.6	81.9	132.4	114.9	11.7	16.0
	2 Row	0.25	1.0	1.0	0.3	79.6	91.7	149.9	135.3	14.7	21.9
			2.0	3.6	1.0	83.4	100.0	162.6	152.6	16.9	26.8
			4.0	12.7	3.6	85.8	105.7	170.6	164.5	18.4	30.2
625	1 Row	0.15	0.5	0.3	0.1	72.9	79.3	130.6	113.0	12.1	16.5
	2 Row	0.31	1.0	1.0	0.3	77.7	88.7	148.5	133.4	15.4	22.8
			2.0	3.6	1.0	81.4	96.8	161.7	151.0	17.9	28.3
			4.0	12.7	3.6	83.8	102.5	170.0	163.5	19.5	32.2
700	1 Row	0.19	0.5	0.3	0.1	71.4	77.2	129.1	111.4	12.5	16.9
	2 Row	0.38	1.0	1.0	0.3	76.1	86.2	147.3	131.7	16.0	23.7
			2.0	3.6	1.0	79.7	94.1	160.8	149.7	18.7	29.6
			4.0	12.7	3.6	82.1	99.8	169.5	162.6	20.5	34.0

Data is based on 180°F entering water and 55°F entering air at sea level. See selection procedure for other conditions.

HOT WATER COIL DATA

MODEL TSS-WC - SIZE 10

AIRFLOW			WATER FLOW			LAT (°F)		LWT (°F)		CAPACITY (MBH)	
Rate (CFM)	Air PD (IN. W.G.)		Rate (GPM)	Water PD (FT. W.G.)							
				1 Row	2 Row	1 Row	2 Row	1 Row	2 Row	1 Row	2 Row
300	1 Row	0.02	0.5	0.3	0.1	89.6	103.0	134.1	116.4	11.2	15.6
	2 Row	0.04	1.0	1.2	0.3	96.5	116.2	152.4	139.4	13.5	19.9
			2.0	4.2	1.2	101.1	125.3	164.6	156.6	15.0	22.9
			4.0	14.9	4.2	103.9	130.9	171.8	167.3	15.9	24.7
400	1 Row	0.04	0.5	0.3	0.1	83.8	94.5	129.1	110.4	12.5	17.1
	2 Row	0.07	1.0	1.2	0.3	90.4	107.3	148.6	133.7	15.4	22.7
			2.0	4.2	1.2	95.1	116.9	162.2	152.5	17.4	26.8
			4.0	14.9	4.2	98.0	123.0	170.4	164.9	18.6	29.5
500	1 Row	0.05	0.5	0.3	0.1	79.8	88.6	125.2	106.0	13.4	18.2
	2 Row	0.11	1.0	1.2	0.3	86.1	100.8	145.5	129.4	16.9	24.8
			2.0	4.2	1.2	90.7	110.5	160.2	149.3	19.3	30.0
			4.0	14.9	4.2	93.6	116.9	169.3	162.8	20.9	33.5
600	1 Row	0.07	0.5	0.3	0.1	76.8	84.2	122.2	102.8	14.2	19.0
	2 Row	0.15	1.0	1.2	0.3	82.9	95.8	143.0	125.9	18.1	26.5
			2.0	4.2	1.2	87.4	105.4	158.4	146.5	21.0	32.7
			4.0	14.9	4.2	90.3	111.9	168.2	161.0	22.9	37.0
700	1 Row	0.10	0.5	0.3	0.1	74.5	80.9	119.7	100.2	14.8	19.6
	2 Row	0.19	1.0	1.2	0.3	80.3	91.8	140.8	123.1	19.2	27.9
			2.0	4.2	1.2	84.7	101.2	156.9	144.1	22.5	35.1
			4.0	15.0	4.2	87.6	107.9	167.3	159.4	24.7	40.1
800	1 Row	0.12	0.5	0.3	0.1	72.7	78.3	117.6	98.1	15.3	20.2
	2 Row	0.25	1.0	1.2	0.3	78.2	88.6	138.9	120.7	20.1	29.1
			2.0	4.2	1.2	82.5	97.8	155.6	142.1	23.8	37.1
			4.0	15.0	4.2	85.3	104.4	166.5	158.0	26.3	42.8
900	1 Row	0.15	0.5	0.3	0.1	71.2	76.1	115.7	96.4	15.8	20.6
	2 Row	0.30	1.0	1.2	0.3	76.5	85.9	137.3	118.6	20.9	30.1
			2.0	4.2	1.2	80.6	94.9	154.4	140.3	25.0	38.9
			4.0	15.0	4.2	83.4	101.5	165.8	156.8	27.7	45.3
1000	1 Row	0.18	0.5	0.3	0.1	69.9	74.4	114.2	94.9	16.2	21.0
	2 Row	0.37	1.0	1.2	0.3	75.0	83.6	135.8	116.8	21.6	31.0
			2.0	4.2	1.2	79.1	92.4	153.3	138.7	26.1	40.5
			4.0	15.0	4.2	81.8	98.9	165.1	155.6	29.1	47.6

MODEL TSS-WC - SIZE 12

AIRFLOW			WATER FLOW			LAT (°F)		LWT (°F)		CAPACITY (MBH)	
Rate (CFM)	Air PD (IN. W.G.)		Rate (GPM)	Water PD (FT. W.G.)							
				1 Row	2 Row	1 Row	2 Row	1 Row	2 Row	1 Row	2 Row
400	1 Row	0.02	0.5	0.4	0.1	87.5	98.9	122.5	102.7	14.1	19.0
	2 Row	0.04	1.0	1.4	0.4	95.3	113.5	144.3	128.3	17.4	25.3
			2.0	4.9	1.4	100.6	124.0	159.7	149.4	19.8	29.9
			4.0	17.4	4.9	103.9	130.5	169.1	163.2	21.2	32.7
550	1 Row	0.04	0.5	0.4	0.1	81.3	89.8	116.2	95.8	15.7	20.7
	2 Row	0.07	1.0	1.4	0.4	88.6	103.5	139.1	121.1	20.0	28.9
			2.0	4.9	1.4	93.9	114.5	156.2	143.8	23.2	35.4
			4.0	17.4	4.9	97.3	121.6	167.1	159.7	25.2	39.7
700	1 Row	0.05	0.5	0.4	0.1	77.1	83.8	111.7	91.3	16.8	21.9
	2 Row	0.11	1.0	1.4	0.4	84.0	96.6	135.1	115.8	22.0	31.5
			2.0	5.0	1.4	89.2	107.4	153.4	139.4	25.9	39.7
			4.0	17.4	4.9	92.6	114.9	165.4	156.7	28.5	45.4
850	1 Row	0.08	0.5	0.4	0.1	74.2	79.6	108.2	88.1	17.7	22.7
	2 Row	0.16	1.0	1.4	0.4	80.6	91.4	131.8	111.8	23.6	33.5
			2.0	5.0	1.4	85.7	102.0	151.1	135.8	28.3	43.3
			4.0	17.5	5.0	89.0	109.6	163.9	154.3	31.3	50.3
1000	1 Row	0.10	0.5	0.4	0.1	71.9	76.5	105.4	85.6	18.4	23.3
	2 Row	0.21	1.0	1.4	0.4	78.0	87.4	129.1	108.6	24.9	35.1
			2.0	5.0	1.4	82.9	97.7	149.0	132.8	30.2	46.2
			4.0	17.5	5.0	86.2	105.3	162.6	152.1	33.8	54.5
1150	1 Row	0.13	0.5	0.4	0.1	70.2	74.1	103.1	83.7	18.9	23.8
	2 Row	0.27	1.0	1.4	0.4	75.9	84.3	126.8	105.9	26.1	36.4
			2.0	5.0	1.4	80.7	94.2	147.3	130.2	32.0	48.8
			4.0	17.5	5.0	83.9	101.7	161.5	150.2	36.1	58.2
1300	1 Row	0.17	0.5	0.4	0.1	68.8	72.2	101.1	82.1	19.4	24.2
	2 Row	0.33	1.0	1.4	0.4	74.2	81.7	124.8	103.7	27.1	37.5
			2.0	5.0	1.4	78.8	91.2	145.7	128.0	33.5	51.0
			4.0	17.5	5.0	82.0	98.7	160.5	148.5	38.1	61.5
1450	1 Row	0.20	0.5	0.4	0.1	67.6	70.6	99.5	80.8	19.8	24.5
	2 Row	0.40	1.0	1.4	0.4	72.8	79.5	123.1	101.8	27.9	38.5
			2.0	5.0	1.4	77.2	88.7	144.3	126.1	34.9	52.9
			4.0	17.5	5.0	80.4	96.1	159.6	147.0	39.9	64.5

Data is based on 180°F entering water and 55°F entering air at sea level. See selection procedure for other conditions.

MODEL TSS-WC - SIZE 14

AIRFLOW			WATER FLOW			LAT (°F)		LWT (°F)		CAPACITY (MBH)	
Rate (CFM)	Air PD (IN. W.G.)		Rate (GPM)	Water PD (FT. W.G.)							
				1 Row	2 Row	1 Row	2 Row	1 Row	2 Row	1 Row	2 Row
700	1 Row	0.03	0.5	0.5	0.1	80.2	87.0	102.4	81.8	19.1	24.2
	2 Row	0.06	1.0	1.7	0.5	88.6	102.1	128.1	107.4	25.5	35.7
			2.0	6.0	1.7	94.9	114.8	149.0	133.7	30.3	45.4
			4.0	21.0	6.0	99.1	123.3	162.9	153.5	33.4	51.8
900	1 Row	0.04	0.5	0.5	0.1	75.9	81.0	97.3	77.5	20.4	25.3
	2 Row	0.09	1.0	1.7	0.5	83.7	94.7	123.1	101.4	27.9	38.7
			2.0	6.0	1.7	89.9	107.2	145.2	128.1	34.0	50.9
			4.0	21.1	6.0	94.0	116.1	160.5	149.5	38.0	59.6
1100	1 Row	0.06	0.5	0.5	0.1	72.9	76.9	93.5	74.6	21.3	26.0
	2 Row	0.13	1.0	1.7	0.5	80.1	89.3	119.1	97.0	29.9	40.9
			2.0	6.1	1.7	86.1	101.4	142.1	123.6	37.0	55.3
			4.0	21.1	6.0	90.2	110.5	158.5	146.2	41.9	66.1
1300	1 Row	0.08	0.5	0.5	0.1	70.6	73.9	90.6	72.5	22.0	26.6
	2 Row	0.17	1.0	1.8	0.5	77.4	85.3	115.8	93.6	31.5	42.6
			2.0	6.1	1.7	83.1	96.9	139.5	120.0	39.6	58.9
			4.0	21.1	6.0	87.2	105.9	156.8	143.4	45.3	71.7
1500	1 Row	0.11	0.5	0.5	0.1	68.9	71.6	88.3	70.9	22.6	27.0
	2 Row	0.22	1.0	1.8	0.5	75.2	82.1	113.1	90.8	32.9	44.0
			2.0	6.1	1.8	80.8	93.2	137.2	116.9	41.9	62.0
			4.0	21.2	6.1	84.7	102.1	155.2	140.9	48.3	76.5
1700	1 Row	0.14	0.5	0.5	0.1	67.5	69.8	86.3	69.6	23.1	27.3
	2 Row	0.27	1.0	1.8	0.5	73.5	79.5	110.8	88.6	34.0	45.1
			2.0	6.1	1.8	78.8	90.1	135.2	114.3	43.9	64.6
			4.0	21.2	6.1	82.7	98.9	153.9	138.7	51.0	80.8
1900	1 Row	0.17	0.5	0.5	0.1	66.4	68.4	84.7	68.6	23.5	27.5
	2 Row	0.33	1.0	1.8	0.5	72.0	77.4	108.8	86.7	35.0	46.0
			2.0	6.1	1.8	77.2	87.5	133.4	112.0	45.6	66.9
			4.0	21.2	6.1	81.0	96.1	152.6	136.8	53.5	84.7
2100	1 Row	0.20	0.5	0.5	0.1	65.5	67.2	83.3	67.8	23.9	27.8
	2 Row	0.40	1.0	1.8	0.5	70.8	75.6	107.0	85.1	35.9	46.8
			2.0	6.1	1.8	75.8	85.3	131.8	110.0	47.2	68.8
			4.0	21.2	6.1	79.5	93.7	151.5	135.0	55.7	88.1

MODEL TSS-WC - SIZE 16

AIRFLOW			WATER FLOW			LAT (°F)		LWT (°F)		CAPACITY (MBH)	
Rate (CFM)	Air PD (IN. W.G.)		Rate (GPM)	Water PD (FT. W.G.)							
				1 Row	2 Row	1 Row	2 Row	1 Row	2 Row	1 Row	2 Row
1600	1 Row	0.09	0.5	0.6	0.1	68.9	71.2	82.5	66.6	24.1	28.1
	2 Row	0.18	1.0	1.9	0.6	75.6	82.1	107.4	85.0	35.7	46.9
			2.0	6.6	1.9	81.7	94.0	132.8	111.3	46.3	67.5
			4.0	22.9	6.6	86.1	103.7	152.4	136.9	53.9	84.4
1800	1 Row	0.11	0.5	0.6	0.1	67.6	69.5	80.7	65.5	24.5	28.3
	2 Row	0.22	1.0	1.9	0.6	73.9	79.6	105.1	82.9	36.9	47.9
			2.0	6.6	1.9	79.8	91.0	130.7	108.7	48.3	70.1
			4.0	22.9	6.6	84.1	100.6	150.9	134.6	56.8	88.9
2000	1 Row	0.13	0.5	0.6	0.1	66.5	68.2	79.2	64.7	24.9	28.5
	2 Row	0.26	1.0	1.9	0.6	72.5	77.5	103.1	81.2	37.9	48.8
			2.0	6.6	1.9	78.1	88.4	128.8	106.4	50.1	72.4
			4.0	23.0	6.6	82.4	97.9	149.6	132.6	59.4	92.9
2200	1 Row	0.16	0.5	0.6	0.1	65.6	67.0	78.0	64.0	25.2	28.7
	2 Row	0.31	1.0	1.9	0.6	71.3	75.8	101.3	79.7	38.7	49.5
			2.0	6.6	1.9	76.7	86.2	127.2	104.4	51.8	74.4
			4.0	23.0	6.6	80.9	95.5	148.4	130.7	61.8	96.6
2400	1 Row	0.18	0.5	0.6	0.1	64.8	66.1	76.8	63.4	25.5	28.8
	2 Row	0.37	1.0	1.9	0.6	70.2	74.3	99.7	78.4	39.5	50.2
			2.0	6.6	1.9	75.5	84.3	125.6	102.6	53.3	76.2
			4.0	23.0	6.6	79.6	93.4	147.3	129.1	64.0	99.9
2600	1 Row	0.21	0.5	0.6	0.1	64.1	65.3	75.9	62.9	25.7	29.0
	2 Row	0.42	1.0	1.9	0.6	69.3	73.0	98.3	77.3	40.2	50.7
			2.0	6.6	1.9	74.4	82.6	124.2	101.0	54.7	77.8
			4.0	23.0	6.6	78.4	91.5	146.2	127.5	66.0	102.9
2800	1 Row	0.24	0.5	0.6	0.1	63.6	64.6	75.0	62.5	25.9	29.1
	2 Row	0.48	1.0	1.9	0.6	68.5	71.9	97.0	76.3	40.9	51.2
			2.0	6.7	1.9	73.5	81.1	123.0	99.6	56.0	79.2
			4.0	23.0	6.6	77.4	89.9	145.2	126.1	67.9	105.7
3000	1 Row	0.27	0.5	0.6	0.1	63.0	64.0	74.2	62.1	26.1	29.2
	2 Row	0.55	1.0	1.9	0.6	67.8	70.9	95.9	75.4	41.4	51.7
			2.0	6.7	1.9	72.6	79.8	121.8	98.3	57.1	80.5
			4.0	23.1	6.6	76.5	88.3	144.3	124.8	69.7	108.3

Data is based on 180°F entering water and 55°F entering air at sea level. See selection procedure for other conditions.

HOT WATER COIL DATA

MODEL TSS-WC - SIZE 19

AIRFLOW			WATER FLOW			LAT (°F)		LWT (°F)		CAPACITY (MBH)	
Rate (CFM)	Air PD (IN. W.G.)		Rate (GPM)	Water PD (FT. W.G.)							
				1 Row	2 Row	1 Row	2 Row	1 Row	2 Row	1 Row	2 Row
2300	1 Row	0.11	0.5	0.6	0.1	65.7	66.9	72.3	60.5	26.6	29.6
	2 Row	0.23	1.0	2.2	0.6	71.9	76.1	94.6	73.8	42.1	52.5
			2.0	7.4	2.2	78.1	87.5	121.5	97.9	57.4	80.9
			4.0	25.6	7.4	82.8	97.9	144.5	125.5	69.4	106.9
2600	1 Row	0.14	0.5	0.6	0.1	64.6	65.6	70.8	59.9	27.0	29.7
	2 Row	0.28	1.0	2.2	0.6	70.3	73.9	92.4	72.2	43.2	53.3
			2.0	7.4	2.2	76.2	84.6	119.1	95.3	59.8	83.5
			4.0	25.7	7.4	80.9	94.8	142.7	122.9	72.9	112.0
2900	1 Row	0.17	0.5	0.6	0.1	63.7	64.5	69.7	59.4	27.3	29.8
	2 Row	0.34	1.0	2.2	0.6	69.1	72.2	90.4	70.8	44.2	54.0
			2.0	7.5	2.2	74.7	82.3	117.0	93.0	61.8	85.7
			4.0	25.7	7.4	79.2	92.1	141.1	120.6	76.1	116.6
3200	1 Row	0.21	0.5	0.6	0.1	62.9	63.6	68.7	59.0	27.5	29.9
	2 Row	0.41	1.0	2.2	0.6	68.0	70.7	88.7	69.7	45.0	54.6
			2.0	7.5	2.2	73.4	80.3	115.2	91.1	63.7	87.6
			4.0	25.8	7.4	77.8	89.8	139.6	118.5	79.0	120.7
3500	1 Row	0.24	0.5	0.6	0.1	62.3	62.9	67.8	58.7	27.7	30.0
	2 Row	0.48	1.0	2.2	0.6	67.1	69.5	87.3	68.7	45.7	55.0
			2.0	7.5	2.2	72.2	78.6	113.5	89.5	65.3	89.3
			4.0	25.8	7.5	76.6	87.8	138.3	116.7	81.7	124.4
3800	1 Row	0.28	0.5	0.6	0.1	61.8	62.3	67.1	58.4	27.9	30.1
	2 Row	0.56	1.0	2.2	0.6	66.3	68.5	86.0	67.9	46.4	55.4
			2.0	7.5	2.2	71.2	77.1	112.0	88.0	66.8	90.8
			4.0	25.8	7.5	75.4	86.0	137.0	115.0	84.2	127.7
4100	1 Row	0.32	0.5	0.6	0.1	61.3	61.8	66.5	58.2	28.1	30.2
	2 Row	0.64	1.0	2.2	0.6	65.6	67.6	84.8	67.2	47.0	55.8
			2.0	7.5	2.2	70.4	75.7	110.6	86.7	68.2	92.1
			4.0	25.8	7.5	74.5	84.4	135.8	113.5	86.5	130.7
4400	1 Row	0.36	0.5	0.6	0.1	60.9	61.3	65.9	58.0	28.2	30.2
	2 Row	0.73	1.0	2.2	0.6	65.0	66.8	83.7	66.6	47.5	56.1
			2.0	7.5	2.2	69.6	74.6	109.4	85.5	69.5	93.3
			4.0	25.9	7.5	73.6	83.0	134.8	112.1	88.6	133.5

MODEL TSS-WC - SIZE 22

AIRFLOW			WATER FLOW			LAT (°F)		LWT (°F)		CAPACITY (MBH)	
Rate (CFM)	Air PD (IN. W.G.)		Rate (GPM)	Water PD (FT. W.G.)							
				1 Row	2 Row	1 Row	2 Row	1 Row	2 Row	1 Row	2 Row
3100	1 Row	0.16	0.5	0.7	0.1	63.4	64.0	66.6	58.0	28.0	30.2
	2 Row	0.31	1.0	2.3	0.7	68.8	71.6	86.0	67.6	46.4	55.6
			2.0	8.0	2.3	74.7	81.9	112.8	88.6	66.1	90.2
			4.0	27.5	8.0	79.5	92.2	137.9	116.4	82.4	124.9
3500	1 Row	0.19	0.5	0.7	0.1	62.5	63.0	65.5	57.6	28.3	30.3
	2 Row	0.39	1.0	2.3	0.7	67.5	69.8	84.0	66.4	47.4	56.2
			2.0	8.0	2.3	73.1	79.4	110.4	86.3	68.4	92.5
			4.0	27.6	8.0	77.8	89.3	135.9	113.8	86.3	130.1
3900	1 Row	0.23	0.5	0.7	0.1	61.8	62.2	64.7	57.4	28.5	30.4
	2 Row	0.47	1.0	2.3	0.7	66.4	68.4	82.3	65.4	48.2	56.7
			2.0	8.0	2.3	71.7	77.4	108.3	84.3	70.5	94.5
			4.0	27.6	8.0	76.2	86.9	134.2	111.5	89.7	134.7
4300	1 Row	0.28	0.5	0.7	0.1	61.2	61.5	63.9	57.1	28.7	30.4
	2 Row	0.56	1.0	2.3	0.7	65.5	67.3	80.8	64.5	49.0	57.1
			2.0	8.0	2.3	70.5	75.6	106.5	82.6	72.3	96.1
			4.0	27.7	8.0	74.9	84.8	132.6	109.4	92.9	138.8
4700	1 Row	0.33	0.5	0.7	0.1	60.7	61.0	63.3	56.9	28.9	30.5
	2 Row	0.66	1.0	2.3	0.7	64.7	66.3	79.6	63.9	49.6	57.5
			2.0	8.1	2.3	69.5	74.2	104.8	81.2	74.0	97.6
			4.0	27.7	8.0	73.8	83.0	131.2	107.6	95.7	142.4
5100	1 Row	0.38	0.5	0.7	0.1	60.2	60.5	62.8	56.8	29.0	30.5
	2 Row	0.76	1.0	2.3	0.7	64.1	65.5	78.4	63.3	50.2	57.8
			2.0	8.1	2.3	68.7	72.9	103.4	79.9	75.4	98.8
			4.0	27.7	8.0	72.8	81.4	129.8	106.0	98.4	145.7
5500	1 Row	0.43	0.5	0.7	0.1	59.9	60.1	62.3	56.7	29.1	30.5
	2 Row	0.87	1.0	2.3	0.7	63.5	64.7	77.5	62.8	50.7	58.0
			2.0	8.1	2.3	67.9	71.8	102.0	78.8	76.8	100.0
			4.0	27.7	8.1	71.9	80.0	128.6	104.5	100.8	148.7
5900	1 Row	0.49	0.5	0.7	0.1	59.6	59.8	62.0	56.6	29.2	30.6
	2 Row	0.99	1.0	2.3	0.7	63.0	64.1	76.6	62.3	51.1	58.2
			2.0	8.1	2.3	67.2	70.8	100.8	77.8	78.0	101.0
			4.0	27.8	8.1	71.1	78.7	127.5	103.1	103.0	151.4

Data is based on 180°F entering water and 55°F entering air at sea level. See selection procedure for other conditions.

ELECTRIC HEAT

MODEL TSS-EH

STANDARD FEATURES

- cETL listed as an assembly
- Single point power connection
- Primary auto-reset high limit
- Secondary high limit
- Airflow switch
- Hinged control panel
- Ni-Chrome elements
- Primary/secondary power terminations
- Fusing per NEC
- Wiring diagram and ETL label
- Available kW increments are as follows:
  0.5 to 8.0 kW - .50 kW; 8.0 to 16.0 kW - 1.0 kW
  Above 16 kW - 2.0 kW

OPTIONAL FEATURES

- Disconnect (toggle or door interlocking)
- PE switches
- Mercury and magnetic contactors
- Manual reset secondary limit
- Proportional control (SSR)
- 24 V control transformer

SELECTION PROCEDURE

With standard heater elements, the maximum capacity (kW) is obtained by dividing the heating (minimum) SCFM by 70. In other words, the terminal must have at least 70 SCFM per kW. In addition, each size terminal has a maximum allowable kW based upon the specific heater element configuration (i.e. voltage, phase, number of steps, etc.). Contact your Johnson Controls representative or refer to the VAV computer selection program for design assistance.

Heaters require a minimum of 0.07" w.g. downstream static pressure to ensure proper operation.

Selection Equations

$$kW = \frac{SCFM \times DT \times 1.085^*}{3413}$$

$$SCFM = \frac{kW \times 3413}{\Delta T \times 1.085^*}$$

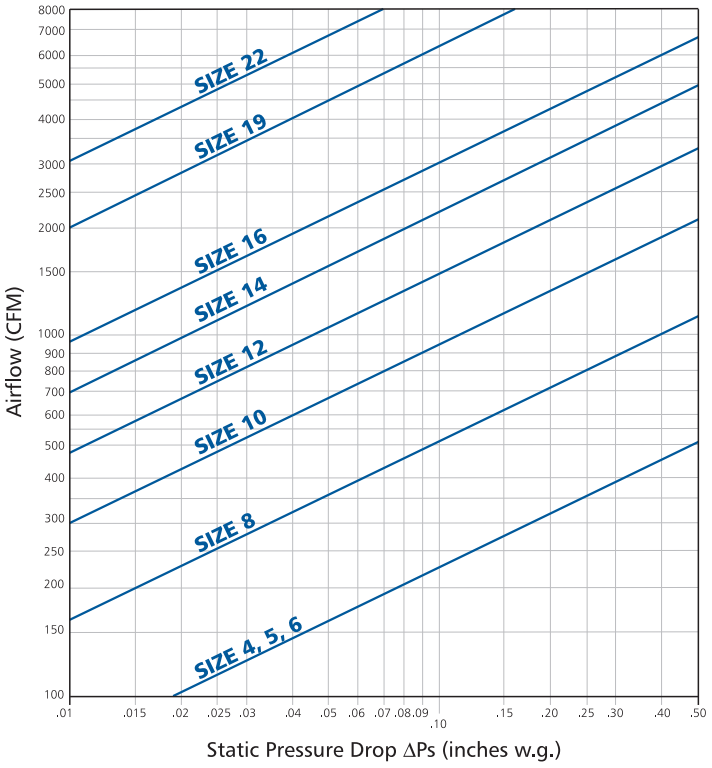
$$\Delta T = \frac{kW \times 3413}{SCFM \times 1.085^*}$$

** Air density at sea level - reduce by 0.036 for each 1000 feet of altitude above sea level.*

Calculating Line Amperage

$$\text{Single Phase Amps} = \frac{kW \times 1000}{Volts}$$

$$\text{Three Phase Amps} = \frac{kW \times 1000}{Volts \times 1.73}$$



GUIDE SPECIFICATIONS

GENERAL

Furnish and install Johnson Controls Model TSS Single Duct Variable Air Volume Terminal Units of the sizes and capacities as scheduled. Terminals shall be certified by AHRI and bear the AHRI 880 seal.

CONSTRUCTION

Terminals shall be constructed of not less than 22 gauge galvanized steel, able to withstand a 125 hour salt spray test per ASTM B-117. Stainless steel casings, or galvannealed steel casings with a baked enamel paint finish, may be used as an alternative. The terminal casing shall be mechanically assembled (spot-welded casings are not acceptable).

Casing shall be internally lined with 1/2" thick fiberglass insulation, rated for a maximum air velocity of 5000 f.p.m. Maximum thermal conductivity shall be .24 (BTU • in) / (hr • ft^2 • °F). Insulation must meet all requirements of ASTM C1071 (including C665), UL 181 for erosion, and carry a 25/50 rating for flame spread/smoke developed per ASTM E-84, UL 723 and NFPA 90A. Raw insulation edges on the discharge of the unit must be covered with metal liner to eliminate flaking of insulation during field duct connections. Simple "buttering" of raw edges with an approved sealant is not acceptable.

All appurtenances including control assemblies, control enclosures, hot water heating coils, and electric heating coils shall not extend beyond the top and bottom of the unit casing. At an inlet velocity of 2000 f.p.m., the static pressure drop across the basic terminal or basic terminal with a sound attenuator shall not exceed .08" W.G. for all unit sizes.

PRIMARY AIR VALVE

The primary air valve shall consist of a minimum 22 gauge cylindrical body that includes embossment rings for rigidity. The damper blade shall be connected to a solid shaft by means of an integral molded sleeve which does not require screw or bolt fasteners. The shaft shall be manufactured of a low thermal conducting composite material, and include a molded damper position indicator visible from the exterior of the unit. The damper shall pivot in self lubricating bearings. The damper actuator shall be mounted on the exterior of the terminal for ease of service. The valve assembly shall include internal mechanical stops for both full open and closed positions. The damper blade seal shall be secured without use of adhesives. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3" W.G. inlet pressure.

PRIMARY AIRFLOW SENSOR

For inlet diameters 6" or greater, the differential pressure airflow sensor shall traverse the duct along two perpendicular diameters. Cylindrically shaped inlets shall utilize the equal cross sectional area or log-linear traverse method. Single axis sensor shall not be acceptable for duct diameters 6" or larger. A minimum of 12 total pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. A sensor that delivers the differential pressure signal from one end of the sensor is not acceptable. The sensor shall output an amplified differential pressure signal that is at least 2.5 times the equivalent velocity pressure signal obtained from a conventional pitot tube. The sensor shall develop a differential pressure of 0.03" w.g. at an air velocity of <450 FPM. Documentation shall be submitted which substantiates this requirement. Balancing taps and airflow calibration charts shall be provided for field airflow measurements.

HOT WATER COIL

Single duct terminal shall include an integral hot water coil where indicated on the plans. The coil shall be manufactured by the terminal unit manufacturer and shall have a minimum 22 gauge galvanized sheet metal casing. Stainless steel casings, or galvannealed steel casings with a baked enamel paint finish, may be used as an alternative. Coil to be constructed of pure aluminum fins with full fin collars maintaining accurate fin spacing and maximum tube contact. Fins shall be spaced with a minimum of 10 per inch and mechanically fixed to seamless copper tubes for maximum heat transfer.

Each coil shall be hydrostatically tested at a minimum of 450 PSIG under water, and rated for a maximum 300 PSIG working pressure at 200°F.

ELECTRIC HEATERS

Terminal shall include an integral electric heater where indicated on the plans. Heater shall be cETL listed. The heater cabinet shall be constructed of not less than 20 gauge galvanized steel. Stainless steel cabinets, or galvannealed steel casings with a baked enamel paint finish, may be used as an alternative. Heater shall have a hinged access panel for entry to the controls.

Electric heaters shall be factory mounted to the terminal with the heating elements located upstream of the airflow control damper to ensure uniform velocity profile

over the elements. Elements located downstream of the damper are not acceptable.

A power disconnect shall be furnished to render the heater non-operational. Heater shall be furnished with all controls necessary for safe operation and full compliance with UL 1996 and National Electric Code requirements.

Heater shall have a single point electrical connection. It shall include a primary disc-type automatic reset high temperature limit, secondary high limit(s), airflow switch, Ni-Chrome elements, and fusing per UL and NEC. Heater shall have complete wiring diagram with label indicating power requirement and kW output.

SOUND ATTENUATOR

Sound attenuator shall be provided where scheduled to meet acoustical performance requirements. The attenuator and terminal unit shall be single piece construction at least 50" long. Attenuator casing shall be constructed as specified for the base terminal.

MULTIPLE-OUTLET PLENUM

Multiple-outlet plenum (MOP) shall be provided where scheduled. The MOP shall have trim balancing dampers in each outlet. Damper shall have a locking quadrant to ensure that the damper position is maintained. Multiple-outlet casing shall be constructed as specified for the base terminal.

OPTIONS

Foil Faced Insulation
Insulation shall be covered with scrim backed foil facing. All insulation edges shall be covered with foil or metal nosing. Insulation shall meet ASTM C1136 for mold, mildew, and humidity resistance.

Elastomeric Closed Cell Foam Insulation
Provide Elastomeric Closed Cell Foam Insulation in lieu of standard. Insulation shall conform to UL 181 for erosion and NFPA 90A for fire, smoke and melting, and comply with a 25/50 Flame Spread and Smoke Developed Index per ASTM E-84 or UL 723. Additionally, insulation shall comply with Antimicrobial Performance Rating of 0, no observed growth, per ASTM G-21. Polyethylene insulation is not acceptable.

Double Wall Construction
The terminal casing shall be double wall construction using a 22 gauge galvanized metal liner covering all insulation.

Low Temperature Construction
Terminals shall be designed for use with primary airflow temperatures as low as 46°F and maximum ceiling plenum conditions of 78°F and 60% R.H. In addition to other design criteria, the primary air valve shall be thermally isolated from the terminal casing. The damper shaft shall be made from non-conducting thermoplastic composite material. Metal shafts will not be acceptable.

Piping Packages
Provide a standard factory assembled non-insulated valve piping package to consist of a 2 way, on/off, motorized electric control valve and two ball isolation valves. Control valves are piped normally closed to the coil. Maximum entering water temperature on the control valve shall be 200°F. The maximum close-off pressure is 40 PSIG (1/2") or 20 PSIG (3/4"). Maximum operating pressure shall be 300 PSIG.

Option: Provide 3-wire floating point modulating control valve (fail-in-place) in lieu of standard 2-position control valve with factory assembled valve piping package.

Option: Provide high pressure close-off actuators for 2-way, on/off control valves. Maximum close-off pressure is 50 PSIG (1/2") or 25 PSIG (3/4)".

Option: Provide either a fixed or adjustable flow control device for each piping package.

Option: Provide unions and/or pressure-temperature ports for each piping package.

Piping package shall be completely factory assembled, including interconnecting pipe, and shipped separate from the unit for field installation on the coil, so as to minimize the risk of freight damage.

CONTROLS

Analog Electronic Controls
Furnish and install Series 7000 Pressure Independent Analog Electronic Control System where indicated on the plans and in the specifications. The complete system shall be fully operational and include the following:

- Single duct, dual duct, and/or fan powered terminal units
- Pressure independent Series 7000 analog electronic zone controllers with integral differential pressure transducer
- Analog electronic wall thermostat
- Electronic air valve actuator
- 24 VAC control transformers

- Air pressure switches as required
- Electronic duct temperature sensors as required

Pneumatic Controls
Units shall be controlled by a pneumatic differential pressure reset volume controller. Controller shall be capable of pressure independent operation down to 0.03 inches W.G. differential pressure and shall be factory set to the specified airflow (CFM). Controller shall not exceed 11.5 scim (Standard Cubic Inches per Minute) air consumption @ 20 PSIG.

Unit primary air valve shall modulate in response to the room mounted thermostat and shall maintain airflow in relation to thermostat pressure regardless of system static pressure changes. An airflow (CFM) curve shall be affixed to the terminal unit expressing differential pressure vs. CFM. Pressure taps shall be provided for field use and ease of balancing.

Terminal unit manufacturer shall supply and manufacture a 5 to 10 PSIG pneumatic actuator capable of a minimum of 45 in. lbs. of torque.

Actual sequence of operation is shown on the contract drawings. Terminal unit manufacturer shall coordinate, where necessary, with the Temperature Control Contractor.

JOHNSON CONTROLS DDC CONTROL

N2
Each VAV terminal unit shall be bundled with a digital controller. The controller shall be compatible with a Johnson Controls N2 system network. A unique Johnson Controls N2 network address shall be assigned to each controller, and referenced to the tagging system used on the drawings and in the schedules provided by the Project Engineer. All controllers shall be factory mounted and wired, with the controller's hardware address set, and all of the individual terminal's data pre-loaded into the controller. The terminal's data shall include, but not be limited to the Max CFM, Min CFM, Heating CFM, and terminal K factor. Heating system operating data shall also be factory installed for all terminals with heat. Communication with the digital controller shall be accomplished through the Johnson Controls N2 network. The digital controller shall have hardware input and output connections to facilitate the specified sequence of operation in either the network mode, or on a stand-alone basis. The terminal unit manufacturer shall coordinate, where necessary, with the temperature Control Contractor.

MS/TP BACnet
Each VAV terminal unit shall be bundled with a digital controller. The controller shall be compatible with a MS/TP BACnet system network. A unique network address and a BACnet site address shall be assigned to each controller, and referenced to the tagging system used on the drawings and in the schedules provided by the Project Engineer. All controllers shall be factory mounted and wired, with the controller's hardware address set, and all of the individual terminal's data pre-loaded into the controller. The terminal's data shall include, but not be limited to Max CFM, Min CFM, Heating CFM, and terminal K factor. Heating system operating data shall also be factory installed for all terminals with heat. Communications with the digital controller shall be accomplished through the MS/TP BACnet network or through a Bluetooth connector. The digital controller shall have hardware input and output connections to facilitate the specified sequence of operation in either the network mode, or on a stand-alone basis. The terminal unit manufacturer shall coordinate, where necessary, with the Temperature Control Contractor.

LON
Each VAV terminal unit shall be bundled with a digital controller. The controller shall be compatible with a LON system network. A unique network address shall be assigned to each controller and referenced to the tagging system used on the drawings and in the schedules provided by the Project Engineer. All controllers shall be factory mounted and wired, and all of the individual terminal's data pre-loaded into the LNS database for the project. The terminal's data shall include, but not be limited to Max CFM, Min CFM, Heating CFM, and terminal K factor. Heating system operating data shall also be factory installed for all terminals with heat. Communication with the digital controller shall be accomplished through the LON network. The digital controller shall have hardware input and output connections to facilitate the specified sequence of operation in either the network mode, or on a stand-alone basis. The terminal unit manufacturer shall coordinate, where necessary, with the Temperature Control Contractor.

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ATTACHMENT C

AERCO

INNOVATION

HIGH-PERFORMANCE WATER HEATER

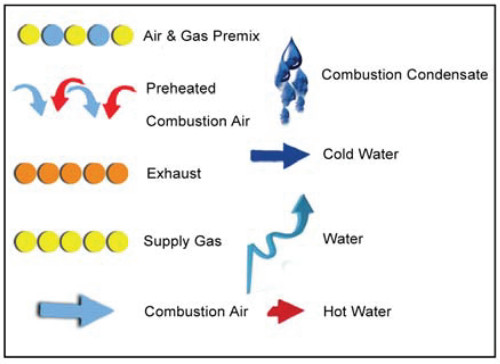
25 YEARS 1987 - 2012
Condensing Firetube Designs

INNOVATION

AERCO, the company that developed the first high-efficiency, commercial, condensing gas-fired, domestic water heater and hydronic boiler in the U.S. over two decades ago, continues to lead the way in commercial water-heating technology with the Innovation line of water heaters. Available in four sizes – 600, 800, 1060 and 1350 MBH – Innovation features advanced condensing/modulating technology and a thermal shock-proof, firetube heat exchanger that is highly resistant to scale buildup.

The Innovation design is based on AERCO's 25+ years of experience in the condensing domestic heater market. This gives AERCO an advantage over the competition with long history of success with:

- **Real-world installation scenarios**
- **Real-world domestic heater water load profiles and changes**
- **Real-world operating efficiencies**



INDUSTRY LEADING EFFICIENCY—UP TO 99%

Innovation is the only commercial-size tankless water heater that provides hot water on demand without the need for any storage. Thanks to its unique tankless design, the Innovation is highly space efficient and cost-effective, as it eliminates the need for significant storage volume to buffer load change and provide stable hot water outlet temperatures, which tank-type heaters require.

Key features of Innovation include:

- **Up to 99% efficiency**
- **+/-4°F temperature control, thanks to dynamic feed-forward sensing and unmatched turndown (up to 30:1)**
- **All stainless steel helical firetube heat exchanger that is thermal shockproof and scale resistant**
- **Small footprint and high installation flexibility**
- **Reduced cycling losses due to unmatched turndown and onboard multiunit sequencing controls**
- **Low NOx and low CO emissions**
- **1/3 standby losses compared to conventional tank-type heaters**
- **Designed and manufactured in the USA**

AERCO Innovation water heaters utilize state-of-the-art technology to easily meet highly diverse, demanding commercial and industrial hot water requirements in a compact and reliable condensing design. Its durable, high-efficient, helical wound firetube heat exchanger is time-tested to be impervious to thermal stress for an extended life. Enhanced waterside flow distribution maintains constant minimum velocities above 4 ft/sec across the heat exchanger. This keeps solids in suspension and greatly reduces scale dropout to maintain high efficiency and long life.

Combine two benefits, reduced scaling and no (minimal) fireside cleaning, into lower maintenance requirements than other commercial water heaters.

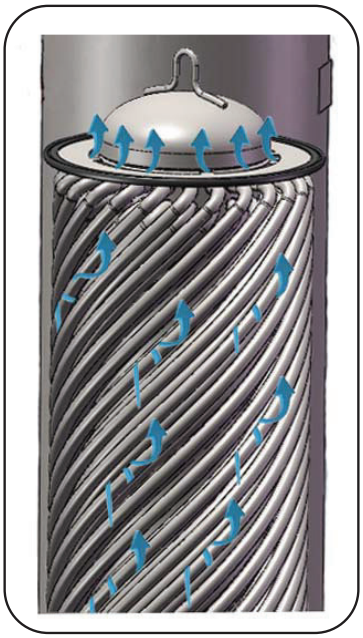
The all stainless steel construction maximizes longevity in the condensing application and will never need fireside cleaning. The corrugated tubes increase effective heat transfer surface area for optimal thermal efficiencies up to 99%.

Precise Temperature Control and High Turndown Delivers Money-Saving Precision

INN600 @ 14:1 Turndown **INN1060 @ 24:1 Turndown**

INN800 @ 18:1 Turndown **INN1350 @ 30:1 Turndown**

Enhanced Waterside Flow Distribution



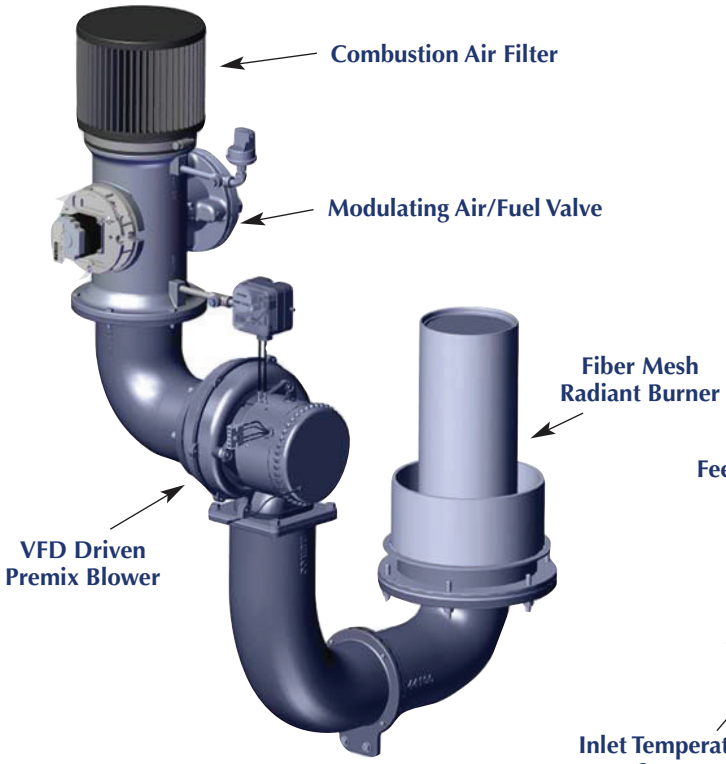
ADVANCED DESIGN AND COMPONENTS

Further improving the efficiency of Innovation is AERCO's Dynamic Load Anticipator, an advanced control system that helps maintain precise modulation of the high turndown air/fuel delivery system. Field-proven for more than 60 years, dynamic feed-forward sensing uses feed-forward and feed-back sensors that monitor inlet flow via the proportional change in mixed temperature due to variations in the flow. The system controls fire the unit to accurately match load requirements and produce tight +/-4°F outlet temperature control.

The high turndown air/fuel delivery system of Innovation consists of AERCO's patented fully modulating air/fuel valve, VFD driven premix blower, and fiber mesh radiant burner. The system guarantees safe, stable, reliable and efficient combustion with the lowest NOx and CO emissions, as well as eliminates wasted fuel and reduces operating costs, making Innovation a smart choice for "green" designs.

Dynamic Load Anticipator

High Turndown Air/Fuel Valve Delivery System



Commercial Tankless Design

The unique tankless design of the Innovation water heaters allows the system to operate with set points of 120°F or below – saving energy and reducing the risk of scalding. Because water volume is kept to a minimum and continuous circulation is maintained through the Innovation unit, the risk of Legionella bacteria growth is virtually eliminated.

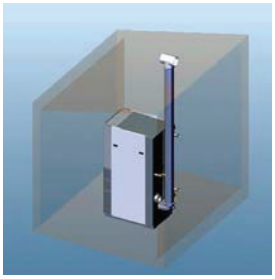
Venting Versatility

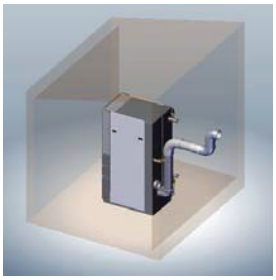
Innovation provides a number of venting options. Sidewall, through-the-roof, and sealed combustion capabilities (direct-vent), approved for venting with PVC, CPVC, Polypropylene, or AL29-4C materials, are all available and provide broad installation flexibility and savings.

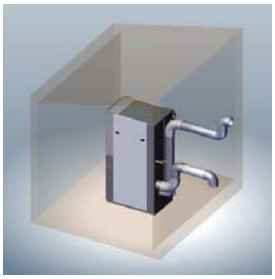
Space-Saving Design

The AERCO Innovation is delivered as a single, fully assembled unit. Its small footprint, doorway size, and quiet operation make it ideal for both new construction and retrofit applications. The tankless design ensures the smallest possible footprint for a commercial size application, reducing standby losses to 1/3 of a comparable storage-type system.

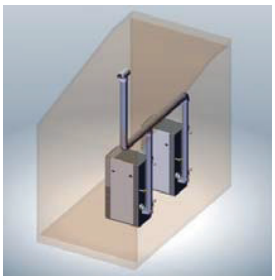
Vent Configurations

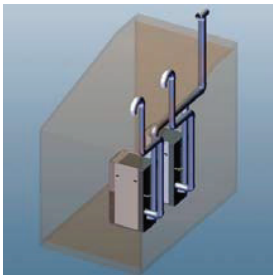

Vertical vent/room air

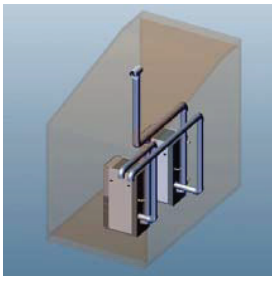

Sidewall vent/room air


Direct-vent


Vertical vent/sidewall air


Common vertical vent/ room air


Common vertical vent/ individual vertical air


Common vertical vent/ individual sidewall air


Individual sidewall vent/ common sidewall air

Advanced C-More Controls with Onboard Sequencing

Developed specifically to support the fully modulating operation of AERCO water heaters, the C-More Control System combines temperature and operating controls, combustion safeguards and fault enunciator functions in a single, state-of-the-art controller. In addition to basic water heater operation, C-More has many other beneficial features:

- **User-friendly interface with step-by-step diagnostics menus and status messages**
- **Ability to read system status during start-up sequence and operation**
- **One-touch access to operating parameters and recent fault history**
- **Flash-upgradeable platform**
- **Building Automation system integration via Modbus with optional support for LonWorks, BACnet, N2, etc.**
- **Supports tracking of more than 100 data points**
- **Ensures fail-safe heater operation if external building controls fail**

C-More also includes onboard multi-unit sequencing logic designed to efficiently sequence up to eight water heaters on the same system to meet load requirements. This minimizes cycles per unit to maximize system efficiency and turndown, and significantly reduces service and maintenance costs. With this unique feature, the operating systems turndown will equal the individual unit turndown multiplied by the number of units employed. Hence an application using eight INN1060s @ 24:1 will modulate to meet system load with a total turndown of 192:1.

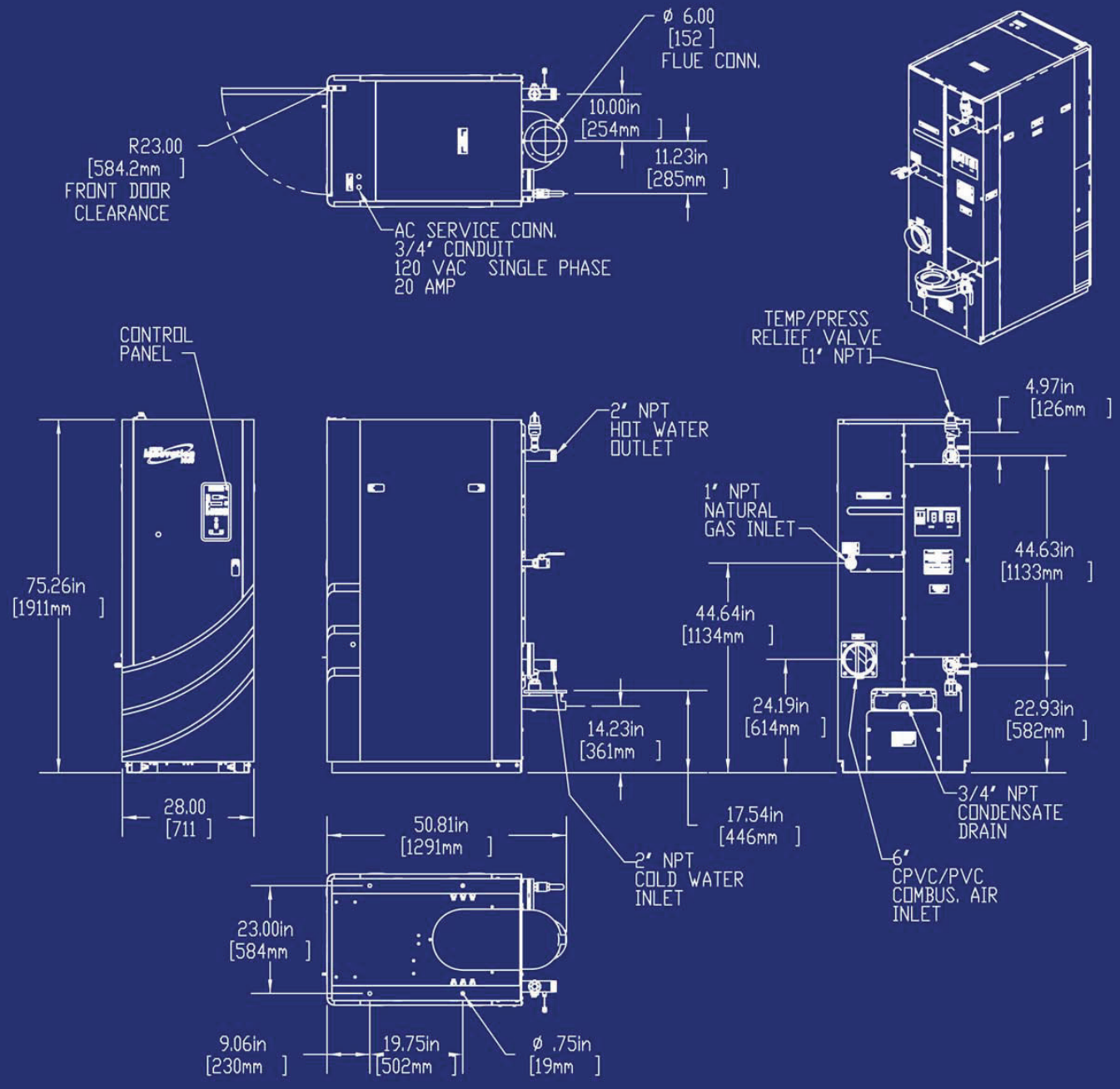
The “Master C-More” operates one motorized valve per unit as an element of the load sequencing. The program logic also incorporates a unique master/slave backup feature that provides automatic bumpless transfer of master functions to the next unit on the chain, in case of designated master unit shutdown.

The result is the most energy-efficient and reliable water heating system design available. Only those units required to meet load are operating. Units in standby do not needlessly cycle to maintain set point – reducing system standby losses and unit wear to the bare minimum. Compared to a conventional storage system which requires 125 gallons of storage for every 500 MBTUH input, an Innovation system truly provides reliable domestic hot water on demand in the smallest possible energy footprint.

SETTING A NEW STANDARD

Innovation provides consulting specifying engineers, facilities management, and building owners with time-tested and trusted excellence that the industry has come to expect from AERCO. Innovation features the cutting-edge technology necessary to maximize forward-thinking designs – no matter the environment or conditions.

ADVANCED DESIGN AND COMPONENTS



INNOVATION SPECIFICATIONS

	600	800	1060	1350
Adjustable Temperature Control	50°F to 190°F	50°F to 190°F	50°F to 190°F	50°F to 190°F
Ambient Temperature	0°F to 130°F	0°F to 130°F	0°F to 130°F	0°F to 130°F
Accuracy	+/-4°F	+/-4°F	+/-4°F	+/-4°F
Input	600,000 BTUH (Natural Gas)	800,000 BTUH (Natural Gas)	1,060,000 BTUH (Natural Gas)	1,350,000 BTUH (Natural Gas)
Net Output	578,000 BTUH (Natural Gas)	771,000 BTUH (Natural Gas)	1,022,000 BTUH (Natural Gas)	1,310,000 BTUH (Natural Gas)
Turndown Ratio	14:1	18:1	24:1	30:1
Flue Size	6" Diameter	6" Diameter	6" Diameter	6" Diameter
Flue Material (per local code)	PVC, CPVC, PP or AL29-4C	PVC, CPVC, PP or AL29-4C	PVC, CPVC, PP or AL29-4C	PVC, CPVC, PP or AL29-4C
Water Inlet & Outlet	2" NPT Male	2" NPT Male	2" NPT Male	2" NPT Male
Gas Connection	1" NPT Male	1" NPT Male	1" NPT Male	1" NPT Male
Gas Pressure Requirements	14" WC Maximum, 4" WC Minimum @ Full Load (Nat. Gas)	14" WC Maximum, 4" WC Minimum @ Full Load (Nat. Gas)	14" WC Maximum, 4" WC Minimum @ Full Load (Nat. Gas)	14" WC Maximum, 4" WC Minimum @ Full Load (Nat. Gas)
Maximum Continuous Water Flow	50 GPM	50 GPM	50 GPM	50 GPM
Condensate Connection	3/4" NPT Female	3/4" NPT Female	3/4" NPT Female	3/4" NPT Female
Maximum Condensate Flow	4.5 GPH	6 GPH	8 GPH	11 GPH
Pressure Rating	160 PSIG @ 210°F	160 PSIG @ 210°F	160 PSIG @ 210°F	160 PSIG @ 210°F
NOx Emissions Certifications	SCAQMD, TCEQ	SCAQMD, TCEQ	SCAQMD, TCEQ	SCAQMD, TCEQ
Standard Listing & Approvals	UL, CUL, ASME (HLW)	UL, CUL, ASME (HLW)	UL, CUL, ASME (HLW)	UL, CUL, ASME (HLW)
Gas Train Options	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)
Electrical Requirements	120/1/60 20 AMP (9 Amp FLA)	120/1/60 20 AMP (9 Amp FLA)	120/1/60 20 AMP (9 Amp FLA)	120/1/60 20 AMP (15 Amp FLA)
Water Pressure Drop @ 15 gpm	.75 psi	.75 psi	.75 psi	.75 psi
Water Pressure Drop @ 30 gpm	1.5 psi	1.5 psi	1.5 psi	1.5 psi
Water Volume	26 gallons	24.5 gallons	23 gallons	20.6 gallons
Weight, Installed	960 lbs (dry), 1,177 lbs (wet)	980 lbs (dry), 1,202 lbs (wet)	1,000 lbs (dry), 1,190 lbs (wet)	1,050 lbs (dry), 1,222 lbs (wet)
Weight, Shipping	1,060 lbs	1,080 lbs	1,100 lbs	1,150 lbs

AERCO

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AERCO

ATTACHMENT D

Business/Residential/Hotels

Available in 7 sizes from 750,000 to 6 million BTU/hr.

Education

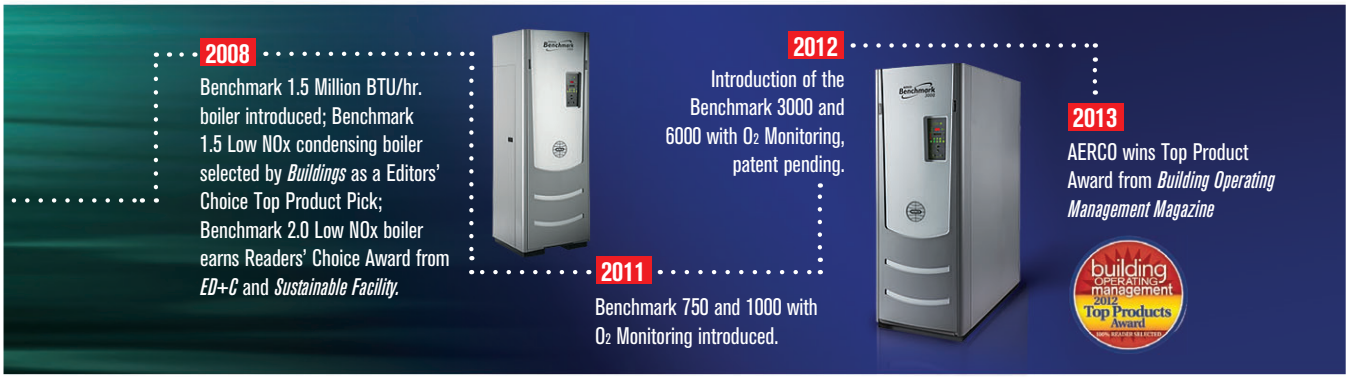
Government

BENCHMARK SERIES High-Efficiency Boilers

AERCO. The Benchmark of High-Efficiency for 25 Years.

AERCO introduced condensing firetube designs to the commercial marketplace over 25 years ago, raising the standard in hydronic heating. While other companies have attempted to develop similar designs, only AERCO has decades of experience, making its condensing, fully modulating boilers the standard by which all others are measured.

The Benchmark boiler family re-affirms AERCO's leadership. Having the longest proven performance record of any condensing, modulating boiler, Benchmark delivers unparalleled cost savings, efficiency benefits, and design advantages. With the introduction of re-designed 1.5 - 3 million BTU/hr and revolutionary 6 million BTU/hr models, AERCO once again raises the bar.



At a Glance

Key Features

- Available in seven models ranging from 750,000 BTU/hr to 6 million BTU/hr
- High Efficiency – up to 98%
- Stainless Steel Firetube Heat Exchanger
- Low NOx and CO Emissions
- Small Footprint
- Installation Flexibility
- Serviceability
- Designed and Manufactured in the USA

Leader in High Efficiency

High efficiency has become a buzz term in recent years, but it is a philosophy at AERCO. Since the first Benchmark boiler was installed in 1997, it has set the gold standard for high efficiency.

Reliability

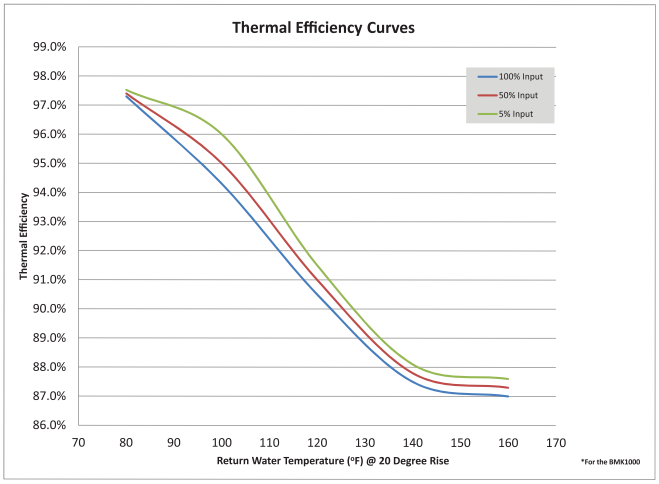
First introduced in 1997, the Benchmark boiler is among the oldest high-efficiency products available in the U.S. The market leader for the last decade, several thousand Benchmark units have been installed throughout North America and have continued to operate flawlessly season after season. Their performance proven reliability can be credited to:

Superior Construction Materials – A new 439 stainless steel heat exchanger offers even longer life and improves longevity with a simplified design that has only two moving parts.

Advanced Design and Components – AERCO's patented air/fuel delivery system and fully modulating burner reduces cycling losses, as well as wear and tear.

Warranty – AERCO stands behind its products. The heat exchanger in the Benchmark boilers has a 10-year full (non-prorated) warranty.

Efficiency



Benchmark Model Numbers As Approved and Listed on the AHRI Directory	Thermal Efficiency, 100% Input • (High Fire) 100°F Temperature Differential • (80°F to 180°F)
BMK750	95.6%
BMK1000	96.8%
BMK1500	94.6%
BMK2000	94.6%
BMK2500	93.5%
BMK3000	93.5%
BMK6000	94.5%

Environmental

The Greenspec® Listed Benchmark boilers are perfect for "green" designs. Their small footprint, flexible venting/piping options, high efficiency, and lower operating costs can help facilities earn LEED points. Benchmark has been designed with environmental advantages:

O_2 monitoring system – Benchmark units are available with AERCO's proprietary O_2 monitoring system, which displays the oxygen level directly on the C-More controller in real time. It can be monitored via Modbus, so customers can measure emission levels and fuel combustion efficiency to maximize fuel economy.

Low NOx burner – Benchmark boilers are fitted with a low NOx burner whose emissions consistently meet the highest regulatory standards. Ultra low NOx (9 ppm or less) calibrations are available.*

*See tech data sheets for model specs.

Advanced Controls

C-More

Efficiency and operation are further optimized via the C-More Control System. Intuitive, advanced, and simple to operate, C-More combines temperature and operating controls, combustion safeguards and fault enunciator functions – all at your fingertips! Benefits include:

- User-friendly intuitive control
- Simplifies diagnostic troubleshooting
- Full integration with BAS and EMS systems
- Supports remote monitoring and control
- Integrated Boiler Sequencing Technology (BST)

Ensures fail-safe boiler operation (if external building controls fail).

Remote Data Collection

AERCO's remote data collection continually monitors the internal operations of your AERCO equipment, scanning performance parameters and potential fault risks. This information, transmitted via the Internet, is collected and evaluated at our data center. Our data center has the capability to monitor performance trends and fault occurrences. Future capabilities include early warnings before faults occur and email alerts to the user.*

*Consult AERCO if you are interested in the benefit of remote monitoring service.

Installation Advantages

Venting Versatility

Benchmark products provides a number of venting options; Sidewall, through-the-roof, and ducted combustion capabilities (direct-vent), approved for venting with PVC, CPVC, Polypropylene, or AL29-4C materials are all available and provide broad installation flexibility and savings.

Space-saving Design

All Benchmark products are delivered as a single, fully assembled unit. Its small footprint, doorway size, and quiet operation make it ideal for both new construction and retrofit applications. Our new Benchmark 6000 model is the most compactly designed 6 million BTU/hr boiler in the market. No one is even close. A re-designed Benchmark 3000 model is 22% smaller than earlier generations.

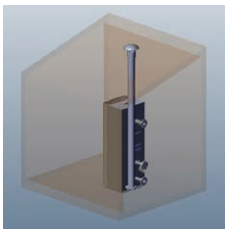
Zero Side Clearance

The redesigned Benchmark can be serviced via the front or top of the boiler, as well as the side. This flexibility allows units to be configured side by side.

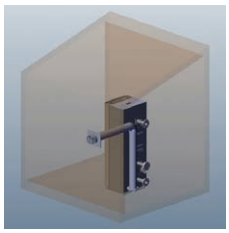
BMK 3000
Shown

Consult an AERCO representative of factory for additional venting configuration inquiries.

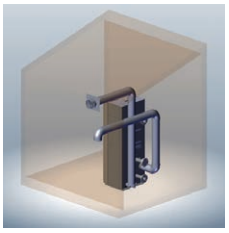
Vent Configurations



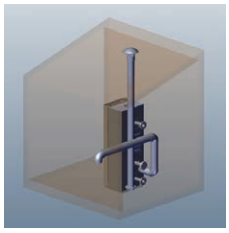
Vertical vent/room air



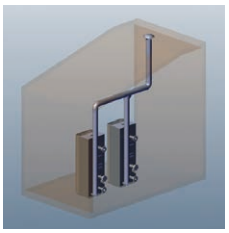
Sidewall vent/room air



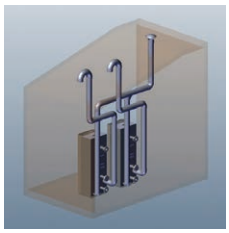
Direct-vent



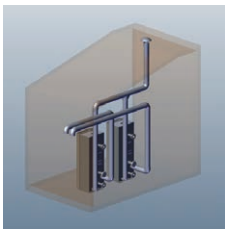
Vertical vent/sidewall air



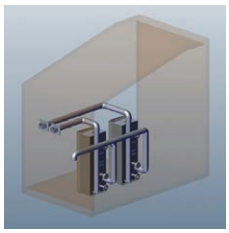
Common vertical vent/room air



Common vertical vent/
individual vertical air



Common vertical vent/
individual sidewall air



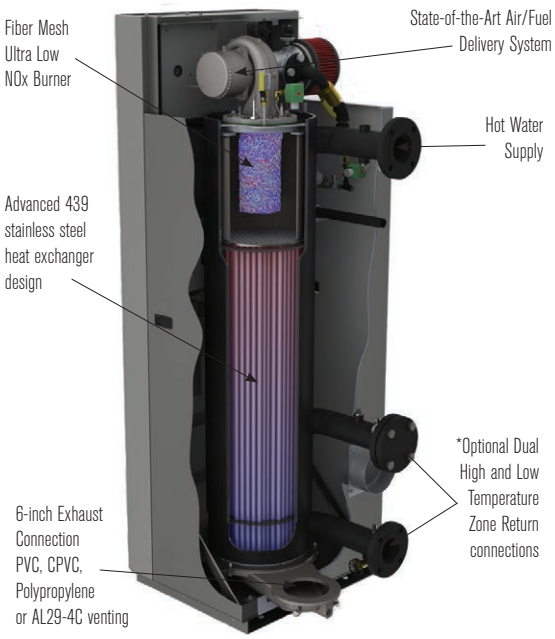
Individual sidewall vent/
common sidewall air

At a Glance

Benchmark 750 (BMK750) and Benchmark 1000 (BMK1000)

Features

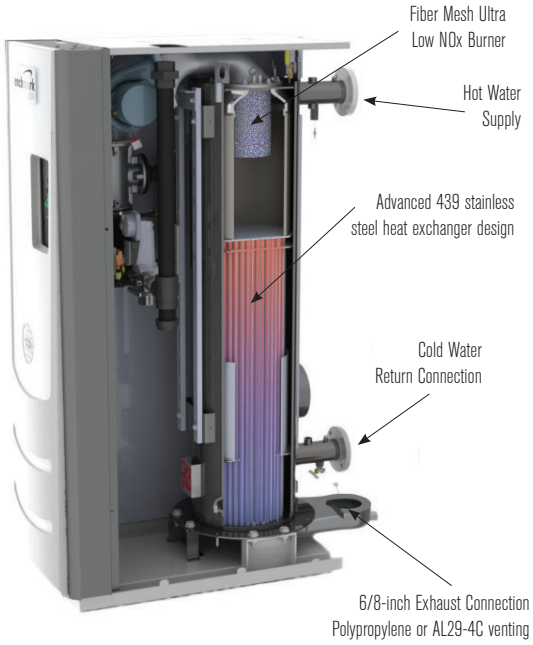
- BMK 750 – 15:1 Turndown Ratio (7%)
- BMK 1000 – 20:1 Turndown Ratio (5%)
- Oxygen Level (O_2) Monitoring standard
- Stainless Steel Firetube Heat Exchanger
- Capable of variable primary flow installations
- NOx Emissions 20 ppm or less at all firing rates
- 9 ppm optional calibration
- Compact Footprint (25"D x 28"W x 78"H)
- High and Low Temperature System Return Connections*
- Ducted Combustion Capable
- Acceptable vent materials AL29-4C, Polypropylene, CPVC, and PVC
- Available in Natural Gas and Propane



Benchmark 1500 (BMK1500) and Benchmark 2000 (BMK2000)

Features

- BMK 1500 – 20:1 Turndown Ratio (5%)
- BMK 2000 – 20:1 Turndown Ratio (5%)
- Oxygen Level (O_2) Monitoring standard
- Stainless Steel Firetube Heat Exchanger
- Capable of variable flow installations
- NOx Emissions 20 ppm or less at all firing rates
- 9 ppm optional calibration
- Compact Footprint (41"D x 28"W x 79"H)
- Ducted Combustion Capable
- Available in Natural Gas, Propane, and Duel Fuel
- Acceptable vent materials AL29-4C, and Polypropylene

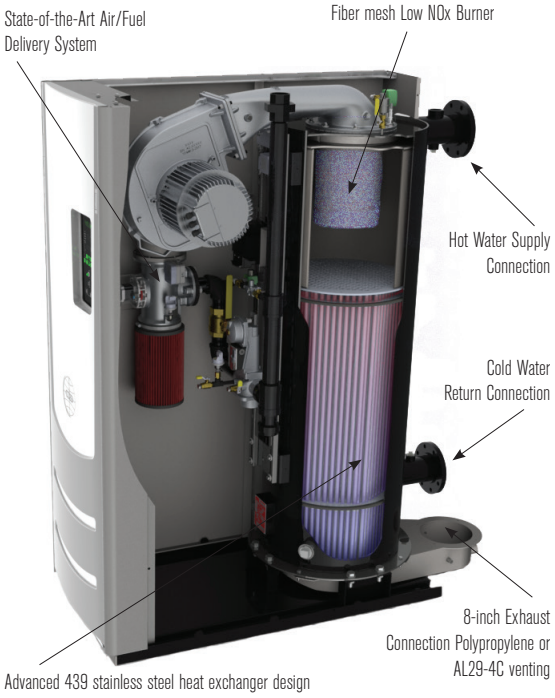


At a Glance

Benchmark 2500 (BMK2500) and Benchmark 3000 (BMK3000)

Features

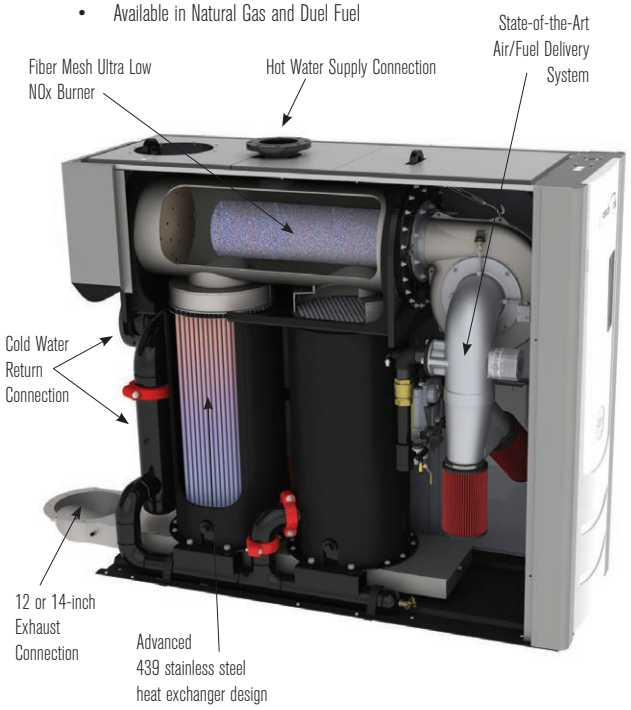
- Natural Gas
- 15:1 Turndown Ratio (7%)
- Oxygen Level (O_2) Monitoring
- Stainless Steel Firetube Heat Exchanger
- Capable of variable primary flow installations
- NOx Emissions 20 ppm or less at all firing rates
- Compact Footprint (78"H x 28"W x 56"D)
- Ducted Combustion Capable
- Acceptable vent materials AL29-4C, Polypropylene
- Available in Natural Gas, Propane, and Duel Fuel



Benchmark 6000 (BMK6000)

Features

- Natural Gas
- 15:1 Turndown Ratio (7%)
- Oxygen Level (O_2) Monitoring
- Stainless Steel Firetube Heat Exchanger
- Capable of variable primary flow installations
- NOx Emissions 20 ppm or less at all firing rates
- Compact Footprint (78"H x 34"W x 88"D)
- Ducted Combustion Capable
- Acceptable vent materials AL29-4C, Polypropylene
- 9 ppm optional calibration (requires 14" exhaust venting)
- Available in Natural Gas and Duel Fuel



Venting

AERCO understands that every system design is different. To provide flexibility and meet any space configuration, venting options are available:

- Security Chimneys International SS and SSD/SSID venting systems are made from AL29-4C® super-ferritic stainless steel. The single- and double-wall SS and SSD/SSID install effortlessly, are highly reliable and meet industry specifications.
- DuraVent PolyPro® polypropylene vent pipe is for ANSI Category II and IV gas-burning appliances. The PolyPro vent system is suitable for exhaust temperatures up to 230°F/110°C and a maximum positive pressure of 15 in w.c. without the toxic risk associated with other plastic materials.

  Engineering support - Customers can also leverage the vast experience of AERCO engineers who have devoted their careers to developing cost- and space-saving solutions. Standard services available include:

  • Engineering – AERCO engineers work with manufacturers to verify vent sizing/design for enhanced reliability.
  • AutoCAD drawings
  • Submittal information
  • Customer service
  • Quotes within two business days
  • Orders shipped within 10 days of receipt

DuraVent PolyPro®

Security Chimneys SS and SSD/SSID Venting Systems

Accessories

AERCO Control System (ACS)

The ACS is the best choice for maximizing heating plant efficiency if your heating plant has more than eight boilers or if your designing a combination control system as shown in the diagram on the next page. There is an ACS relay panel available to provide additional pump and valve control for several combination control configurations.

Motorized Valves

The Belimo F6...HDU Series 2-way butterfly valves are designed to meet the needs of HVAC and commercial application requiring bubble tight shut-off for liquids. Typical applications include boiler isolation, chiller isolation, cooling tower isolation, change-over systems, air handler coil control, bypass and process control applications. Valves specifically designed for easy installation on BST configured boiler plants are available as well.

BST Integration Panel

BST boiler plants have this option available to enable the BST Master to automatically switch a C-More Slave to the BST Master control if the currently designated master is not able to manage the boilers in the plant. The change is automatic so there is no need for a technician to intervene. The C-More may change from a slave to a master if a unit is taken down for service or if there is a fault that disables the C-More currently acting as the BST Master. The panel is the connection point for the Modbus sensors used by the BST Master Control. This allows the signal input of any sensors attached to the Integration Panel to be accessed at any node on the BST communication cables.

AERCO Protonode/Gateways

AERCO offers a multi-protocol, communications gateway to support integration with customers' building control and energy management systems. The plug-n-play package supports integration with BACnet/IP, BACnet MS/TP, LonWorks, and Johnson Controls Metasys N2 systems. AERCO's Communications Gateway is available for all AERCO boilers, water heaters and electronically controlled indirect systems.

Condensate Neutralizer Kit

AERCO Condensate Neutralizers are ideal for neutralizing condensate from condensing boilers and furnaces operating on natural gas or propane. The condensate is acidic and has the potential to harm the environment and the sewer system. The AERCO Condensate Neutralizer will raise the pH of the condensate to a more neutral level before it is discharged to drain.

Buffer Tanks

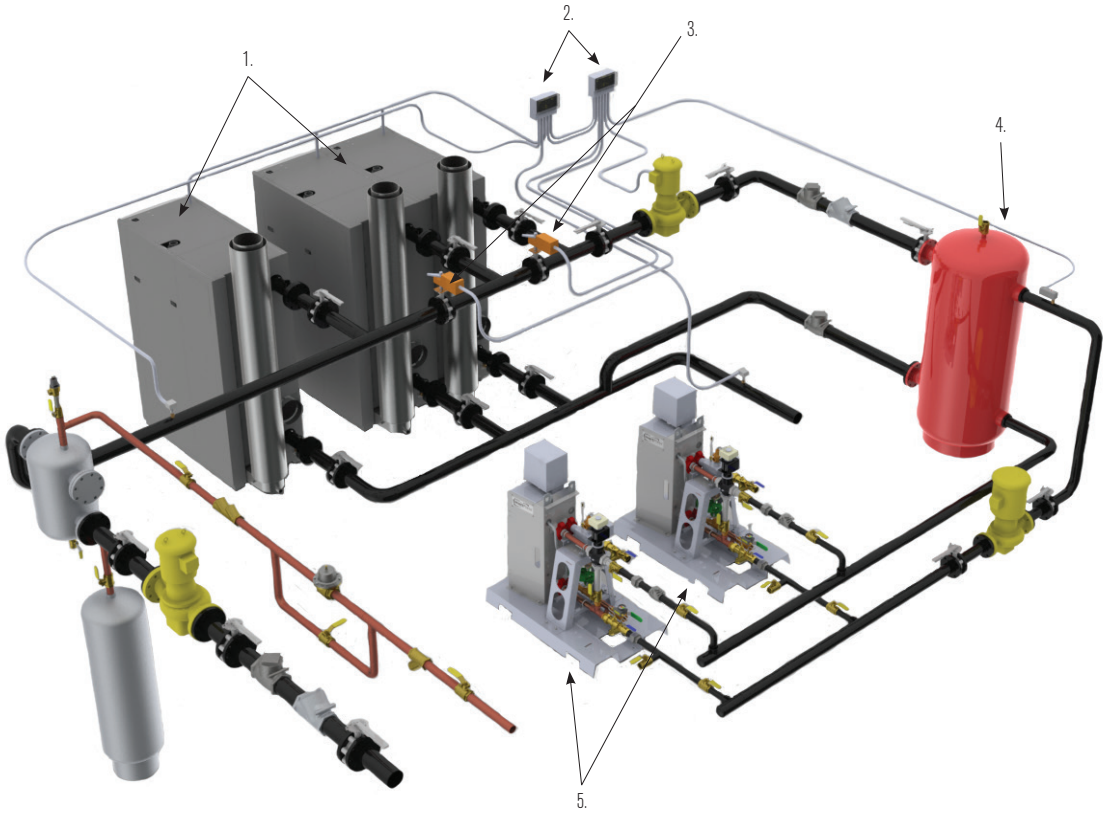
AERCO buffer tanks are ASME certified pressure vessels designed for use with high efficiency, low volume systems that incorporate low-mass condensing boilers. They add thermal mass, dampen fast transitions and minimize boiler cycling that occurs during zero or low domestic load conditions. The AERCO buffer tanks are available in two and four-port (Primary-Secondary) configurations.

Venting Muffers

AERCO offers 6", 8", and 14" exhaust mufflers that are specifically designed with flanged ends to fit directly on the exhaust manifold of Benchmark boilers. The flanged-end design allows the muffler to be used with any venting system manufacturer – the only adapter required is an AERCO starter piece at one or both ends of the muffler.

Sample Installation

1. Benchmark 3000
2. AERCO Control System (ACS) and ACS Relay Panel
3. Motorized Valves
4. Buffer Tank
5. SmartPlate



Benchmark Specifications

	750	1000	1500
Adjustable Temperature Control	50°F to 190°F	50°F to 190°F	50°F to 190°F
Ambient Temperature	0°F to 130°F	0°F to 130°F	0°F to 130°F
Accuracy	+/-4°F	+/-4°F	+/-4°F
Input	750,000 BTUH (Natural Gas)	1,000,000 BTUH (Natural Gas)	1,500,000 BTUH (Natural Gas)
Net Output	697,000 BTUH (Natural Gas)	930,000 BTUH (Natural Gas)	1,395,000 BTUH (Natural Gas)
Turndown Ratio	15:1	20:1	20:1
Flue Size	6" Diameter	6" Diameter	6" Diameter
Flue Material (per local code)	PVC, CPVC, PP or AL29-4C	PVC, CPVC, PP or AL29-4C	AL29-4C, PP
Water Inlet and Outlet	3" 150# Flange	3" 150# Flange	4" 150# Flange
Gas Connection	1" NPT Male	1" NPT Male	2" NPT Male
Gas Pressure Requirements*	14" WC Maximum, 4" WC Minimum at Full Load	14" WC Maximum, 4" WC Minimum at Full Load	14" WC Maximum, 4" WC Minimum at Full Load
Min/Max Water Flow	12-175 GPM	12-175 GPM	25-250 GPM
Condensate Connection	3/4" NPT Female	3/4" NPT Female	1.5" Tube
Maximum Condensate Flow	6 GPH	8 GPH	9 GPH
Pressure Rating	160 PSIG at 210°F	160 PSIG at 210°F	160 PSIG at 210°F
NOx Emissions Certifications	SCAQMD, TCEQ	SCAQMD, TCEQ	SCAQMD, TCEQ
Standard Listing and Approvals	UL, CUL, ASME	UL, CUL, ASME	UL, CUL, ASME
Gas Train Options	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)
Electrical Requirements	120/1/60 20 AMP (13 AMP FLA)	120/1/60 20 AMP (13 AMP FLA)	120/1/60 20 AMP (16 AMP FLA)
Water Pressure Drop at 20°ΔT	1.5 psi	3 psi	2.8 psi
Water Volume	16.25 gallons	14.25 gallons	44 gallons
Weight, Installed	669 lbs. (dry), 802 lbs. (wet)	700 lbs. (dry), 817 lbs. (wet)	1,406 lbs. (dry), 1,654 lbs. (wet)

*Values are for Natural Gas FM Compliant gas trains only. See Benchmark Gas Components & Supply Design Guide GF-2030 for Propane, DBB & Duel Fuel gas train gas pressure requirements.

2000	2500	3000	6000
50°F to 190°F	50°F to 190°F	50°F to 190°F	50°F to 190°F
0°F to 130°F	0°F to 130°F	0°F to 130°F	0°F to 130°F
+/-4°F	+/-4°F	+/-4°F	+/-4°F
2,000,000 BTUH (Natural Gas)	2,500,000 BTUH (Natural Gas)	3,000,000 BTUH (Natural Gas)	6,000,000 BTUH (Natural Gas)
1,820,000 BTUH (Natural Gas)	2,325,000 BTUH (Natural Gas)	2,790,000 BTUH (Natural Gas)	5,580,000 BTUH (Natural Gas)
20:1	15:1	15:1	15:1
8" Diameter	8" Diameter	8" Diameter	12" or 14" Diameter
PP or AL29-4C	PP or AL29-4C	PP or AL29-4C	PP or AL29-4C
4" 150# Flange	4" 150# Flange	4" 150# Flange	6" 150# Flange
2" NPT Male	2" NPT Male	2" NPT Male	2" NPT Male
14" WC Maximum, 4" WC Minimum at Full Load	14" WC Maximum, 4" WC Minimum at Full Load	14" WC Maximum, 4" WC Minimum at Full Load	2" PSI Maximum, 14" WC Minimum at Full Load
25-350 GPM	25-350 GPM	25-350 GPM	75-600 GPM
1.5" Tube	1.5" Tube	1.5" Tube	1.5" Tube
10 GPH	17 GPH	20 GPH	40 GPH
160 PSIG at 210°F	160 PSIG at 210°F	160 PSIG at 210°F	80 PSIG at 210°F / 150 PSIG at 210°F
SCAQMD, TCEQ	SCAQMD, TCEQ	SCAQMD, TCEQ	SCAQMD, TCEQ
UL, CUL, ASME	UL, CUL, ASME	UL, CUL, ASME	UL, CUL, ASME
FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)
120/1/60 20 AMP (16 AMP FLA)	208-230/3/60 20 AMP (10 AMP FLA) 460-230/3/60 15 AMP (5 AMP FLA)	208-230/3/60 20 AMP (10 AMP FLA) 460-230/3/60 15 AMP (5 AMP FLA)	208-230V/3/60 30 AMP (19 AMP FLA) 460/3/60 15 AMP (12 AMP FLA) 575/3/60 15 AMP (9 AMP FLA)
3.4 psi	2.9 psi	4 psi	6.2 psi
40 gallons	58 gallons	55 gallons	110 gallons
1,500 lbs. (dry), 1,760 lbs. (wet)	2,000 lbs. (dry), 2,332 lbs. (wet)	1,700 lbs. (dry), 2,364 lbs. (wet)	3,000 lbs. (dry), 3,920 lbs. (wet)

Distributed by:

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Boilers

AERCO

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UL
LISTED

BMK
5K 1/15

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Since its founding in 1976, EVAPCO, Incorporated has become an industry leader in the engineering and manufacturing of quality heat transfer products around the world. EVAPCO's mission is to provide first class service and quality products for the following markets:

- **Commercial HVAC**
- **District Energy**
- **Industrial Process**
- **Industrial Refrigeration**
- **Power**

EVAPCO's powerful combination of financial strength and technical expertise has established the company as a recognized manufacturer of market-leading products on a worldwide basis. EVAPCO is also recognized for the superior technology of their environmentally friendly product innovations in sound reduction and water management.

EVAPCO is an employee owned company with a strong emphasis on research & development and modern manufacturing plants. EVAPCO has earned a reputation for technological innovation and superior product quality by featuring products that are designed to offer these operating advantages:

- **Higher System Efficiency**
- **Environmentally Friendly**
- **Lower Annual Operating Costs**
- **Reliable, Simple Operation and Maintenance**

With an ongoing commitment to Research & Development programs, EVAPCO provides the most advanced products in the industry – ***Technology for the Future, Available Today***!

EVAPCO products are manufactured in 19 locations in 9 countries around the world and supplied through a sales network consisting of over 170 offices.

Experience, Innovation, Guaranteed Performance

With over 45 U.S. Patents and their 92 foreign counterparts, EVAPCO's engineering expertise speaks for itself and provides an exceptional foundation for various product development projects. This foundation is the catalyst for providing customer driven features and benefits in an environmentally safe manner.

The state of the art Research & Development Center, located at EVAPCO's World Headquarters in Taneytown, Maryland USA, has over 60,000 square feet dedicated to thermal analysis and product development. Experienced R&D engineers perform product and application research year round in seven environmental test chambers.

The Research & Development Center features customized laboratories that are designed to conduct tests through a wide range of environmental conditions. The computerized data acquisition system records the data and graphically displays continuous results, thereby providing the R&D engineers with valuable test information on a continuous basis.

The Research & Development Center also has the industry's largest Low Temperature Environmental Test Chamber. This test chamber was converted from ammonia to CO_2 refrigerant in order to perform detailed thermal analysis on steel evaporators.

In addition, the R&D Center houses a modern Water Analytical Laboratory for advanced water chemistry analysis in support of the company's *Pulse*~Pure® Non-Chemical and Smart Shield® Solid, Time Released Water Treatment business and an AMCA Fan Test Chamber for evaporator fan performance verification. Product sound ratings are measured on a dedicated Sound Test Pad located on the property.

Most recently, EVAPCO has designed, built and commissioned a unique wind tunnel to investigate Air Cooled Condenser (ACC) heat exchangers. This one of a kind laboratory incorporates a full size heat exchanger test section. The heat exchanger is tested with steam under vacuum rather than hot water to allow EVAPCO to optimize the ACC design with unprecedented accuracy.

EVAPCO products are the result of extensive research and thermal testing. As a result, EVAPCO products deliver guaranteed performance in order to maximize system performance.

Commercial HVAC, Industrial Process and Power Market Products

Cooling Towers


AT


USS


UT


cAT

Factory Assembled Induced Draft


LSTE


LPT


PMTQ

Factory Assembled Forced Draft

Field Erected


Air Cooled Steam Condenser


Evaporative Cooling Tower

Field Erected

Closed Circuit Coolers


ATWB


ESWA


WDW


eco-ATW


eco-ATWE

Factory Assembled Induced Draft

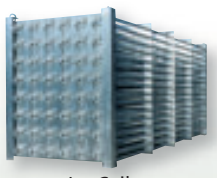

PMWQ


LSWE


LRWB

Factory Assembled Forced Draft

Thermal Energy Storage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Non-Chemical Water Treatment


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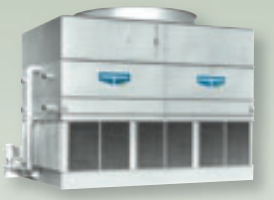
Industrial Refrigeration System Products

Evaporative Condensers



ATC-E

eco-ATC

WDC

cATC

Induced Draft Models

Evaporative Condensers

eco-PMC/PMC-E

LSC-E/LRC

Forced Draft Models

Rooftop Air Units

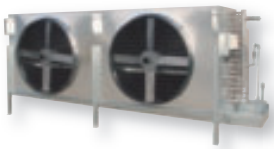
Critical Process Air Systems

Penthouse Evaporators

Make-Up Air Systems

Evaporators — Stainless Steel • Aluminum • Galvanized Steel • Copper

SSTMC Unit Coolers

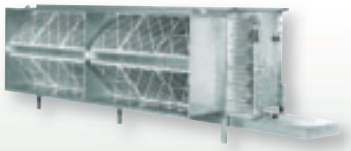


SSTL Product Coolers

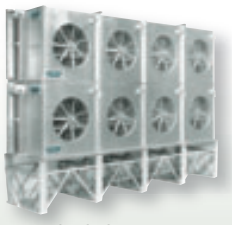
SSTWC Workroom Units

SSTD Low Profile Coolers

Custom Freezing Capabilities



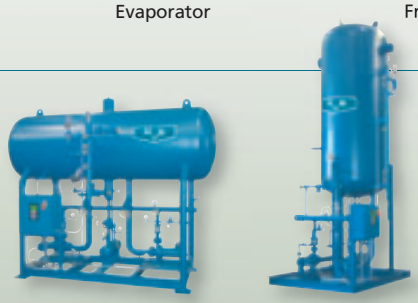
Draw Through Coils with Inlet Air Filters



Stacked Blast Freezer Evaporator

Spiral Blast Freezer Evaporator

Liquid Recirculator Packages & ASME Pressure Vessels



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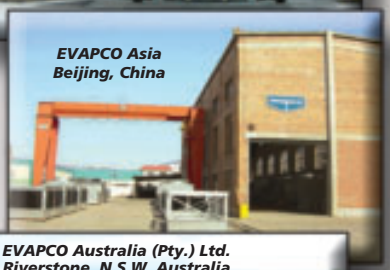
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TRIDIUM

ATTACHMENT F

Niagara Analytics Framework

Shrink big data and grow performance for your customers with the only analytics framework native to Niagara

The Niagara platform is the industry's first truly open framework, harnessing the power of the Internet of Things. Now, with the Niagara Analytics Framework, we're giving you the power to bring your customers the one thing they need most to optimize their operations—real-time intelligence that gives them actionable insights into their enterprise.

The Niagara Analytics Framework takes the big data generated by Niagara and shrinks it through a variety of analytic applications—from building automation to manufacturing to transportation and beyond. But unlike the vast majority of analytics tools, which provide business intelligence through historical data, the Niagara Analytics Framework captures historical patterns as well as real-time data on events as they unfold. No longer do your customers have to rely solely on data from last cycle to plan for the upcoming cycle—with our analytics platform they can respond proactively and make smarter, swifter decisions that drive their business forward.

BECAUSE THE NIAGARA ANALYTICS FRAMEWORK IS POWERED BY NIAGARA, YOU GET THE ADDED BENEFIT OF:

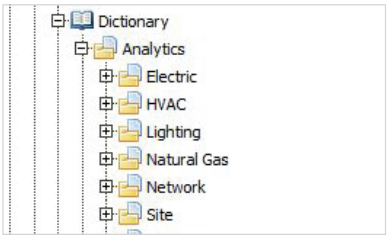
- The Niagara community to help expand your product
- Our global, end-user footprint to upsell a high-demand solution
- An open platform for support of multiple analytics applications
- Built-in analytics to enhance your enterprise solutions

AND YOUR CUSTOMERS BENEFIT FROM AN ENTERPRISE SOLUTION THAT INCLUDES:

- Operational intelligence—real-time visibility for immediate remediation
- Single software certification for a complete solution

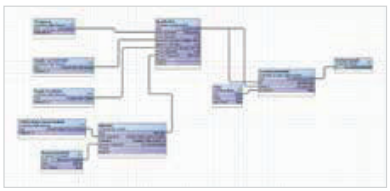
Niagara Analytics Framework

Niagara Analytics Framework will run in Niagara^{AX} Supervisor and is compatible with Niagara^{AX} 3.7.106 or later.



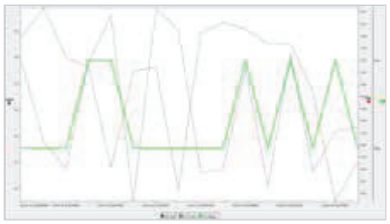
DATA DEFINITIONS VIEW

Data definitions let the user define data and formulas in a specific way to make results clearer and more consistent when running analytics.



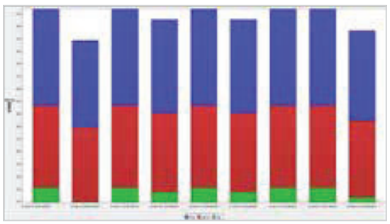
FORMULA & RULE CREATIONS VIEW

Formulas and rules can be created on the Niagara Wiresheet without code, so no new programming or logic language needs to be learned.



LINE CHART VIEW

Issues can be identified on a line chart—for example, when the belt drive speed increases while the belt tension decreases, resulting in belt slippage.

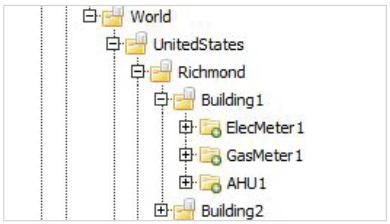


BAR CHART VIEW

Data can be viewed in aggregate—for example, this bar chart shows the electrical load of the HVAC, lighting and plug circuits.

INDIVIDUAL RESULTS VIEW

Individual results—such as this alarm record of a faulty water valve on an air handler—can be reviewed with hourly and total cost implications.



DATA MODELING VIEW

Data is taken out of the "driver-based" modeling format in Niagara^{AX} and set up in a geographically or system-typed model based on project requirements.

Integrate the Niagara Analytics Framework with your next application and give your customers the real-time intelligence they need to increase production, reduce costs and improve quality.

Contact your Niagara OEM to get started.

TRIDIUM

REFRIGERATION EQUIPMENT

For Food and Beverage

A complete line of Industrial Refrigeration products

ATTACHMENT G

Frick®
BY JOHNSON CONTROLS

TDIndustries

Why buy FRICK products?

FRICK HAS A REPUTATION FOR MAKING RELIABLE PRODUCTS

Frick began building quality products in Waynesboro, PA, USA in 1853. We built our first refrigeration compressor in 1883 and have been on the cutting edge of technology ever since. Each year, Frick continues to be stronger and strengthens its reputation for reliability, world-class engineering and application knowledge.

PART OF JOHNSON CONTROLS

As a part of Johnson Controls, Frick has access to the technical and financial resources of a Fortune 100 company. This allows us to share knowledge among our various sales and service organizations around the world.

FRICK FACTOR NETWORK

When you purchase a Frick industrial refrigeration system from your Frick Factor, you get the benefits of Frick product and service experience. Frick Factors have the skills to understand complex processes, product applications, and provide reliable, energy-wise installations, and service after the installation.

STATE-OF-THE-ART TECHNOLOGY IN BOTH DESIGN AND MANUFACTURING

We lead the industrial refrigeration industry with cutting edge controls technologies that allow for seamless system integration. Our product innovations continue to be a major focus as we strive to bring tomorrow's products to the marketplace today.

ENGINEERING EXCELLENCE

Frick engineers have provided reliable products for over 150 years. Frick engineers continually refine existing products, adding features and incorporating the newest technologies. This constant evolution of products ensures that Frick and Frick Factors will deliver customer satisfaction by providing the most technologically advanced equipment in the industry. As we make changes to improve the performance of current products, Frick engineers ensure that these improvements can be applied to previous installations. This allows continual upgrades to existing equipment and allows you to keep your Frick equipment current.

QUALITY, SATISFACTION AND RELIABILITY

The Industrial refrigeration industry places high demands on the equipment it uses. Today's equipment must be easy to maintain and meet high standards for quality, reliability and energy efficiency. Unit designs must be both robust and easily installed. Frick products accomplish all of these goals. High quality materials, innovative design and modern manufacturing methods add up to a product that is unmatched in overall quality. JOHNSON CONTROLS QUALITY POLICY - We will deliver products and services that conform to our customer's requirements and strive to exceed their expectations.

ENERGY EFFICIENT

Facility owners and operators are focused on energy efficiency now more than ever. Energy efficiency investments must provide a reasonable payback. Frick's many years of experience in the industrial refrigeration industry provides for varied and innovative energy efficiency solutions for your system. As an example, our VSD drives with unique liquid cooling ensure that your compressor operates at the most energy efficient level. Our cutting edge designs, along with Frick Control Systems and the use of VSD's can dramatically reduce operating costs.

ENGINEERED CONTROL SYSTEMS FEATURE Q-NET TECHNOLOGY

Get optimum performance when you use Q-Net to take control of your refrigeration system. View, monitor and control your entire system by changing setpoints; react to system changes from one location because everything is linked. Our

constant evaluation of best practices regarding energy conservation and system performance keeps pace with current technologies and sets the standard by which competition is gauged. We offer nearly limitless expansion of your controls capability to keep pace with controls technology. Select from complete PLC based Engineered Control Systems to Q-Net Technology panels.

SUPERIOR SYSTEM INTEGRATION

Our expertise in each product area means a better understanding of how to build a complete and superior refrigeration system with integrated controls. This complete system integration allows for a dependable, efficient and sustainable refrigeration system.

COOLWARE

Coolware selection software enables the user to select the best system components for a refrigeration system. Coolware allows products to be selected, priced, and placed directly into an order document, assuring that the correct equipment is ordered. It also provides flexibility in selection considerations to model a total system that is green, sustainable and efficient. Coolware is the most sophisticated and complete software found in industrial refrigeration today.

WE ARE ENVIRONMENTALLY GREEN

NATURAL
REFRIGERANTS
DON'T LEAVE A FOOTPRINT!

Ammonia and CO2 are the primary refrigerants used for industrial refrigeration. Both are natural refrigerants that are environmentally friendly and have low Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

AFTERMARKET SERVICE

If you have FRICK equipment, it is our policy to support it. Our technical support does not end with the warranty. The Baltimore Parts Center online ordering system is designed to help Frick® Factors obtain parts fast. Prompt and accurate service is our standard. We also offer a priority order service to expedite in-stock parts orders when same day shipment is required.

A GLOBAL LEADER

The Frick Brand is produced by Johnson Controls, a global diversified technology and industrial leader serving customers in over 150 countries. Johnson Controls serves these markets through three business units; Building Efficiency, Automotive Experience, Power Solutions.

Our Values

- Integrity
- Customer Satisfaction
- Employee Engagement
- Innovation
- Sustainability

Our commitment to sustainability includes our products, services, and operations. We believe in efficient use of resources around the world. We are committed to delivering value and making our customers successful.

Our 130,000 employees create quality products, services and solutions to optimize energy and operational efficiencies of buildings; lead-acid automotive batteries and advanced batteries for hybrid and electric vehicles; and interior systems for automobiles.

Building Efficiency is a leading provider of equipment and controls for heating, ventilating, air-conditioning and refrigeration, as well as security systems for buildings.

Automotive Experience is a global leader in automotive seating, overhead systems, door and instrument panels, and interior electronics.

Power Solutions is the global leader in lead-acid and advanced batteries fro the automotive industry.

RWF II and RXF Rotary Screw Compressors Quiet! Reliable! Efficient!

Frick® RWF II and RXF Rotary Screw Compressors... leading the food and beverage industry with the most innovative and broadest product range available for industrial applications.

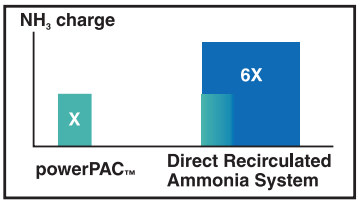
- **Variable volume ratio** for maximum efficiency
- **Infinite capacity control** to match changing loads... exactly!
- **Smart Series™ Motors** are NEMA premium efficient, low noise. Standard on Frick® compressor packages.
- **Flange mounting** eliminates troublesome field alignment between low-noise motor and compressor
- **Factory-mounted starter** simplifies electrical installation
- **Cold-start valve** provides oil pressure without the need for a pump
- **Lower leakage potential** because of fewer threads, less fittings and welded connections
- **Oil Cooling** by EZ-Cool™ Liquid Injection using a motorized expansion valve controlled by the Frick® Quantum™LX for optimum discharge temperature control; or by Thermosyphon which uses a plate and shell vessel to cool the oil with no compressor capacity lost or compressor power penalties incurred.

QUANTUM™LX CONTROL Easy To Learn! Easy To Use!

Our new LX display has contemporary graphics that are easy to read and navigate, just like the web. For today's personal computer user, the look and feel of Quantum™LX is second nature.

Our simple graphical interface is perfect for your newest users, while our advanced interface has detail to satisfy even your most experienced operator.

- Four user-defined capacity control modes for a wide application range
- Built-in diagnostic functions simplify troubleshooting
- Quantum™LX has on-screen calibrations and operator-friendly graphics
- Real-time and historical trending
- Smart safeties mean trouble-free operation
- Uses Ethernet for high-speed communications
- Backward compatible to Plus/Quantum™ micro with serial communication
- Industry standard serial communication protocols: Frick® ASCII • Allen-Bradley® DF1 Serial, Modbus ASCII • Modbus RTU
- Ethernet: Modbus TCP/IP • Web accessible



Frick® PowerPac™ ...Your next refrigeration plant should be easy to buy, easy to install and easy to operate!

Frick® PowerPac™ reduces the need for field labor. Frick® compressors, heat exchangers, evaporators, and condensers come in a compact package controlled by Frick® Quantum™LX controls and Frick® "turnkey" software.

Your Frick® PowerPac™ puts advanced heat exchanger technology to work for reduced refrigerant usage and maximum operating efficiency.

Reduces the requirement for a Process Safety Management (PSM) program.

Frick® PowerPac™

- Less jobsite labor means lower cost
- Optimized design means fewer welds
- "Factory Built" controlled environment; site delivered ready to operate
- Simplified electrical hookups
- Process side uses pumped glycol
- Freeze protection from 3-Directional expansion
- Plate and frame heat exchanger means less refrigerant charge

Unit-Mounted Solid-State Starter or Variable Speed Drive...Why?

- Lower installation costs
- Less mounting space
- Extended motor life and improved system integrity because it's factory wired
- Superior motor overload protection
- Main circuit breaker disconnect provides immediate shutdown protection at the compressor.

Vyper™ Variable Speed Drive gives you the kind of control you need, today, to respond to the unique load demands of your Process Cooling Requirements.

There are many processes that could benefit from the use of the Vyper™ VSD. Some examples are:

· Carbonated Beverage · Cold Storage · Meat Processing · Dairy · Poultry Processing · Industrial Bakeries · Seafood · Fruits & Vegetables · Breweries · Ice Making

Contact your Frick® sales representative to better realize the potential of this technology when applied to your process.

A smart, environmentally friendly way to upgrade your facility and reduce your carbon footprint!

Frick SmartPac™ Heat Pumps

SmartPac™ Heat Pumps capture the heat from your ammonia refrigeration system that is normally rejected to the atmosphere. SmartPac™ then transforms this valuable resource into hot water that can then be utilized throughout your industrial facility.

SmartPac™ enables you to make more efficient use of your ammonia refrigeration system ... bottom line ... lower utility bills and a reduced carbon footprint.

Frick® SmartPac™–Easy to Install; Easy to Own

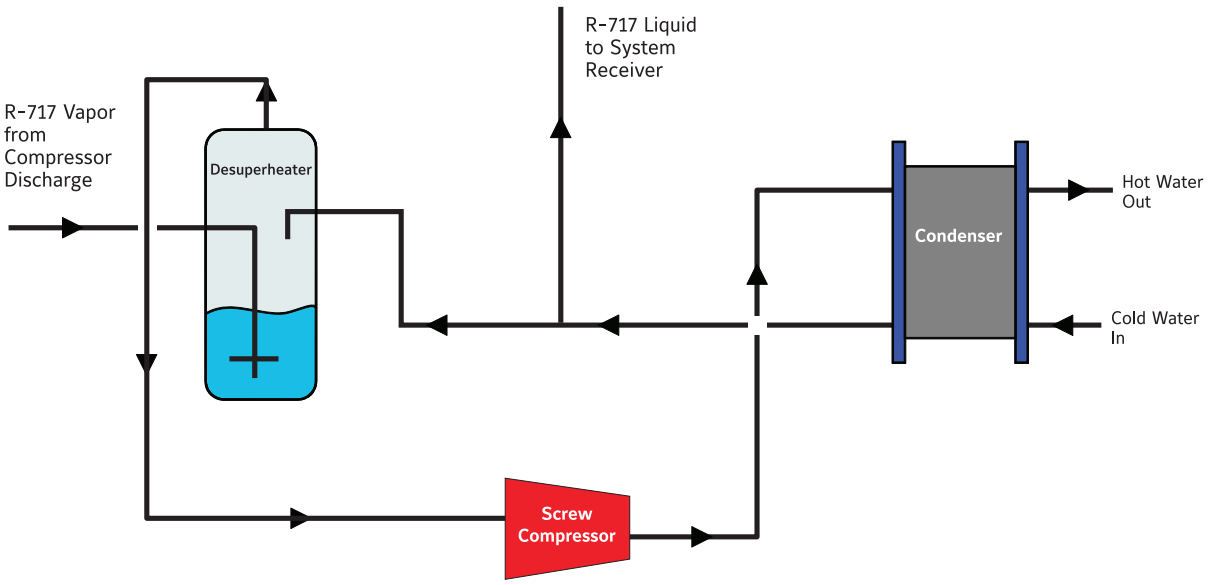
Frick screw compressors, heat exchangers, pressure vessels and controls all come together in a compact package ready to install.

Advanced heat exchanger technology increases operating efficiency with a reduced refrigerant charge.

When installed by a Frick Factor, get a 3-year warranty No worries start saving $$ now.

SmartPac™ Applications

- **Beef**
- **Poultry**
- **Dairy**
- **Brewery**
- **Prepared Foods**
- **Ice Rinks**
- **District Heating**



ACUAIR® HYGIENIC AIR HANDLING UNITS

Sanitary conditions, compliance with regulations and the demand to deliver a quality product are all part of the success equation. Frick® AcuAir® systems are precision-engineered and painstakingly built to the high sanitary standards of food processors and help you meet the requirements of the United States Department of Agriculture.

Frick AcuAir® Hygienic Air-Handling Units

Process Room Control of Temperature, Pressure, and Filtration, Creating a Safe, Sanitary Food Processing Environment

- Hygienic air conditioning
- Rooftop installation
- Engineered to your specific sanitary requirements

Makeup Air Handlers

Whether your application requires simple fresh-filtered air with little temperature conditioning or specific volumes of tempered air, the AcuAir applications team knows just the questions to ask in order to provide you with your most economical solution.

Frick AcuAir® products are the best solution for clean, conditioned air!

Custom Engineering

The extensive experience of Frick AcuAir® and the array of unit options allows us to customize a unit for your specific application..

AcuAir products controlled by Quantum™LX technology provide access for monitoring and control, using the web browser of any connected network computer or a laptop at the unit. Simply type in the Unit's IP Address for easy access. The remote mounted System Interface Panel (optional & shown here) can also be used for quick easy access to monitor and control your AcuAir units. The System Interface Panel will also provide access to any Quantum™LX control panel (compressor, evaporator, condenser/vessel) on the network from one convenient, central location.

Designed for Internal Wash-Down

Floor drains are provided throughout the unit that are piped to the exterior of the unit base. Under the cooling coil and downstream, the unit is provided with recessed stainless steel drain pans that are double-sloped for positive water drainage. Internal wiring and motors are also engineered for wash-down duty.

A Frick® heavy-duty evaporator means:

- Reliable heat transfer for continuous operation at all temperature levels
- Design flexibility in geometry, fan selection, and construction materials.

Innovative solutions driven by your application needs!

- CleanCoil™ hygienic fin design
- Fully welded hygienic drain pans
- Vari-Fin frost management design
- Full coverage drain pans

Frick Quantum™LX controllers provide the right solution for efficient capacity control.

- Flexible defrost-sequencing control platform
- Control up to 32 evaporators from each Quantum™LX graphical interface
- Remote terminal boxes minimize wiring requirements and reduce installation expenses.

And ... for extremely large facilities, link several Frick® Quantum™LX control panels together to manage all of the evaporators at the same time.

RTF Rooftop Freezer Systems

Penthouse Unit Features:

- **4″ (R-32) or 5″ (R-41) urethane foamed-in-place wall panels.**
- **Exterior painted, stucco-embossed steel panel.**
- **Large service doors with heated seals.**
- **OSHA guards at fan inlet.**
- **Fan motor service rail.**
- **Interior maintenance lighting.**
- **Refrigerant and drain lines extend through the insulated enclosure.**
- **Insulated drain pan – with or without hot gas pan coil. Interconnecting hot gas piping not included.**
- **External electrical control panel (Optional).**

The Evaporator System Includes:

- **Coils constructed of stainless steel tube and aluminum fins or all hot dip galvanized steel.**

- **Direct-drive cast aluminum, non-overloading axial propeller fans. Standard motors are TEFC, 1160 or 1750 RPM.**
- **Air or hot gas defrost coil designs**

Easy Maintenance

- Internal Access – The interior of the unit is spacious and easily accessible via multiple large hinged access doors for adjusting the float valve, cleaning the strainer, or flushing the basin.
- Basin Sweeper System – The basin contains an optional piping system to sweep away sediment.
- Harmony™ Removal System – Water distribution branch removal system that requires no tools.

Reliable Year-Round Operation

- Drive System – The fans, motor, and drive system are located to protect them from moisture, condensation and icing. Backed by a 5-year fan drive and motor warranty, these units are suitable for year-round operation.
- HDGAF Coil – The coil is hot dip galvanized after fabrication.

Low Installed Cost

- Support – All models mount directly on two parallel I beams and ship complete with motors and drives factory installed and aligned.
- Modular Design– Large models ship in multiple sections to minimize the size and weight of the heaviest lift, allowing for the use of smaller, less costly cranes.

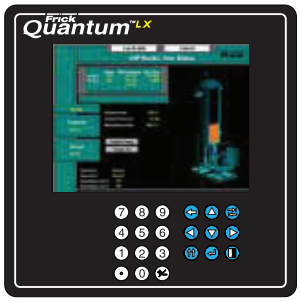
Green (Energy Saving)

- PE VFD Motors – Fan motors are premium efficient inverter duty.
- VFD – Variable frequency fan motor drives are optional.
- Design – Evaporative condensers lower the condensing temperature saving up to 15% compared to a traditional condenser.

The Frick Quantum™LX Condenser Control Panel

- Multi-step head pressure control
- Graphical operator interface (GOI) simplifies operator training
- Menu driven control-sequencing options
- Vessel level control to manage engine room needs

PRESSURE VESSELS



Accumulators

Vertical accumulators with or without coils.

Intercoolers

Vertical intercoolers with or without coils..

Receivers

- Horizontal and vertical high-pressure receivers.
- Horizontal and vertical thermosyphon receivers.
- Vertical high-pressure thermosyphon receivers.

Oil Pots

Horizontal oil pots.

Economizers

Flash type and shell-and-coil type.

Surge Drums

Horizontal surge drums with either single-flow or dual-flow.

Surge Drum Packages

Horizontal vessel design with sufficient room for plate and frame heat exchangers mounted below vessel.

Special Vessels and Packages

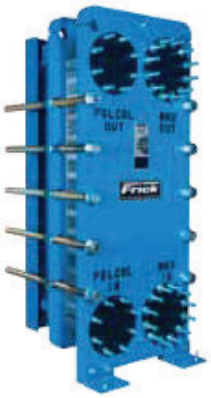
Frick® manufactures vessels and packages customized to specific application and design requirements.

Horizontal and Vertical Liquid Recirculator Vessels and Packages

Horizontal and vertical recirculator packages and vessels from 24 to 120 inch outside diameter. Offered with either mechanical seal or semihermetic style pumps, packages are completely factory piped and come standard with a 3-inch float column and 3 level eyes. Standard ammonia packages include an oil pot. Options include control panels, liquid-level control systems, oil pot heaters, variable speed drives, and liquid makeup assemblies (shipped loose).

HEAT EXCHANGERS

A plate and frame heat exchanger mounted on a structural base, piped to a liquid separator and wired with a NEMA 4 liquid level control panel. Designed to cool water or brine utilizing liquid refrigerant from a central refrigeration system.

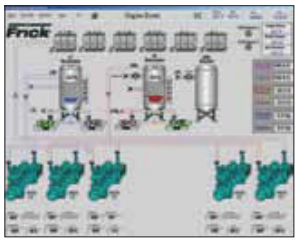


Frick custom engineered control systems are tailored to your individual requirements and are used on all types of new and existing Industrial Refrigeration applications.

- Custom solutions for any refrigeration application
- All setpoints password-protected with supervisor-assigned accessibility
- Open architecture
- Nonproprietary hardware and software

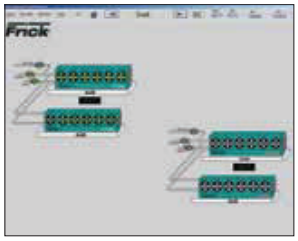
Opto 22 · Allen-Bradley®
RSView®32™ · Wonderware® In-Touch®

- All systems are protected by a NEMA 4 enclosure. NEMA 4x available as an option.



Engine room overview screen

- Remote monitoring
- Data logging and trending
- Report generation and printouts



Individual or group evaporator overview screen

- Unit-Mounted Starters and Controls for ease of installation and accessibility

Single Source Industrial Refrigeration Solutions!

Heat Exchangers

Packaged Equipment

Air Handlers

Vessels

Frick BY JOHNSON CONTROLS

Controls

Evaporators

Compressors

Condensers

Johnson Controls

Johnson Controls Inc.
100 CV Avenue • P.O. Box 997
Waynesboro, PA 17268-0997 U.S.A.
Tel: 717-762-2121 • Fax: 717-762-8624
www.johnsoncontrols.com

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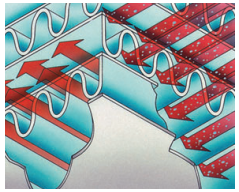
TDIndustries

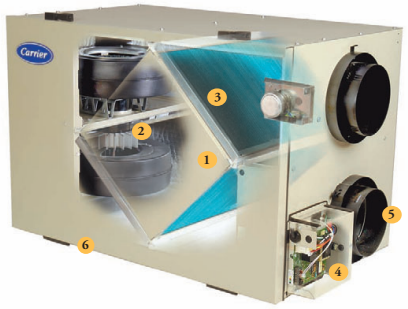
BREATHE EASY WITH A CARRIER ENERGY RECOVERY VENTILATOR.

TECHNOLOGY



This illustration shows how the central core doesn't mix the fresh air from outside with the stale polluted air from inside.

1. **Efficiency and comfort** is ensured by the high-efficiency energy recovery central core which recovers energy from the indoor air and transfers it to the fresh incoming air without mixing airstreams.The core also helps to remove unwanted humidity from air inside your home during winter, and removes the humidity from the outside air before it enters your home in the summer.
2. **Quiet comfort and energy savings** are provided by the motor which efficiently moves air through the system.
3. **Fresh, outdoor air is cleaned** by the filter prior to entering your living space.
4. **Better operating control and reliability** is provided by the electronic circuit board.
5. **Energy savings and added system reliability** is provided by the damper defrost. By periodically recirculating indoor air when temperatures drop below 23 degrees, the damper defrost helps prevent frost from forming, eliminating the need for energy-consuming supplementary electric defrost that can be found on competitive models.
6. **Easy access to internal components** comes from the briefcase-style latches. No tools are required for removing and cleaning filters.



Energy Recovery Ventilators (ERVs)

Model #	ERVCCLHU1150	ERVCCLHU1200
Capacity (CFM) @ 0.5-0.3 ESP(in. wc)	117-152	182-214
Apparent Sensible Effectiveness @ 32 degrees F - percent	79	76
Net Moisture Transfer Efficiency 95 degrees F - percent	52	45
Cooling Season Total Recovery Efficiency 95 degrees - percent	45	41

This information is in the ERVC Product Data – ERV-2PD.
Units can be installed as independent systems for bathrooms or kitchens or integrated for whole house ventilation.

CARRIER INDOOR COMFORT SYSTEMS OFFER UNMATCHED PERFORMANCE.

CARRIER SYSTEMS

Humidifier
As part of a total indoor comfort system, a Carrier humidifier replenishes moisture to dry, indoor air.

Zoning
Comfort zoning allows you to set different temperatures for different areas of your home. Enjoy greater comfort and added energy savings with room-to-room temperature control.

Comfort Ventilator
A Carrier comfort ventilator adds a breath of fresh air to today's tightly constructed home. It combines fresh outdoor air with conditioned indoor air for improved air and energy exchanges.

Thermidistat™ Control
A Carrier Thermidistat™ Control is your command center. Precise temperature control and programmable features keep you in touch with your comfort.

Evaporator Coil
A Carrier evaporator coil is matched with the proper outdoor unit to provide top cooling efficiency and years of reliable service. If replacing your outdoor unit, Carrier recommends the replacement of the indoor section as well, to ensure peak performance and reliability.

Furnace
Carrier offers a complete line of top-quality, high-efficiency gas and oil furnaces. Ask your Carrier dealer which one is right for you.

Air Cleaner
Carrier air cleaners can substantially improve your indoor comfort by removing harmful and irritating airborne pollutants from your home.

Air Conditioner
A complete line of Carrier air conditioners provides reliable, high-efficiency cooling for long-lasting comfort and energy savings. Ask your Carrier dealer about environmentally sound Carrier air conditioners with Puron® refrigerant.

MATCHING COMPONENTS PROVIDE OPTIMUM COMFORT, EFFICIENCY AND PERFORMANCE

- Forced-air systems are usually built around an indoor unit, such as a furnace or a fan coil.
- The outdoor unit will be an air conditioner or heat pump combined with a furnace for year-round comfort.
- Air quality is greatly improved with the addition of an air cleaner, humidifier and a ventilator.
- Precise temperature control comes from a Carrier thermostat matched to your indoor comfort system.
- Zoning provides the ultimate in control over your indoor comfort system.

WARRANTY

Carrier extends your comfort by providing written product and component warranties. The Energy Recovery Ventilator (ERV) is covered by a **five-year parts limited warranty** and a **lifetime limited** warranty on the core. Ask your Carrier dealer for details.

Carrier

EXPERTISE

Carrier has been on the leading edge of the indoor comfort industry since Willis Carrier invented what we now know as air conditioning in 1902. Since that time, Carrier scientists, engineers and dealers have been providing homeowners with the most advanced indoor comfort technology available. This technological advantage has enabled Carrier to customize indoor comfort systems for millions of homeowners nationwide.

Today, you can rely on your local Carrier dealer to evaluate your indoor comfort needs and suggest a customized system that fits those precise requirements. By recommending the appropriate furnace, air conditioner, humidifier, air cleaner, ventilator, zoning system and controls, your Carrier dealer can deliver enhanced comfort while improving the efficiency of your system. Ask your Carrier dealer for a system evaluation today.

Carrier

www.carrier.com

A member of the United Technologies Corporation family. Stock Symbol UTX.

08VL-3A3

Always look for these symbols. These are seals of certified performance, efficiency and capacity.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice or without incurring obligations.

Carrier®

ENERGY RECOVERY VENTILATOR

Attachment B-10.1

THE CARRIER ERV REFRESHES YOUR INDOOR AIR

A CARRIER ENERGY RECOVERY VENTILATOR ENHANCES YOUR OVERALL COMFORT.

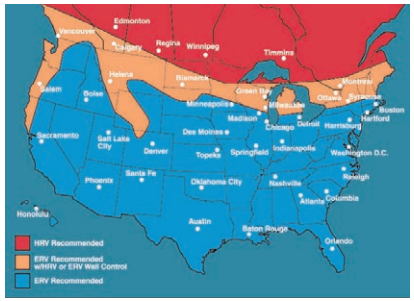
IAQ

As the cold weather settles in, let a Carrier Energy Recovery Ventilator (ERV) provide the fresh comfort you deserve. Today's air-tight homes provide excellent energy efficiency. However, better insulation restricts the air exchange, trapping stale, polluted air inside your home. Without proper ventilation, dust, airborne particles, volatile organic compounds (VOCs), excessive humidity and other pollutants from building materials constantly recirculate throughout your home. That's why Carrier offers the ERV.

EFFICIENCY

The Carrier ERV recovers energy from indoor air and transfers it to incoming outdoor air, so you can enjoy fresh air without sacrificing energy efficiency. The ERV draws fresh air into your home from outside as stale, polluted air is pulled out of your home and expelled outside. When the two air streams move through the central energy recovery core, energy is transferred from the stale outgoing air to the fresh incoming air without ever mixing airstreams. That means maximum comfort with fresh, clean air and efficient performance from your indoor comfort system.

Climate Map for Energy and Heat Recovery Ventilators



HRV or ERV? If you live in a colder climate with a longer heating season, your dealer will likely recommend the HRV. For most of the United States, ERV are recommended because of their year-round efficiency. Your local Carrier dealer can determine which is best for you.

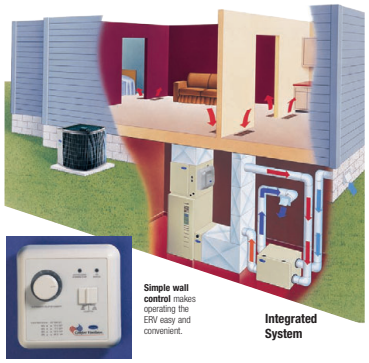
FOR UNEQUALLED PERFORMANCE AND DURABILITY, CHOOSE CARRIER.

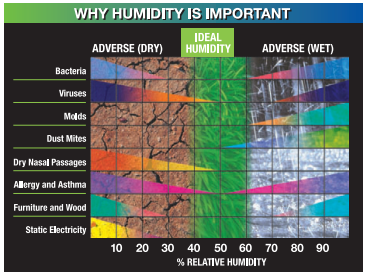
CUSTOM COMFORT

In addition to improving air quality, the ERV enhances your overall comfort. With the easy-to-use, wall-mounted control unit equipped with three different modes, you'll have fresh air at your fingertips. The recirculation mode provides air movement throughout your home without bringing in outside air. The continuous mode works 24 hours a day to provide a continuous flow of fresh outdoor air into your home. The intermittent mode operates when the indoor humidity exceeds your desired level, providing maximum fuel economy. The ERV will ensure your indoor comfort for years to come.

AIRFLOW

A Carrier ERV expels stale polluted air outdoors and refreshes your home with clean outside air, while at the same time recovering energy. This helps prevent and dilute the build-up of radon gas, carbon monoxide and other volatile organic compounds (VOCs). It is much more economical than opening a window in the middle of winter or summer. It also reduces humidity levels during winter months to reduce condensation on windows and doors.





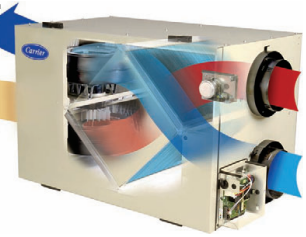
Maintaining ideal humidity in your home can be the key to relief from dry nasal passages, static electricity, and dry, itchy skin. Proper humidity control is also important for minimizing the growth of bacteria, molds, viruses and dust mites. With tighter built homes, too much humidity in the winter can be a problem. For example, excessive moisture in the winter can cause sweating/water drops to develop on windows and door jambs. This condition could prematurely deteriorate windows and door jambs, in corners, near floors or basements, and cause mold and mildew to develop.

AN ENERGY RECOVERY VENTILATOR CAN BE THE SOLUTION TO IMPROVING YOUR INDOOR AIR QUALITY.

ERV AIRFLOW

STALE AIR TO OUTSIDE
Removes the stale air from your home after the energy transfer has taken place in the high-efficiency core and exhausts it outside.

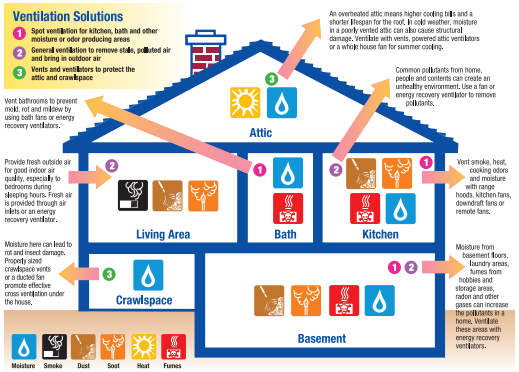
FRESH AIR TO BUILDING
Delivers fresh, filtered, conditioned air back into your home comfort system.



FRESH AIR FROM OUTSIDE
Brings fresh, outside air into the unit. The fresh air filter removes large particles of dust and dirt from incoming fresh air.

STALE AIR FROM BUILDING
Connects to the return air duct system in your home to draw stale, indoor air into the ventilator core.

TODAY'S HOMES NEED PROPER VENTILATION

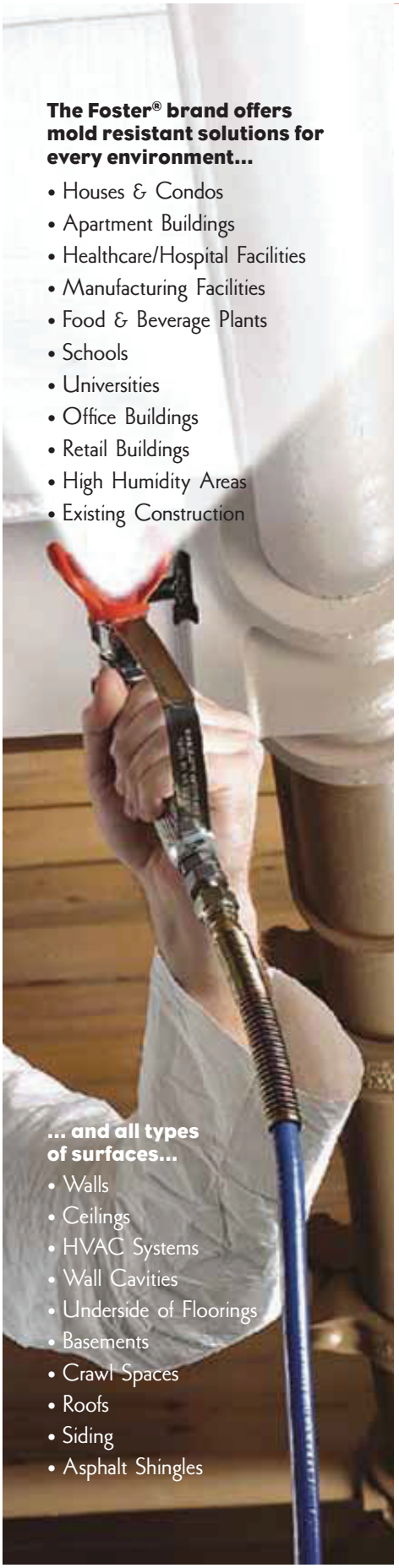


TDIndustries

ATTACHMENT H

Foster™

Mold Remediation and Prevention Products



The Foster® brand offers mold resistant solutions for every environment...

- Houses & Condos
- Apartment Buildings
- Healthcare/Hospital Facilities
- Manufacturing Facilities
- Food & Beverage Plants
- Schools
- Universities
- Office Buildings
- Retail Buildings
- High Humidity Areas
- Existing Construction

... and all types of surfaces...

- Walls
- Ceilings
- HVAC Systems
- Wall Cavities
- Underside of Floorings
- Basements
- Crawl Spaces
- Roofs
- Siding
- Asphalt Shingles

Foster™

A World Leader

For over 60 years, the Foster® brand of products have been leading the way with its mastic, coating, sealant and adhesive products for the industrial, commercial and residential construction markets. Foster introduced the first EPA-registered antimicrobial coating, and still the only, for use in HVAC systems in 1992 and has continued to manufacture and sell water-based coatings, disinfectants and accessory products for mold remediation and prevention to the indoor air quality market. Our reputation has been built on the best technical expertise driving the best technology for superior performing products.

When tested against rigorous American Standards Testing Method (ASTM) D-5590, Foster products exhibit a "0" growth rate (see next page for more information). This means Foster products have proven performance and superior efficacy that truly work!

As a leader in the IAQ industry, the Foster brand product line includes:

- EPA-Registered Antimicrobial Products
- Mold Resistant Products
- Disinfectant/Sanitizer
- Accessory Products

For additional information, please visit **www. fosterproducts.com**.

TDIndustries

EPA-Registered Antimicrobial Products

Our customers come first, and our ability to meet their needs is the key to our success.

Foster® products are "Globally Specified, Proven, and Preferred" by IAQ professionals around the world. Specifically, our antimicrobial coatings are ideal for use in buildings and locations where mold already exists, or may potentially exist. These products have been successfully used in the field as the number one mold resistant coatings since 1992. Both of our EPA-Registered mold resistant coatings (Foster® 40-20™ and Foster® 40-30™) are the only coatings registered for use both in HVAC systems and on walls/ceilings.

Solutions that Work!

The cost of remediating a mold-infested building can be staggering, especially when it may be repeated due to mold growth on an inferior coating. When applied to lined and unlined HVAC systems, walls, sub floors, and studs, Foster EPA-Registered fungicidal coatings provide long-term protection by preventing the growth and spread of odor causing bacteria and mold on the coating surface.

The samples at the right show standard untreated house paint (above) vs. Foster coating (below). The Foster 40-20 coating is free of mold!

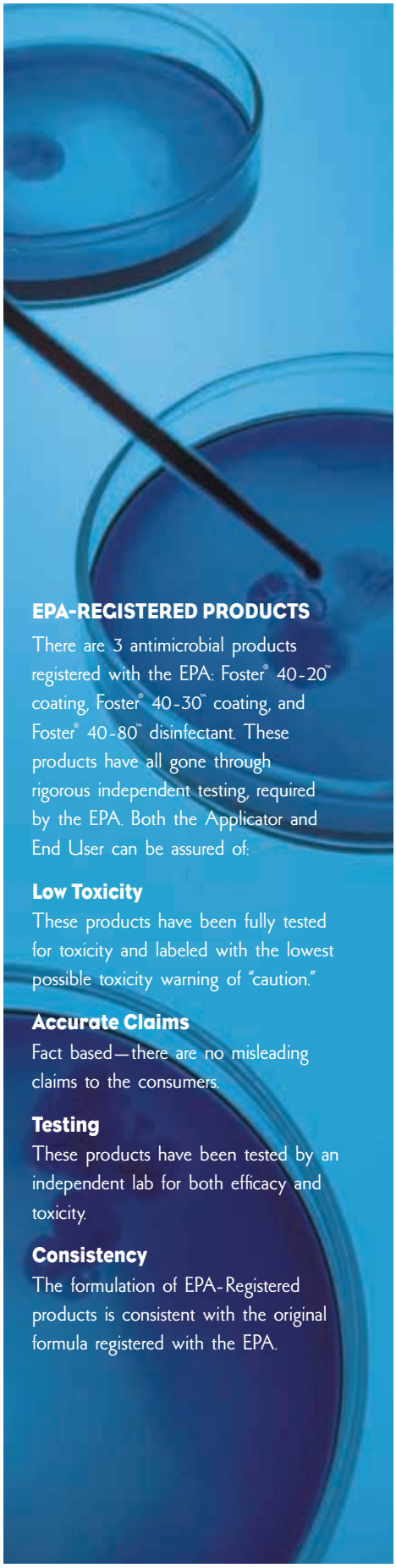
Mold covers the control sample completely.

Mold growth is inhibited on the Foster® 40-20™ coating.

Foster® Coatings Proven Effective 15 Years and Running . . .

Regardless of the job, Foster 40-20 offers the highest level of resistance to mold growth on its surface while protecting the substrate from deterioration. It is the first and only EPA-registered coating for application in HVAC duct work, as well as on walls, ceilings, pipes or wherever effective controls are essential. Foster 40-20 provides a flexible, tough film that remains clean while retarding fiber release and further erosion of the duct insulation. Over the past 15 years, Foster 40-20 has been extensively specified and used in numerous mold remediation projects. In one study, when used in the duct system of a prominent maximum security prison, Foster 40-20 has remained fully effective since 1992.

Visit www. fosterproducts.com for the full case study, and the use of Foster 40-20 in other remediation situations.



EPA-REGISTERED PRODUCTS

There are 3 antimicrobial products registered with the EPA: Foster® 40-20™ coating, Foster® 40-30™ coating, and Foster® 40-80™ disinfectant. These products have all gone through rigorous independent testing, required by the EPA. Both the Applicator and End User can be assured of:

Low Toxicity
These products have been fully tested for toxicity and labeled with the lowest possible toxicity warning of "caution."

Accurate Claims
Fact based—there are no misleading claims to the consumers.

Testing
These products have been tested by an independent lab for both efficacy and toxicity.

Consistency
The formulation of EPA-Registered products is consistent with the original formula registered with the EPA.

EPA-Registered Antimicrobial Products

All Foster® Indoor Air Quality products are water-based. Additional information and specifications can be found on the MSDS sheets and Product Data Sheets, available at **www.fosterproducts.com.**

Product Number/ General Description	Color	Substrate	Coverage	Dry Time	Application Method	Spray Tips
Foster® Fungicidal Protective Coatings						
40-20™ Fungicidal Protective Coating • Industry leading antimicrobial coating. • Prevents the re-growth and spread of odor causing bacteria and mold on its surface. • Provides a tough, elastic, water resistant coating. • Prevents air erosion and fiber release when applied to fibrous duct liner insulation.	White	• Walls • Ceilings • Pipes • Interior & Exterior HVAC duct systems	80 ft^2/gal. (2.0 m^2/L)	Set to touch: 4 hours Dry through: 16 hours	• Airless Sprayer • Brush or Roller	Tip Size*: 0.023 to 0.025", 8" to 10" fan width
40-30™ Fungicidal Protective Coating • Prevents the re-growth and spread of odor causing bacteria and mold on its surface. • Prevents air erosion and fiber release when applied to fibrous duct liner insulation.	Black	• Fiberglass duct liners • Duct board insulation • Galvanized surfaces	Galvanized Metal: 133 ft^2/gal. (3.3 m^2/L) New Duct Liner: 100 ft^2/gal. (2.5 m^2/L) Old Eroded Duct Liner: 67 ft^2/gal. (1.6 m^2/L)	Set to touch: 6 hours Dry through: 24 hours	• Airless Sprayer • Brush or Roller	Tip Size*: 0.019 to 0.025", 8" to 10" fan width
Foster® Disinfectant/Sanitizer						
40-80™ Disinfectant/Sanitizer** • Use as a disinfectant, sanitizer, cleaner, fungicide, deodorizer, virucide and germicide. • Kills a large variety of microbes within minutes. • Contains surfactants to help clean and remove residue. • Designed for use in water damage restoration situations.	Clear	• All hard, non-porous surfaces • Sanitizes porous and semi-porous materials	Depends on application method and surface. Apply sufficient quantity to insure the surface remains wet continuously for at least ten (10) minutes.	Dry thoroughly before applying top coating.	• Garden sprayer, spray bottle, cloth, mop or sponge	Airless sprayers are NOT recommended. Coarse spray only.

Guide to Primer Use

Surface	Required Primer	Coating
Wood (structural studs, OSB, plywood)	None	All
Metal (galvanized, foil)	40-26 (recommended)	All
Drywall (unpainted)	None	All
Concrete, brick, plaster, masonry cement block (unpainted)	40-22 or 40-26	All
Painted surfaces (flat finish)	None	All
Painted surfaces (gloss finish)	40-26 or sanding	All
Wood (smooth, sanded, hardwoods)	40-26	All
Ductliner, duct board	None	40-20 or 40-30

Airless Spray Equipment Guidelines

Foster Mold Resistant Coatings can be applied with most manufacturers commercial grade electric airless sprayers. Sprayers with the following minimum specifications are suggested:

Operating Pressure (psi):	3000
Motor Size (hp)	3/8
Volume (gpm):	0.45
Hose (inches i.d.):	1/4" up to 50', 5/16" over 50'
Spray Tips*:	Refer to Product Information Chart.

* Tip sizes as small 0.017" may be used, however, application will be slower and may require multiple passes to achieve recommended coverage rate. Spray equipment manufacturers specifications should be reviewed for maximum tip size acceptable for the sprayer being used.

** Not for use on the interior on HVAC systems. Refer to product label for use directions.

Mold Resistant Products

Resisting Mold in the Toughest Environments

Foster® brand coatings provide the highest level of performance even in the harshest conditions. Foster Mold Resistant Coatings specialize in resisting long-term mold growth on their surface. In addition to coatings, our accessory products improve the adhesion and aesthetic appeal when used.

ASTM D-5590 Testing Provides Evidence

We demonstrate the efficacy of our mold resistant products with extensive ASTM D-5590 Testing. ASTM D-5590 is specifically designed to test paints and coatings in the most severe environment possible for promotion of fungal growth. This makes it an excellent method for evaluation of a mold resistant coating's performance under the harshest conditions.

Foster® Brand Products Superior Performance and Highest Standards

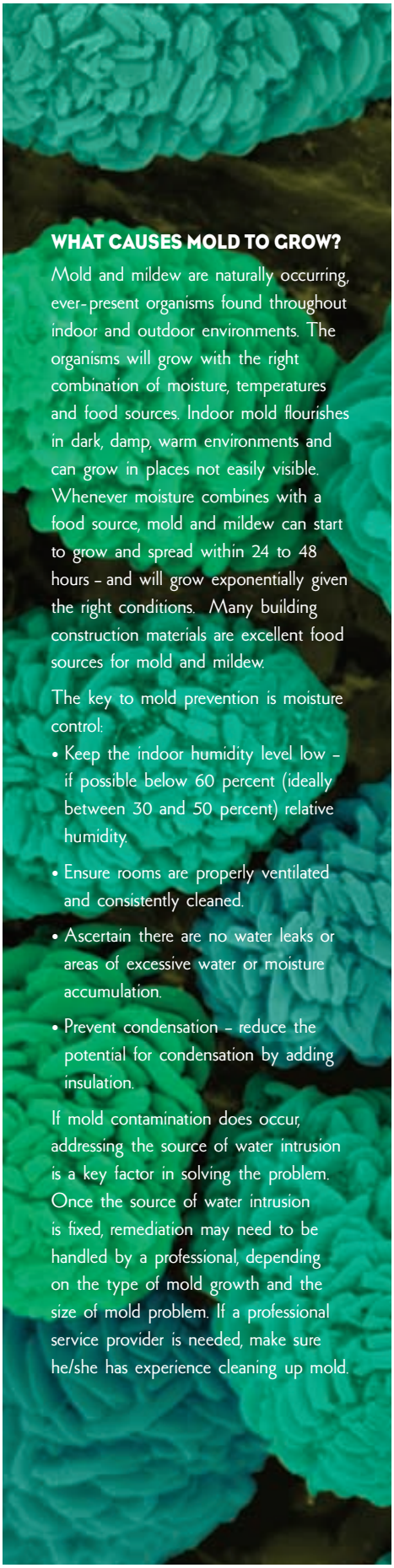
Our products are constantly monitored for high quality through our ISO 9001 certification. This high level plant quality certification assures consistent, high quality Foster brand products. In addition, we test independently through a leading commercial IAQ laboratory (Aerotech Laboratories, Inc.) to maintain our position of leadership.

ASTM D-5590 Test Method

ASTM D-5590 was purposefully developed to test paints and coatings in the "worst-case conditions" possible for promotion of mold, mildew, fungus and algae growth. This method is the best for evaluating a mold resistant coating's performance under ideal mold growth situations.

Mold requires three elements for growth: high humidity, proper temperatures and a food source. ASTM D-5590 provides these elements in an optimal environment for growth. To insure continual exposure, the sample is surrounded with active, continually re-generating mold spores, truly testing the product's resistance to growth. These conditions represent a worst-case scenario in a real world application where there is active mold spore generation on an adjacent substrate to the coated material at a temperature and humidity highly conducive to mold growth.

Other commonly cited tests do not provide this high standard of testing combining all three elements, and consequently do not reflect the product's performance under the most relentless mold growth conditions.



WHAT CAUSES MOLD TO GROW?

Mold and mildew are naturally occurring, ever-present organisms found throughout indoor and outdoor environments. The organisms will grow with the right combination of moisture, temperatures and food sources. Indoor mold flourishes in dark, damp, warm environments and can grow in places not easily visible. Whenever moisture combines with a food source, mold and mildew can start to grow and spread within 24 to 48 hours – and will grow exponentially given the right conditions. Many building construction materials are excellent food sources for mold and mildew.

The key to mold prevention is moisture control:

- Keep the indoor humidity level low – if possible below 60 percent (ideally between 30 and 50 percent) relative humidity.
- Ensure rooms are properly ventilated and consistently cleaned.
- Ascertain there are no water leaks or areas of excessive water or moisture accumulation.
- Prevent condensation – reduce the potential for condensation by adding insulation.

If mold contamination does occur, addressing the source of water intrusion is a key factor in solving the problem. Once the source of water intrusion is fixed, remediation may need to be handled by a professional, depending on the type of mold growth and the size of mold problem. If a professional service provider is needed, make sure he/she has experience cleaning up mold.

Mold Resistant Products

All Foster® Indoor Air Quality products are water-based. Additional information and specifications can be found on the MSDS Sheets and Product Data Sheets, available at **www.fosterproducts.com.**

Product Number/ General Description	Color	Substrate	Coverage	Dry Time	Application Method	Spray Tips
Foster® Mold Resistant Coatings and Sealants						
40-10™ Duct Liner Adhesive Coating • Seals and reinforces the surface of new and aged duct liner. • Prevents air erosion and fiber release. • Resists mold, fungus, and discoloration from mildew and mold stains on its surface.	White	• Fibrous duct liner • Unfaced duct board insulation	80 to 200 ft^2/gal. (2.0 to 4.9 m^2/L)	Set to touch: 6 hours Dry through: 24 hours	• Airless Sprayer • Brush or Roller	Tip Size*: 0.019 to 0.025", 8" to 10" fan width
40-11™ Eclipse™ Coating • Matches the original surface color of most duct liner insulations. • Seals and reinforces the surface of new and aged duct liner. • Prevents air erosion and fiber release resists mold, fungus and discoloration.	Black	• Fibrous duct liner • Duct board insulation	50 to 150 ft^2/gal. (1.2 to 3.7 m^2/L)	Set to touch: 6 hours Dry through: 24 hours	• Airless Sprayer • Brush or Roller	Tip Size*: 0.019 to 0.025", 8" to 10" fan width
40-23™ Insulation Sealer • Penetrates deeply into existing HVAC duct liner insulations, forming a damage resistant surface that reduces particle release. • Resists fungus and mold growth on its surface.	White	• Fibrous duct liner • Duct board insulation	50 to 150 ft^2/gal. (1.2 to 3.7 m^2/L)	Dry through: 2-4 hours at ambient	• Airless Sprayer • Brush or Roller	Tip Size*: 0.019 to 0.025", 8" to 10" fan width
40-50™ Mold Resistant Coating • Formulated with EPA-registered antimicrobial agents which provide protection against odor causing bacteria, mildew and mold growth on the product surface. • For use in areas prone to the growth of mold.	White	• Wall cavities, floor joists, attic spaces • Wood and metal studs, drywall, OSB, furring strips, masonry	300 ft^2/gal. (7.4 m^2/L)	Dry through: 1-2 hours at ambient	• Airless Sprayer • Brush or Roller	Tip Size*: 0.015 to 0.017", 8" to 10" fan width
40-51™ Mold Resistant Coating • Provides a clear finish leaving the original surface visible after application. • Specially formulated with EPA-registered antimicrobial agents for long-term protection from mold growth on its surface.	Clear	• Wall cavities, floor joists, attic spaces • Wood and metal studs, drywall, OSB, furring strips, masonry	Wood: 250 to 450 ft^2/gal. (6.1 to 11.0 m^2/L) Non-Porous Surfaces: 500 to 600 ft^2/gal. (12.3 to 14.7 m^2/L)	Dry through: 1 hour at ambient	• Airless Sprayer • Brush or Roller	Tip Size*: 0.015 to 0.017", 8" to 10" fan width
40-55™ Clear Defense™ Mold Resistant Coating • Specifically designed to protect and maintain the aesthetics of residential, commercial and industrial surfaces. • Formulated with EPA-registered additives, providing long-term resistance to the growth of mold, mildew, fungus and algae on its surface without blushing or yellowing.	Clear	• Masonry, stucco, concrete and clay roofing tiles • Asphalt shingles, vinyl, aluminum, painted wood	Non-Porous Surfaces: 300 ft^2/gal. (7.4 m^2/L) Porous will require more product.	Dry through: 40 minutes-1 hour	• Airless Sprayer • Brush or Roller	Tip Size*: 0.015 to 0.017", 8" to 10" fan width
Foster® Accessory Products						
40-16™ Block Filler • Abrasion-resistant fill coat eliminates pores, depressions and crevices in a one-coat application.	Off White	• Unpainted masonry surfaces	40 to 70 ft^2/gal. (1.0 to 1.7 m^2/L)	Set to touch: 1-2 hours Dry through: 15 hours	• Airless Sprayer • Brush or Roller	30:1 Air Pump with Inductor Plate. Tip Size: 0.021 to 0.025", 8" to 10" fan width
40-22™ Masonry Sealer & Primer • Penetrates into the surface, strengthening it and sealing it to help eliminate blistering and peeling.	Off White (dries clear)	• Unpainted block plaster • Cement surface	50 to 200 ft^2/gal. (1.2 to 4.9 m^2/L)	Dry through: 2-4 hours at ambient	• Airless Sprayer • Garden Sprayer or Spray Bottle	Tip Size: 0.017 to 0.021", 8" to 10" fan width
40-26™ Water-based Primer • Bonds and protects against stains and corrosion. • Increases the bondability of retrofit systems.	Off White (dries translucent)	• Metal, and rusty metal • Concrete • Masonry • Wood	Metal: 200 to 300 ft^2/gal. (4.9 to 7.4 m^2/L) for corrosion protection; 400 to 600 ft^2/gal. (9.8 to 14.7 m^2/L) for improving adhesion.	Dry through: 1 hour at ambient	• Airless Sprayer • Brush or Roller	Tip Size: 0.017 to 0.021", 8" to 10" fan width

*See Airless Spray Equipment Guidelines for information.

The Foster® Clean, Kill & Coat™ three-phased approach for mold remediation eliminates the chance for the return of mold.

Step 1. Clean

- Remove any water-damaged and mold contaminated materials that cannot be salvaged such as carpeting, furniture and wallboard.
- Thoroughly dry all materials to be left in place by exposing them to circulated dry air.
- Follow with a thorough cleaning and removal of all contaminants.

Step 2. Kill

- Sanitize the affected porous and non-porous surfaces with the ready-to-use, EPA-registered Foster® 40-80™ Disinfectant/Sanitizer to clean, deodorize and remove any residual microbial contaminants.
- The surface should remain wet for 10 minutes.

Step 3. Coat

- Coat the surface with the appropriate Foster brand protective coating evenly and thoroughly. We recommend an airless sprayer for an even application.
- Ventilate well for proper drying. Continue ventilation using appropriate fans, negative air machines or air scrubbers until odors are reduced to acceptable levels.
- Always ensure the use of PPE (Proper Protective Equipment).

Foster™

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TDIndustries

VARIABLE FREQUENCY DRIVE

OPERATION AND APPLICATION OF VARIABLE FREQUENCY DRIVE (VFD) TECHNOLOGY

Carrier Corporation
Syracuse, New York

October 2005

TABLE OF CONTENTS

INTRODUCTION

Variable frequency drive (VFD) usage has increased dramatically in HVAC applications. The VFDs are now commonly applied to air handlers, pumps, chillers and tower fans. A better understanding of VFDs will lead to improved application and selection of both equipment and HVAC systems. This paper is intended to provide a basic understanding of common VFD terms, VFD operation, and VFD benefits. In addition this paper will discuss some basic application guidelines regarding harmonic distortion with respect to industry standards.

Common VFD Terms

There are several terms used to describe devices that control speed. While the acronyms are often used interchangeably, the terms have different meanings.

Variable Frequency Drive (VFD)
This device uses power electronics to vary the frequency of input power to the motor, thereby controlling motor speed.

Variable Speed Drive (VSD)
This more generic term applies to devices that control the speed of either the motor or the equipment driven by the motor (fan, pump, compressor, etc.). This device can be either electronic or mechanical.

Adjustable Speed Drive (ASD)
Again, a more generic term applying to both mechanical and electrical means of controlling speed.

This paper will discuss only VFDs.

VFD OPERATION

Understanding the basic principles behind VFD operation requires understanding the three basic sections of the VFD: the rectifier, dc bus, and inverter.

The voltage on an alternating current (ac) power supply rises and falls in the pattern of a sine wave (see Figure 1). When the voltage is positive, current flows in one direction; when the voltage is negative, the current flows in the opposite direction. This type of power system enables large amounts of energy to be efficiently transmitted over great distances.

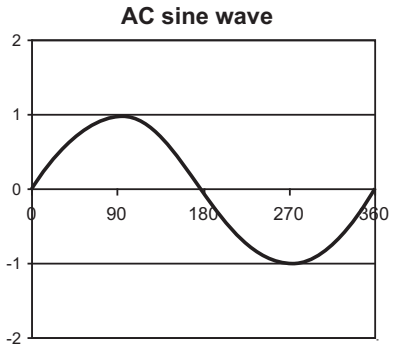

Fig. 1. AC sine wave

The **rectifier** in a VFD is used to convert incoming ac power into direct current (dc) power. One rectifier will allow power to pass through only when the voltage is positive. A second rectifier will allow power to pass through only when the voltage is negative. Two rectifiers are required for each phase of power. Since most large power supplies are three phase, there will be a minimum of 6 rectifiers used (see Figure 2). Appropriately, the term "**6 pulse**" is used to describe a drive with 6 rectifiers. A VFD may have multiple rectifier sections, with 6 rectifiers per section, enabling a VFD to be "**12 pulse,**" "**18 pulse**," or "**24 pulse.**" The benefit of "*multi-pulse*" VFDs will be described later in the harmonics section.

Rectifiers may utilize diodes, silicon controlled rectifiers (SCR), or transistors to rectify power. Diodes are the simplest device and allow power to flow any time voltage is of the proper polarity. Silicon controlled rectifiers include a gate circuit that enables a microprocessor to control when the power may begin to flow, making this type of rectifier useful for solid-state starters as well. Transistors include a gate circuit that enables a microprocessor to open or close at any time, making the transistor the most useful device of the three. A VFD using transistors in the rectifier section is said to have an "**active front end.**"

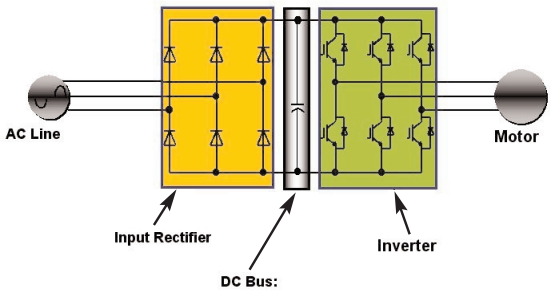

Fig. 2. VFD basics: Existing technology

After the power flows through the rectifiers it is stored on a **dc bus**. The dc bus contains capacitors to accept power from the rectifier, store it, and later deliver that power through the inverter section. The dc bus may also contain inductors, dc links, chokes, or similar items that add inductance, thereby smoothing the incoming power supply to the dc bus. The final section of the VFD is referred to as an "**inverter.**" The inverter contains transistors that deliver power to the motor. The "**Insulated Gate Bipolar Transistor**" (IGBT) is a common choice in modern VFDs. The IGBT can switch on and off several thousand times per second and precisely control the power delivered to the motor. The IGBT uses a method named "**pulse width modulation**" (PWM) to simulate a current sine wave at the desired frequency to the motor.

Motor speed (rpm) is dependent upon frequency. Varying the frequency output of the VFD controls motor speed:

Speed (rpm) = frequency (hertz) x 120 / no. of poles

Example:

2-pole motor at different frequencies
3600 rpm = 60 hertz x 120 / 2 = 3600 rpm
3000 rpm = 50 hertz x 120 / 2 = 3000 rpm
2400 rpm = 40 hertz x 120 / 2 = 2400 rpm

BENEFITS OF VFD

As VFD usage in HVAC applications has increased, fans, pumps, air handlers, and chillers can benefit from speed control. Variable frequency drives provide the following advantages:

- energy savings
- low motor starting current
- reduction of thermal and mechanical stresses on motors and belts during starts
- simple installation
- high power factor
- lower KVA

Understanding the basis for these benefits will allow engineers and operators to apply VFDs with confidence and achieve the greatest operational savings.

VFD Capacity Control Saves Energy

Most applications do not require a constant flow of a fluid. Equipment is sized for a peak load that may account for only 1% of the hours of operation. The remaining hours of operation need only a fraction of the flow. Traditionally, devices that throttle output have been employed to reduce the flow. However, when compared with speed control, these methods are significantly less efficient.

Mechanical Capacity Control

Throttling valves, vanes, or dampers may be employed to control capacity of a constant speed pump or fan. These devices increase the head, thereby forcing the fan or pump to ride the curve to a point where it produces less flow (Figure 3). Power consumption is the product of head and flow. Throttling the output increases head, but reduces flow, and provides some energy savings.

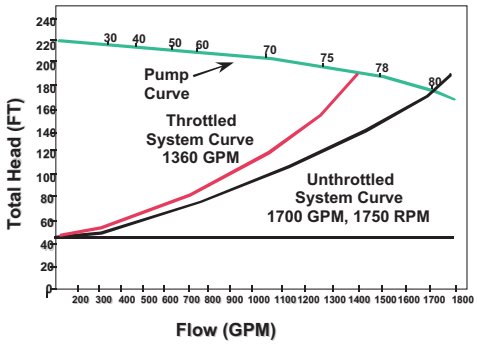

Fig. 3. Mechanical capacity control

Pump power ~ flow x head / 3960[1]

Variable Speed Capacity Control

For centrifugal pumps, fans and compressors, the ideal fan (affinity) laws describe how speed affects flow, head and power consumption (Table A).

When using speed to reduce capacity, both the head and flow are reduced, maximizing the energy savings. A comparison of mechanical and speed control for capacity reduction (Figure 4) shows that variable speed is the most efficient means of capacity control.

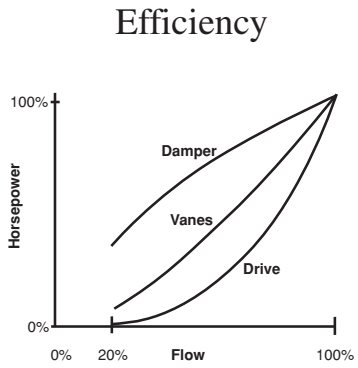

Fig. 4. Comparison of mechanical capacity control and speed capacity control

Table A
Effects of Changes in Fan Speed

Flow changes linearly with speed	$Flow\ Rate_2 = Flow\ Rate_1 \times (RPM_2/RPM_1)$
Head varies as the speed squared	$Lift_2 = Lift_1 \times (RPM_2/RPM_1)^2$
Power varies as the speed cubed	$Power_2 = Power_1 \times (RPM_2/RPM_1)^3$

[1] Assumes fluid is fresh water, (specific gravity = 1).

Low Inrush Motor Starting

Motor manufacturers face difficult design choices. Designs optimized for low starting current often sacrifice efficiency, power factor, size, and cost. With these considerations in mind, it is common for AC induction motors to draw 6 to 8 times their full load amps when they are started across the line. When large amounts of current are drawn on the transformers, a voltage drop can occur[2], adversely affecting other equipment on the same electrical system. Some voltage sensitive applications may even trip off line. For this reason, many engineers specify a means of reducing the starting current of large AC induction motors.

Soft Starters

Wye-delta, part winding, autotransformer, and solid-state starters are often used to reduce inrush during motor starting. All of these starters deliver power to the motor at a constant frequency and therefore must limit the current by controlling the voltage supplied to the motor. Wye delta, part winding, and auto-transformer starters use special electrical connections to reduce the voltage. Solid-state starters use SCRs to reduce the voltage. The amount of voltage reduction possible is limited because the motor needs enough voltage to generate torque to accelerate. With maximum allowable voltage reduction, the motor will still draw two to four times the full load amps (FLA) during starting. Additionally, rapid acceleration associated with wye-delta starters can wear belts and other power transmission components.

VFDs as Starters

A VFD is the ideal soft starter since it provides the lowest inrush of any starter type as shown in Table B. Unlike all other types of starters, the VFD can use frequency to limit the power and current delivered to the motor. The VFD will start the motor by delivering power at a low frequency. At this low frequency, the motor does not require a high level of current. The VFD incrementally increases the frequency and motor speed until the desired speed is met. The current level of the motor never exceeds the full load amp rating of the motor at any time during its start or operation. In addition to the benefit of low starting current, motor designs can now be optimized for high efficiency.

Table B
Comparison of Starter Types Based on Inrush

Starter Type	Starting Current (% of FLA)
VFD	100%
Wye-Delta Starter	200-275%
Solid State Soft Starter	200%
Autotransformer Starter	400-500%
Part Winding Starter	400-500%
Across the Line Starter	600-800%

Easy Installation

Many pieces of equipment are factory shipped with unit mounted VFDs that arrive pre-programmed and factory wired. Motor leads, control power for auxiliaries, and communication lines are all factory wired. The VFD cooling lines on unit-mounted chiller VFDs are also factory installed. The installing contractor needs only to connect the line power supply to the VFD.

High Power Factor

Power converted to motion, heat, sound, etc. is called real power and is measured in kilowatts (kW). Power that charges capacitors or builds magnetic fields is called reactive power and is measured in Kilovolts Amps Reactive (kVAR). The vector sum of the kW and the kVAR is the Total Power (energy) and is measured in Kilovolt Amperes (KVA) (Figure 5). Power factor is the ratio of kW/KVA.

Motors draw reactive current to support their magnetic fields in order to cause rotation. Excessive reactive current is undesirable because it creates additional resistance losses and can require the use of larger transformers and wires. In addition, utilities often penalize owners for low power factor. Decreasing reactive current will increase power factor.

[2] This is a significant consideration for "soft" systems such as backup generators.

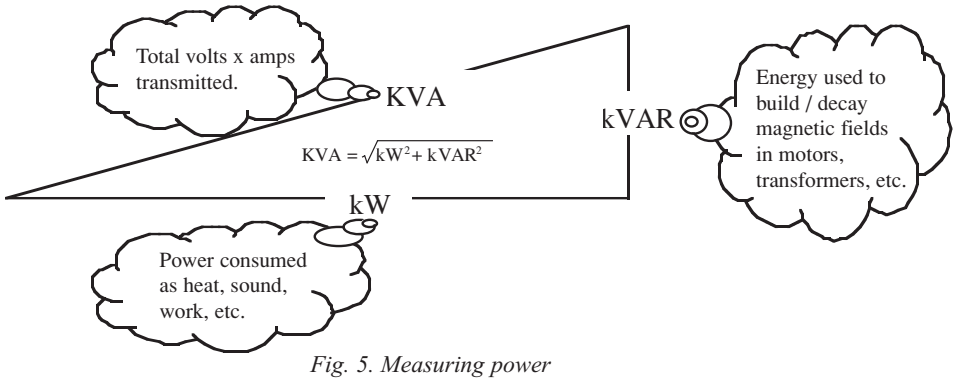

Fig. 5. Measuring power

Typical AC motors may have a full load power factor ranging from 0.84 to 0.88. As the motor load is reduced, the power factor becomes lower. Utilities may require site power factor values ranging from 0.85 to 0.95 and impose penalties to enforce this requirement. Power factor correction capacitors can be added to reduce the reactive current measured upstream of the capacitors and increase the measured power factor. To prevent damage to the motor, power factor correction capacitors should not exceed the motor manufacturer's recommendations. In most cases, this results in maximum corrected values of 0.90 to 0.95.

The VFDs include capacitors in the DC Bus that perform the same function and maintain high power factor on the line side of the VFD. This eliminates the need to add power factor correction equipment to the motor or use expensive capacitor banks. In addition, VFDs often result in higher line side power factor values than constant speed motors equipped with correction capacitors.

Low Full Load KVA

Total Power (KVA) is often the limiting factor in the amount of energy that can be transmitted through an electrical device or system. If the KVA required by equipment can be reduced during periods of peak demand, it will help alleviate voltage sags, brown outs, and power outages. The unit efficiency and power factor are equally weighted when calculating KVA. Therefore, equipment that may be equal or worse in efficiency, but higher in power factor has significantly lower KVA (Table C).

In this example, equipment with a higher power factor uses 15% less KVA while performing the same job. This can lower electrical system cost on new projects and free up KVA capacity on existing systems.

Table C
Power Factors and Energy Usage

Input kW	Power Factor	Amps	Volts	KVA
350.4	.84	502	Nominal 480	417
350.4	.99	426	Nominal 480	354

NOTE: KVA = Volts x Amps x 1.732

Backup generators are typically sized to closely match the load. Lowering KVA can reduce the size of the generator required. When VFDs with active front ends are used, the generator size can approach an ideal 1:1 ratio of kW/KVA because the power factor is near unity (1.0) and the harmonics produced by the VFD are extremely low.

Lower KVA also benefits utilities. When the power factor is higher, more power (kW) can be delivered through the same transmission equipment.

HARMONIC DISTORTION AND INDUSTRY STANDARDS

A discussion of the benefits of VFDs often leads to a question regarding harmonics. When evaluating VFDs, it is important to understand how harmonics are provided and the circumstances under which harmonics are harmful.

Harmonic Definition

In the United States, three-phase AC power typically operates at 60 hertz (60 cycles in one second). This is called the **fundamental frequency**.

A **harmonic** is any current form at an integral multiple of the fundamental frequency. For example, for 60-hertz power supplies, harmonics would be at 120 hertz (2 x fundamental), 180 hertz, 240 hertz, 300 hertz, etc.

What Causes Harmonics?

VFDs draw current from the line only when the line voltage is greater than the DC Bus voltage inside the drive. This occurs only near the peaks of the sine wave. As a result, all of the current is drawn in short intervals (i.e., at higher frequencies). Variation in VFD design affects the harmonics produced. For example, VFDs equipped with DC link inductors produce different levels of harmonics than similar VFDs without DC link inductors. The VFDs with active front ends utilizing transistors in the rectifier section have much lower harmonic levels than VFDs using diodes or silicon controlled rectifiers (SCRs).

Electronic lighting ballasts, uninterruptible power supplies, computers, office equipment, ozone generators, and other high intensity lighting are also sources of harmonics.

Rocks and Ponds

Obviously, the magnitude of the contributing wave forms has an effect on the shape of the resultant wave form. If the fundamental wave form (60 Hz) has a very large magnitude (5,000 amps) and the harmonic wave forms are very low (10 amps), then the resultant wave form will not be very distorted and total harmonic distortion will be low. If the harmonic wave form current value is high relative to the fundamental, the effect will be more dramatic.

In nature, we see this effect with waves in water. If you continually throw baseball size rocks into the ocean, you would not expect to change the shape of the waves crashing onto the beach. However, if you threw those same size rocks into a bathtub, you would definitely observe the effects. It is similar with electrical waves and harmonics.

When you calculate harmonics you are calculating the effect of the harmonics on the fundamental current wave form in a particular distribution system. There are several programs that can perform estimated calculations. All of them take into account the amount of linear loads (loads drawing power through out the entire sine wave) relative to non-lin ear loads (loads drawing power during only a fraction of the sine wave). The higher the ratio of linear loads to non-linear loads, the less effect the non-linear loads will have on the current wave form.

Are Harmonics Harmful?

Harmonics that are multiples of 2 are not harmful because they cancel out. The same is true for 3rd order harmonics (3rd, 6th, 9th etc.). Because the power supply is 3 phase, the third order harmonics cancel each other out in each phase [3]. This leaves only the 5th, 7th, 11th, 13th etc. to discuss. The magnitude of the harmonics produced by a VFD is greatest for the lower order harmonics (5th, 7th and 11th) and drops quickly as you move into the higher order harmonics (13th and greater).

Harmonics can cause some disturbances in electrical systems. Higher order harmonics can interfere with sensitive electronics and communications systems, while lower order harmonics can cause overheating of motors, transformers, and conductors. The opportunity for harmonics to be harmful, however, is dependent upon the electrical system in which they are present and whether or not any harmonic sensitive equipment is located on that same electrical system.

Understanding IEEE 519

IEEE (Institute of Electrical and Electronics Engineers) created a recommendation for evaluating harmonics. The IEEE-519 standard provides recommended limits for harmonic distortion measured at the point of common coupling. The point of common coupling is the point at which the customer's electrical system is connected to the utility.

[3] The neutral wire sizing should account for 3rd order harmonic current.

Although the IEEE standard recommends limits for both voltage distortion and current distortion, specifications that reference a 5% harmonic limitation are generally referring to current distortion. In most cases, if the current distortion falls within IEEE-519 requirements, the voltage distortion will also be acceptable.

Determining compliance with IEEE-519 requires an actual measurement of the system during operation. Predicting compliance in advance often requires a system study that accounts for all electrical equipment (transformers, wires, motors, VFDs, etc.) in the system.

Introduction To Harmonic Terms

Total Harmonic Voltage Distortion - THD (V)

As harmonic currents flow through devices with reactance or resistance, a voltage drop is developed. These harmonic voltages cause voltage distortion of the fundamental voltage wave form. The total magnitude of the voltage distortion is the THD (V). The IEEE-519 standard recommends less than 5% THD (V) at the point of common coupling for general systems 69 kV and under.

Total Harmonic Current Distortion - THD (I)

This value (sometimes written as THID) represents the total harmonic current distortion of the wave form at the particular moment when the measurement is taken. It is the ratio of the harmonic current to the fundamental (non-harmonic) current measured for that load point. Note that the denominator used in this ratio changes with load.

Total Demand Distortion - TDD

Total Demand Distortion (TDD) is the ratio of the measured harmonic current to the full load fundamental current. The full load fundamental current is the total amount of non-harmonic current consumed by all of the loads on the system when the system is at peak demand. The denominator used in this ratio does not change with load. Although TDD can be measured at any operating point (full or part load), the worst case TDD will occur at full load. If the full load TDD is acceptable, then the TDD measured at part load values will also be acceptable. To use our rock analogy, the full load fundamental current is the size of our pond and the harmonic current is the size of our rock. (See Table D.)

Table D
Comparison of TDD and THD(I)

Fundamental Current (rms)	Harmonic Current (rms)	THD(I)	TDD
1000	50	5%	5%
800	43.8	5.4%	4.4%
600	36.3	6.1%	3.6%
400	29.7	7.4%	3.0%
200	20.0	10%	2%
100	13.4	13.4%	1.3%

TDD - Total Demand Distortion
THD(I) - Total Harmonic Current Distortion

Short Circuit Ratio

Short circuit ratio is the short circuit current value of the electrical system divided by its maximum load current. Standard IEEE-519 Table 10.3 defines different acceptance levels of TDD depending on the short circuit ratio in the system. Systems with small short circuit ratios have lower TDD requirements than systems with larger short circuit ratios. This difference accounts for the fact that electrical systems with low short circuit ratios tend to have high impedances, creating larger voltage distortion for equivalent harmonic current levels. (See Table E.)

Mitigating Harmonics

Some utilities now impose penalties for introducing harmonics onto their grid, providing incentives for owners to reduce harmonics. In addition, reducing harmonic levels can prevent potential damage to sensitive equipment residing on the same system. There are many approaches to mitigating harmonics. Several commonly used methods are discussed here.

Line Reactors

Line reactors add reactance and impedance to the circuit. Reactance and impedance act to lower the current magnitude of harmonics in the system and thereby lower the TDD. Line reactors also protect

Table E
Representation of IEEE Table 10.3

I_{SC}/I_L	<11	11<7<17	17<h<23	23<h<35	35<h	TDD
<20	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

LEGEND: h = harmonic number
I_{SC} = maximum short-circuit current at PCC
I_L = maximum demand load current (fundamental) at PCC

devices from large current spikes with short rise times. A line reactor placed between the VFD and the motor would help protect the motor from current spikes. A line reactor placed between the supply and VFD would help protect the supply from current spikes. Line reactors are typically only used between the VFD and the motor when a freestanding VFD is mounted more than fifty feet from the motor. This is done to protect the motor windings from voltage peaks with extremely quick rise times.

Passive Filters

Trap Filters are devices that include an electrical circuit consisting of inductors, reactors, and capacitors designed to provide a low impedance path to ground at the targeted frequency. Since current will travel through the lowest impedance path, this prevents the harmonic current at the targeted frequency from propagating through the system. Filters can be mounted inside the drive cabinet or as free standing devices. Trap filters are typically quoted to meet a THD(I) value that would result in compliance with IEEE-519 requirements if the system were otherwise already in compliance.

Active Filters

Some devices measure harmonic currents and quickly create opposite current harmonic wave forms. The two wave forms then cancel out, preventing harmonic currents from being observed upstream of the filter. These types of filters generally have excellent harmonic mitigation characteristics. Active filters may reduce generator size requirements.

VFDs Using Active Front End Technology (AFE)

Some VFDs are manufactured with IGBT rectifiers. The unique attributes of IGBTs allow the VFD to actively control the power input, thereby lowering harmonics, increasing power factor and making the VFD far more tolerant of supply side disturbances. The AFE VFDs have ultra low harmonics capable of meeting IEEE-519 standards without any external filters or line reactors. This significantly reduces installation cost and generator size requirements. An AFE drive provides the best way to take advantage of VFD benefits and minimize harmonics.

Multi-Pulse VFDs (Cancellation)

There are a minimum of six rectifiers for a three-phase AC VFD. There can be more, however. Manufacturers offer 12, 18, 24, and 30 pulse drives. A standard six-pulse drive has six rectifiers, a 12-pulse drive has two sets of six rectifiers, an 18-pulse drive has three sets of six rectifiers and so on. If the power connected to each set of rectifiers is phase shifted, then some of the harmonics produced by one set of rectifiers will be opposite in polarity from the harmonics produced by the other set of rectifiers. The two wave forms effectively cancel each other out. In order to use phase shifting, a special transformer with multiple secondary windings must be used. For example, with a 12-pulse VFD, a Delta/Delta-Wye transformer with each of the secondary phases shifted by 30 degrees would be used.

CONCLUSION

- **VFDs provide the most energy efficient means of capacity control.**
- **VFDs have the lowest starting current of any starter type.**
- **VFDs reduce thermal and mechanical stresses on motors and belts.**
- **VFD installation is as simple as connecting the power supply to the VFD.**
- **VFDs with AFE technology can meet even the most stringent harmonic standards and reduce backup generator sizing.**
- **VFDs provide high power factor, eliminating the need for external power factor correction capacitors.**
- **VFDs provide lower KVA, helping alleviate voltage sags and power outages.**

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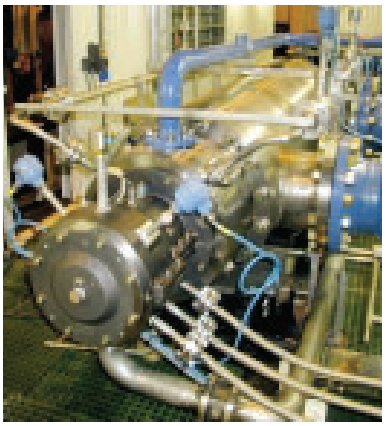
ATTACHMENT J

SULZER

Dunbar Field Life extended using Sulzer Multiphase Pumps

"The advent of high power multiphase pumps is changing the world of oil production, in particular by allowing the exploitation of fields nearing the end of their useful lives. This revolutionary technique has been operated since Autumn 1999 on the Dunbar platform, in the British segment of the North Sea"

TOTALFINA ELF Exploration & Production Magazine
March 2001



Sulzer Multiphase Pumps

- The Sulzer MPP range of pumps are of the helico-axial design originally developed from the Poseidon research programme.
- Pumps of this design are particularly well suited to high capacities. Current installations include pumps with a total capacity of over 500,0000 bpd

The role of Multiphase Pumping

Multiphase Pumping is essentially a means of adding energy to the unprocessed effluent which enables gas/liquid mixtures to be transported over longer distances without the need for prior phase separation. This also enables the wells to produce at a lower WHFP (Wellhead Flowing Pressure) and so consequently :

- The production from existing fields and weak wells is increased
- Ultimate recovery is increased
- Life of a field can be extended.
- Development costs are reduced

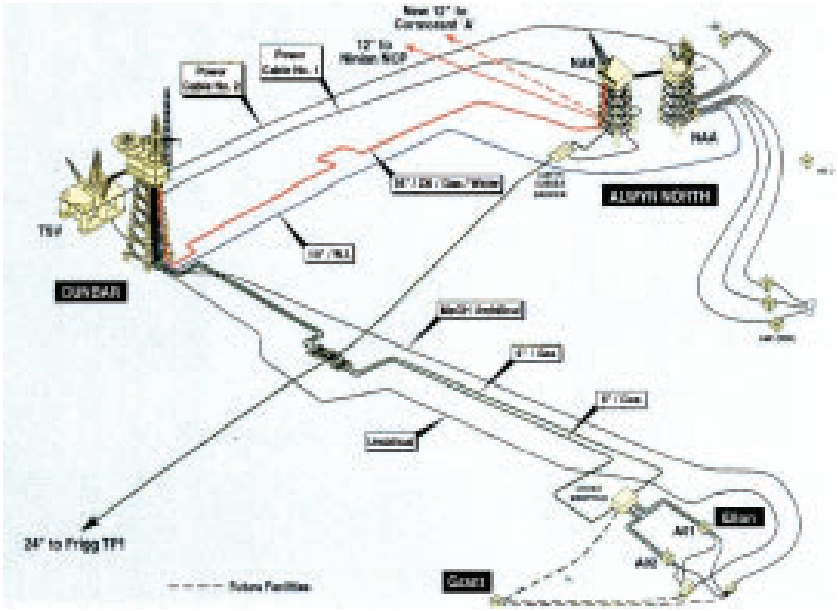
The Dunbar development is an example which demonstrates how these benefits have been realised in the field.

The Dunbar Field

The Dunbar field is located 120 km North East of the Shetland Islands and 440 km from Aberdeen. Dunbar is a wellhead platform which is operated as a satellite of the Alwyn North Platform located 22 km to the North East.

In the first phase of production the wellhead pressure was sufficient for the effluent to flow naturally from Dunbar fields along a 16" multiphase pipeline to the Alwyn platform.

The introduction of multiphase pumps on Dunbar for the second phase has enabled production to continue in the face of declining wellhead pressure.



The Dunbar field

Why multiphase pumps

The two main alternatives considered for the second production phase were :

Firstly a conventional system comprising a separator operated at low pressure with the liquids pumped and the gas compressed upstream of the multiphase pipeline

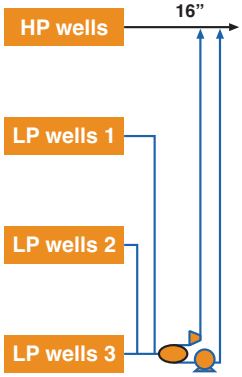
Secondly an innovative system using multiphase pumps to boost the low pressure wells directly in into the multiphase pipeline.

Multiphase pumps were selected in preference to a separator based solution because :

- There would be no need to modify the existing facilities or process operating conditions
- They provide a more cost effective solution
- A module incorporating multiphase pumps would be over 30% lighter
- Vertically installed pumps minimised space requirements
- Weight and space reductions would facilitate the design of the proposed cantilevered module extension

Operational flexibility maximised by implementing a well segregation scheme using multiphase pumps

Concentional concept



Well segregation scheme

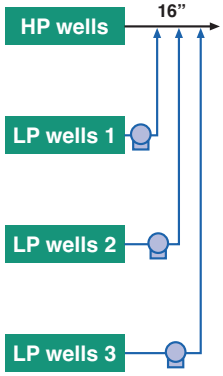
This scheme makes maximum use of the natural energy of the wells which means that electrical power requirements are minimised.

There are three independent lines

- High pressure wells bypass the pumps
- LP wells will be boosted from approx 70 to 125 bar.g via an 8 stage pump
  Note : Both pumps are identical although the pump in this line is destaged to 8 stages
- LLP wells will be boosted from approx 50 to 125 bar.g via a 12 stage pump
- There is also provision for a third pump for even lower pressure wells (20-30 bar.g)

This system therefore matches pumping requirements to evolving and fluctuating production requirements

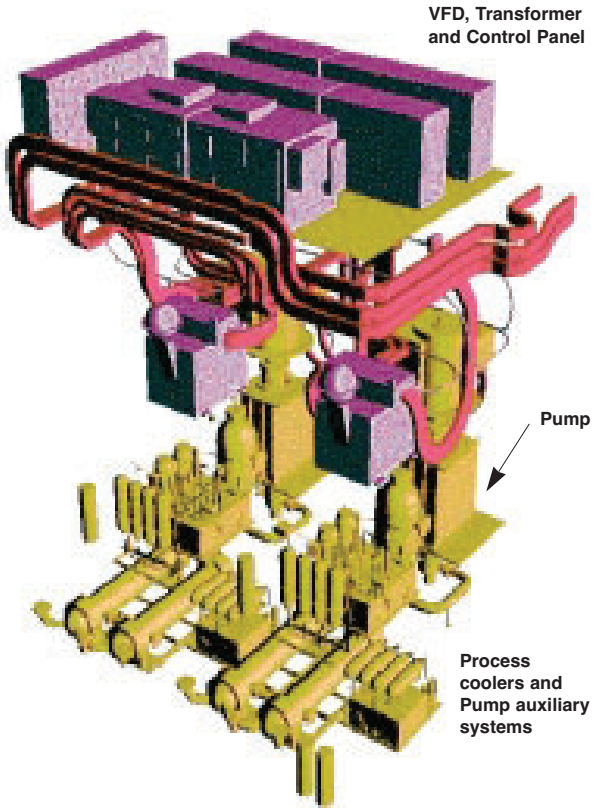
TotalFina Elf estimate that by 2004, approximately 84% of the oil production will be boosted



Well segregation scheme

The pumpset packages were supplied by a consortium between Sulzer and ABB (who were responsible for the electrical equipment. Each pumpset comprises the following main items

- Process Cooler (by TotalFinaElf)
- Buffer tank at pump suction
- Multiphase Pump
- Epicyclic gearbox
- Lube oil and seal oil systems
- Electric motor
- Frequency converter
- Transformer
- Anti-harmonic filters



Main Pumpset Components

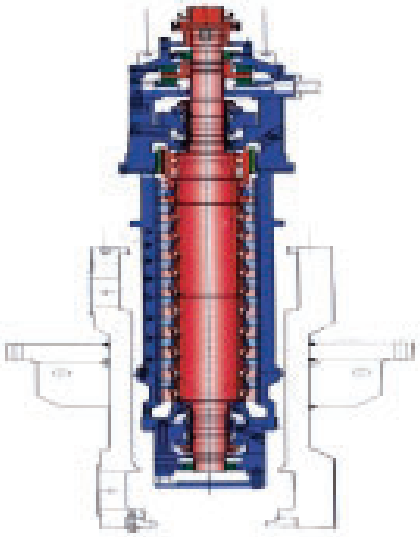
Pump Description

Total Capacity	**180,000 bpd**
GVF	**30 – 90%**
Suction Pressure	**50 – 70 Bar.g**
Discharge Pressure	**125 Bar.g**
Speed Range	**3,500 to 6,000 rpm**
Motor Rating	**4500 kW**

Pump design features include:

- Vertical barrel installation
- Axially split inner casing
- Twistlock design
- Tilting pad bearings
- Balance piston

These are the largest multi-phase pumps installed offshore world wide.

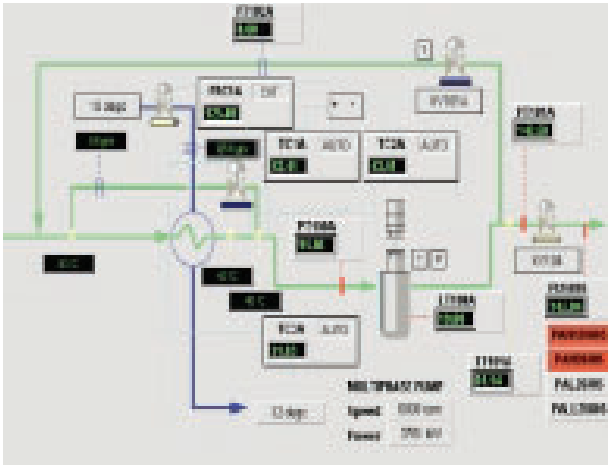


Cartridge replacement

- Twistlock casing design facilitates cartridge withdrawal.
- Cartridges of different hydraulic design or stage combinations can be fitted to suit evolving production requirements

Pumpset Control

- The pump speed is adjusted via the frequency converter to suit process and export requirements.
- The pump is designed for use on an unmanned installation. Pump monitoring and speed control can be effected remotely from Alwyn



Installation

The pump was incorporated into the module at the fabrication yard. The module measures 12m x 7.5m x 19m high and weighs 650 tonnes.The module was installed on the platform in the summer of 1999 and the pumps commissioned in November of the same year.

Since the pumps were commissioned, the pressure in certain wells has declined further. To compensate for this, the pump in the LP line has since been uprated to 12 stages.

Field Reserves significantly increased

The importance of this multiphase pump installation is demonstrated by TotalFinaElf's estimate that the impact on production from the Dunbar field will be as follows :

"**Key Figures :**

- Estimated Reserves in 1986 : 435 million bep
- Reserves re-assesses in 1994 at 700 bep
- Estimated reserves in 2001 owing to multiphase pumps; 1.2 billion bep"

TOTALFINA ELF Exploration & Production Magazine
March 2001

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What You Can Expect From Carrier

Innovation, efficiency, quality: Carrier® Comfort™ Series air conditioners represent years of research and design with one goal in mind – making your family comfortable. With standard models and units designed specifically for the rigors of coastal area installations, Comfort Series air conditioners represent the Carrier quality, environmental stewardship and lasting durability that have endured for more than a century. And, to ensure maximum year-round performance, your dealer can include a new Carrier gas furnace or fan coil and thermostat, all backed by the indoor comfort experts.

Efficiency

SEER (Seasonal Energy Efficiency Ratio) ratings are like your car's MPG – the higher the number, the greater the potential for savings. Comfort™ Series air conditioners offer a range of efficiencies that start at your region's minimum SEER and reach as high as 16.5 SEER.

Durability

A galvanized steel cabinet, heavy-duty wire coil guard and baked-on powder paint provide superior protection against dings, dents and other outdoor threats. For home comfort in a coastal environment, ask about Comfort™ Series models with WeatherShield™ protection for extra-tough, longer lasting corrosion resistance to withstand the harsh sea coast air.

Environment

Carrier was the first to offer systems with Puron® refrigerant, which does not contribute to ozone depletion. Our century-plus commitment to delivering energy-saving comfort continues with our insistence on earning ENERGY STAR® designation on most of our Comfort™ Series air conditioners.

Sound

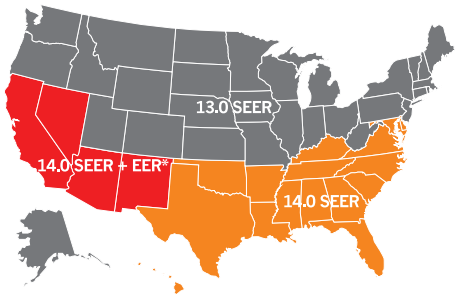
Carrier® Comfort™ Series air conditioners cool your home quietly. All models include components that help keep sound levels low, including an aerodynamic top and quiet motor mounts.

Limited Warranty

To the original owner, Carrier® Comfort™ Series air conditioners are covered by a 10-year parts limited warranty upon timely registration. The limited warranty period is five years if not registered within 90 days of installation. Jurisdictions where warranty benefits cannot be conditioned on registration will receive the registered limited warranty period. See warranty certificate at carrier.com for complete details and restrictions.

Regional Efficiency Standards

On January 1, 2015, a new set of minimum efficiency standards took effect. Under the new standards, there are different efficiency minimums for air conditioners in each of three regions – North, Southeast and Southwest. Your Carrier® dealer will have a Comfort™ Series air conditioner to meet your region's minimum requirement.



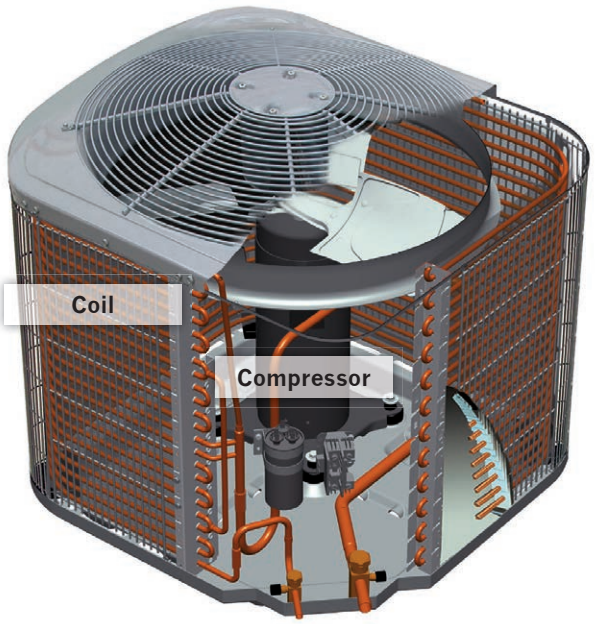
*12.2 EER < 45,000 Btu/h, 11.7 EER ≥ 45,000 Btu/h

A Range of Comfort

Carrier delivers cooling systems in a range of shapes and sizes. Check out this side-by-side comparison to see how our efficient Comfort™ Series air conditioners measure up against our Infinity® and Performance™ models.

	Infinity® Series	Performance™ Series	Comfort™ Series
Performance	Variable-speed rotary, two-stage and single-stage scroll compressors available	Two-stage and single-stage scroll compressors available	**Single-stage scroll compressor**
Efficiency	Up to 21.0 SEER rating	Up to 17.5 SEER rating	**Up to 16.5 SEER rating**
Durability	WeatherArmor™ Ultra cabinet protection	WeatherArmor™ Ultra cabinet protection	**WeatherArmor™ cabinet protection**
Controls	Infinity® Touch Control	Côr™ Wi-Fi® Thermostat	**Carrier® Wi-Fi® Thermostat**
Sound	Silencer System II™, dBA as low as 56	Silencer System II™, dBA as low as 72	**dBA as low as 72**
Limited Warranty	10-year parts*	10-year parts*	**10-year parts***

* Upon timely registration. The warranty period is five years if not registered within 90 days of installation.
Wi-Fi® is a registered trademark of the Wi-Fi Alliance Corporation.



Comfort™ 16 Air Conditioner Shown

The Carrier® Difference

If you could look under the hood of a Carrier Comfort™ Series air conditioner, you'd see what drives the performance: a serious commitment to quality. Our microtube coil technology saves space and provides lasting comfort with its corrosion-resistant construction. And, our smooth-running compressor represents the solid, reliable performance you expect.

Comfort Series air conditioners are built to look their best while enduring exposure to hail, errant soccer balls, lawn equipment and more. The cabinet plays an important role in sound as well, using an aerodynamic top to facilitate airflow and keep operating sound to a minimum.

Visit carrier.com for model comparisons and product specifications.
Explore the full line of Carrier® air conditioners and other system components to find the ideal fit for your home.
24AAA6, 24ABC6, 24AAA5, 24ACC4, 24ABB3, 24ABB3**C

The Total Indoor Comfort System

Your Carrier® dealer will recommend a system that is best suited to meet your home-comfort needs and local weather environment:

1. **Air Conditioner** provides reliable, high-efficiency cooling for long-lasting comfort and energy savings.
2. **Gas Furnace** provides reliable, high-efficiency heating for long-lasting comfort and energy savings.
3. **Wi-Fi® Thermostat** offers precise, programmable comfort from your web-connected device.
4. **Zoning** sets different temperatures for up to three different areas of your home for truly customized comfort and enhanced utility savings.
5. **Air Cleaner** improves air quality by removing harmful and irritating airborne pollutants from your home.
6. **Humidifier** replenishes moisture to dry air.
7. **UV Lamp** inhibits the growth of contaminants on the evaporator coil, leaving your home with cleaner, fresher indoor air.
8. **Ventilator** combines fresh outdoor air with conditioned indoor air for improved air quality – great for today's tightly constructed home.
9. **Evaporator Coil** is matched with the proper outdoor unit to provide top cooling efficiency and years of reliable service.

More Than a Century of Cool

In 1902, a determined engineer answered one of mankind's most nagging questions: How do we make hot, sticky, indoor air go away? In creating the world's first modern air conditioning system, Willis Carrier forever changed indoor life, and, more than a century later, the corporation that bears his name takes inspiration from his example.

Carrier continues to improve on our founder's breakthroughs, introducing new technologies that make life at home even cooler. Today, our nationwide network of experts continues to advance Willis Carrier's lifework. Your expert Carrier® dealer is equipped to evaluate your home and create a customized system designed around your lifestyle.

As an ENERGY STAR® partner, Carrier Corporation has determined that qualifying models meet ENERGY STAR guidelines for energy efficiency. Ask your dealer for details or visit www.energystar.gov.

Carrier® turn to the experts℠

Comfort SERIES

Always Ask For Factory Authorized Parts

FPO FSC® C000000

01-824-083-25

carrier.com 1-800-CARRIER

ATTACHMENT L

Foster™

Mold Remediation and Prevention Products

The Foster® brand offers mold resistant solutions for every environment...

- Houses & Condos
- Apartment Buildings
- Healthcare/Hospital Facilities
- Manufacturing Facilities
- Food & Beverage Plants
- Schools
- Universities
- Office Buildings
- Retail Buildings
- High Humidity Areas
- Existing Construction

... and all types of surfaces...

- Walls
- Ceilings
- HVAC Systems
- Wall Cavities
- Underside of Floorings
- Basements
- Crawl Spaces
- Roofs
- Siding
- Asphalt Shingles

A World Leader

For over 60 years, the Foster® brand of products have been leading the way with its mastic, coating, sealant and adhesive products for the industrial, commercial and residential construction markets. Foster introduced the first EPA-registered antimicrobial coating, and still the only, for use in HVAC systems in 1992 and has continued to manufacture and sell water-based coatings, disinfectants and accessory products for mold remediation and prevention to the indoor air quality market. Our reputation has been built on the best technical expertise driving the best technology for superior performing products.

When tested against rigorous American Standards Testing Method (ASTM) D-5590, Foster products exhibit a "0" growth rate (see next page for more information). This means Foster products have proven performance and superior efficacy that truly work!

As a leader in the IAQ industry, the Foster brand product line includes:

- EPA-Registered Antimicrobial Products
- Mold Resistant Products
- Disinfectant/Sanitizer
- Accessory Products

For additional information, please visit **www. fosterproducts.com**.

EPA-Registered Antimicrobial Products

Our customers come first, and our ability to meet their needs is the key to our success.

Foster® products are "Globally Specified, Proven, and Preferred" by IAQ professionals around the world. Specifically, our antimicrobial coatings are ideal for use in buildings and locations where mold already exists, or may potentially exist. These products have been successfully used in the field as the number one mold resistant coatings since 1992. Both of our EPA-Registered mold resistant coatings (Foster® 40-20™ and Foster® 40-30™) are the only coatings registered for use both in HVAC systems and on walls/ceilings.

Solutions that Work!

The cost of remediating a mold-infested building can be staggering, especially when it may be repeated due to mold growth on an inferior coating. When applied to lined and unlined HVAC systems, walls, sub floors, and studs, Foster EPA-Registered fungicidal coatings provide long-term protection by preventing the growth and spread of odor causing bacteria and mold on the coating surface.

The samples at the right show standard untreated house paint (above) vs. Foster coating (below). The Foster 40-20 coating is free of mold!

Mold covers the control sample completely.

Mold growth is inhibited on the Foster® 40-20™ coating

Foster® Coatings Proven Effective 15 Years and Running . . .

Regardless of the job, Foster 40-20 offers the highest level of resistance to mold growth on its surface while protecting the substrate from deterioration. It is the first and only EPA-registered coating for application in HVAC duct work, as well as on walls, ceilings, pipes or wherever effective controls are essential. Foster 40-20 provides a flexible, tough film that remains clean while retarding fiber release and further erosion of the duct insulation. Over the past 15 years, Foster 40-20 has been extensively specified and used in numerous mold remediation projects. In one study, when used in the duct system of a prominent maximum security prison, Foster 40-20 has remained fully effective since 1992.

Visit www. fosterproducts.com for the full case study, and the use of Foster 40-20 in other remediation situations.

EPA-REGISTERED PRODUCTS

There are 3 antimicrobial products registered with the EPA: Foster® 40-20™ coating, Foster® 40-30™ coating, and Foster® 40-80™ disinfectant. These products have all gone through rigorous independent testing, required by the EPA. Both the Applicator and End User can be assured of:

Low Toxicity
These products have been fully tested for toxicity and labeled with the lowest possible toxicity warning of "caution."

Accurate Claims
Fact based—there are no misleading claims to the consumers.

Testing
These products have been tested by an independent lab for both efficacy and toxicity.

Consistency
The formulation of EPA-Registered products is consistent with the original formula registered with the EPA.

EPA-Registered Antimicrobial Products

All Foster® Indoor Air Quality products are water-based. Additional information and specifications can be found on the MSDS sheets and Product Data Sheets, available at **www.fosterproducts.com.**

Product Number/ General Description	Color	Substrate	Coverage	Dry Time	Application Method	Spray Tips
Foster® Fungicidal Protective Coatings						
40-20™ Fungicidal Protective Coating • Industry leading antimicrobial coating. • Prevents the re-growth and spread of odor causing bacteria and mold on its surface. • Provides a tough, elastic, water resistant coating. • Prevents air erosion and fiber release when applied to fibrous duct liner insulation.	White	• Walls • Ceilings • Pipes • Interior & Exterior HVAC duct systems	80 ft^2/gal. (2.0 m^2/L)	Set to touch: 4 hours Dry through: 16 hours	• Airless Sprayer • Brush or Roller	Tip Size*: 0.023 to 0.025", 8" to 10" fan width
40-30™ Fungicidal Protective Coating • Prevents the re-growth and spread of odor causing bacteria and mold on its surface. • Prevents air erosion and fiber release when applied to fibrous duct liner insulation.	Black	• Fiberglass duct liners • Duct board insulation • Galvanized surfaces	Galvanized Metal: 133 ft^2/gal. (3.3 m^2/L) New Duct Liner: 100 ft^2/gal. (2.5 m^2/L) Old Eroded Duct Liner: 67 ft^2/gal. (1.6 m^2/L)	Set to touch: 6 hours Dry through: 24 hours	• Airless Sprayer • Brush or Roller	Tip Size*: 0.019 to 0.025", 8" to 10" fan width
Foster® Disinfectant/Sanitizer						
40-80™ Disinfectant/Sanitizer** • Use as a disinfectant, sanitizer, cleaner, fungicide, deodorizer, virucide and germicide. • Kills a large variety of microbes within minutes. • Contains surfactants to help clean and remove residue. • Designed for use in water damage restoration situations.	Clear	• All hard, non-porous surfaces • Sanitizes porous and semi-porous materials	Depends on application method and surface. Apply sufficient quantity to insure the surface remains wet continuously for at least ten (10) minutes.	Dry thoroughly before applying top coating.	• Garden sprayer, spray bottle, cloth, mop or sponge	Airless sprayers are NOT recommended. Coarse spray only.

Guide to Primer Use

Surface	Required Primer	Coating
Wood (structural studs, OSB, plywood)	None	All
Metal (galvanized, foil)	40-26 (recommended)	All
Drywall (unpainted)	None	All
Concrete, brick, plaster, masonry cement block (unpainted)	40-22 or 40-26	All
Painted surfaces (flat finish)	None	All
Painted surfaces (gloss finish)	40-26 or sanding	All
Wood (smooth, sanded, hardwoods)	40-26	All
Ductliner, duct board	None	40-20 or 40-30

Airless Spray Equipment Guidelines

Foster Mold Resistant Coatings can be applied with most manufacturers commercial grade electric airless sprayers. Sprayers with the following minimum specifications are suggested:

Operating Pressure (psi):	3000
Motor Size (hp)	3/8
Volume (gpm):	0.45
Hose (inches i.d.):	1/4" up to 50', 5/16" over 50'
Spray Tips*:	Refer to Product Information Chart.

* Tip sizes as small 0.017" may be used, however, application will be slower and may require multiple passes to achieve recommended coverage rate. Spray equipment manufacturers specifications should be reviewed for maximum tip size acceptable for the sprayer being used.

** Not for use on the interior on HVAC systems. Refer to product label for use directions.

Mold Resistant Products

Resisting Mold in the Toughest Environments

Foster® brand coatings provide the highest level of performance even in the harshest conditions. Foster Mold Resistant Coatings specialize in resisting long-term mold growth on their surface. In addition to coatings, our accessory products improve the adhesion and aesthetic appeal when used.

ASTM D-5590 Testing Provides Evidence

We demonstrate the efficacy of our mold resistant products with extensive ASTM D-5590 Testing. ASTM D-5590 is specifically designed to test paints and coatings in the most severe environment possible for promotion of fungal growth. This makes it an excellent method for evaluation of a mold resistant coating's performance under the harshest conditions.

Foster® Brand Products Superior Performance and Highest Standards

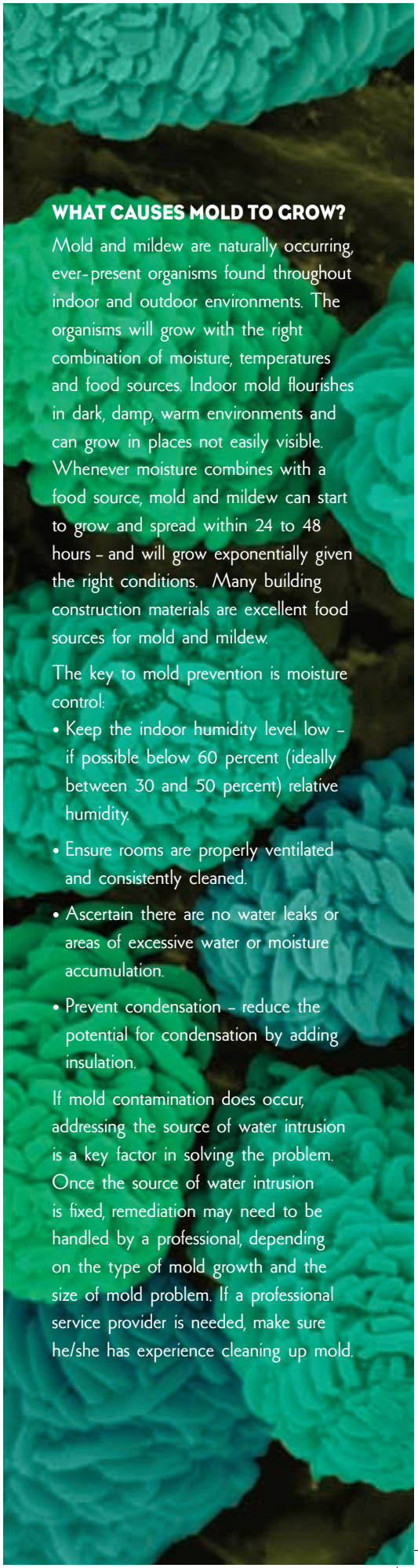
Our products are constantly monitored for high quality through our ISO 9001 certification. This high level plant quality certification assures consistent, high quality Foster brand products. In addition, we test independently through a leading commercial IAQ laboratory (Aerotech Laboratories, Inc.) to maintain our position of leadership.

ASTM D-5590 Test Method

ASTM D-5590 was purposefully developed to test paints and coatings in the "worst-case conditions" possible for promotion of mold, mildew, fungus and algae growth. This method is the best for evaluating a mold resistant coating's performance under ideal mold growth situations.

Mold requires three elements for growth: high humidity, proper temperatures and a food source. ASTM D-5590 provides these elements in an optimal environment for growth. To insure continual exposure, the sample is surrounded with active, continually re-generating mold spores, truly testing the product's resistance to growth. These conditions represent a worst-case scenario in a real world application where there is active mold spore generation on an adjacent substrate to the coated material at a temperature and humidity highly conducive to mold growth.

Other commonly cited tests do not provide this high standard of testing combining all three elements, and consequently do not reflect the product's performance under the most relentless mold growth conditions.



WHAT CAUSES MOLD TO GROW?

Mold and mildew are naturally occurring, ever-present organisms found throughout indoor and outdoor environments. The organisms will grow with the right combination of moisture, temperatures and food sources. Indoor mold flourishes in dark, damp, warm environments and can grow in places not easily visible. Whenever moisture combines with a food source, mold and mildew can start to grow and spread within 24 to 48 hours – and will grow exponentially given the right conditions. Many building construction materials are excellent food sources for mold and mildew.

The key to mold prevention is moisture control:

- Keep the indoor humidity level low – if possible below 60 percent (ideally between 30 and 50 percent) relative humidity.
- Ensure rooms are properly ventilated and consistently cleaned.
- Ascertain there are no water leaks or areas of excessive water or moisture accumulation.
- Prevent condensation – reduce the potential for condensation by adding insulation.

If mold contamination does occur, addressing the source of water intrusion is a key factor in solving the problem. Once the source of water intrusion is fixed, remediation may need to be handled by a professional, depending on the type of mold growth and the size of mold problem. If a professional service provider is needed, make sure he/she has experience cleaning up mold.

TDIndustries

Mold Resistant Products

All Foster® Indoor Air Quality products are water-based. Additional information and specifications can be found on the MSDS Sheets and Product Data Sheets, available at **www.fosterproducts.com.**

Product Number/ General Description	Color	Substrate	Coverage	Dry Time	Application Method	Spray Tips
Foster® Mold Resistant Coatings and Sealants						
40-10™ Duct Liner Adhesive Coating • Seals and reinforces the surface of new and aged duct liner. • Prevents air erosion and fiber release. • Resists mold, fungus, and discoloration from mildew and mold stains on its surface.	White	• Fibrous duct liner • Unfaced duct board insulation	80 to 200 ft^2/gal. (2.0 to 4.9 m^2/L)	Set to touch: 6 hours Dry through: 24 hours	• Airless Sprayer • Brush or Roller	Tip Size*: 0.019 to 0.025", 8" to 10" fan width
40-11™ Eclipse™ Coating • Matches the original surface color of most duct liner insulations. • Seals and reinforces the surface of new and aged duct liner. • Prevents air erosion and fiber release resists mold, fungus and discoloration.	Black	• Fibrous duct liner • Duct board insulation	50 to 150 ft^2/gal. (1.2 to 3.7 m^2/L)	Set to touch: 6 hours Dry through: 24 hours	• Airless Sprayer • Brush or Roller	Tip Size*: 0.019 to 0.025", 8" to 10" fan width
40-23™ Insulation Sealer • Penetrates deeply into existing HVAC duct liner insulations, forming a damage resistant surface that reduces particle release. • Resists fungus and mold growth on its surface.	White	• Fibrous duct liner • Duct board insulation	50 to 150 ft^2/gal. (1.2 to 3.7 m^2/L)	Dry through: 2-4 hours at ambient	• Airless Sprayer • Brush or Roller	Tip Size*: 0.019 to 0.025", 8" to 10" fan width
40-50™ Mold Resistant Coating • Formulated with EPA-registered antimicrobial agents which provide protection against odor causing bacteria, mildew and mold growth on the product surface. • For use in areas prone to the growth of mold.	White	• Wall cavities, floor joists, attic spaces • Wood and metal studs, drywall, OSB, furring strips, masonry	300 ft^2/gal. (7.4 m^2/L)	Dry through: 1-2 hours at ambient	• Airless Sprayer • Brush or Roller	Tip Size*: 0.015 to 0.017", 8" to 10" fan width
40-51™ Mold Resistant Coating • Provides a clear finish leaving the original surface visible after application. • Specially formulated with EPA-registered antimicrobial agents for long-term protection from mold growth on its surface.	Clear	• Wall cavities, floor joists, attic spaces • Wood and metal studs, drywall, OSB, furring strips, masonry	Wood: 250 to 450 ft^2/gal. (6.1 to 11.0 m^2/L) Non-Porous Surfaces: 500 to 600 ft^2/gal. (12.3 to 14.7 m^2/L)	Dry through: 1 hour at ambient	• Airless Sprayer • Brush or Roller	Tip Size*: 0.015 to 0.017", 8" to 10" fan width
40-55™ Clear Defense™ Mold Resistant Coating • Specifically designed to protect and maintain the aesthetics of residential, commercial and industrial surfaces. • Formulated with EPA-registered additives, providing long-term resistance to the growth of mold, mildew, fungus and algae on its surface without blushing or yellowing.	Clear	• Masonry, stucco, concrete and clay roofing tiles • Asphalt shingles, vinyl, aluminum, painted wood	Non-Porous Surfaces: 300 ft^2/gal. (7.4 m^2/L) Porous will require more product.	Dry through: 40 minutes-1 hour	• Airless Sprayer • Brush or Roller	Tip Size*: 0.015 to 0.017", 8" to 10" fan width
Foster® Accessory Products						
40-16™ Block Filler • Abrasion-resistant fill coat eliminates pores, depressions and crevices in a one-coat application.	Off White	• Unpainted masonry surfaces	40 to 70 ft^2/gal. (1.0 to 1.7 m^2/L)	Set to touch: 1-2 hours Dry through: 15 hours	• Airless Sprayer • Brush or Roller	30:1 Air Pump with Inductor Plate. Tip Size: 0.021 to 0.025", 8" to 10" fan width
40-22™ Masonry Sealer & Primer • Penetrates into the surface, strengthening it and sealing it to help eliminate blistering and peeling.	Off White (dries clear)	• Unpainted block plaster • Cement surface	50 to 200 ft^2/gal. (1.2 to 4.9 m^2/L)	Dry through: 2-4 hours at ambient	• Airless Sprayer • Garden Sprayer or Spray Bottle	Tip Size: 0.017 to 0.021", 8" to 10" fan width
40-26™ Water-based Primer • Bonds and protects against stains and corrosion. • Increases the bondability of retrofit systems.	Off White (dries translucent)	• Metal, and rusty metal • Concrete • Masonry • Wood	Metal: 200 to 300 ft^2/gal. (4.9 to 7.4 m^2/L) for corrosion protection; 400 to 600 ft^2/gal. (9.8 to 14.7 m^2/L) for improving adhesion.	Dry through: 1 hour at ambient	• Airless Sprayer • Brush or Roller	Tip Size: 0.017 to 0.021", 8" to 10" fan width

*See Airless Spray Equipment Guidelines for information.

The Foster® Clean, Kill & Coat™ three-phased approach for mold remediation eliminates the chance for the return of mold.

Step 1. Clean

- Remove any water-damaged and mold contaminated materials that cannot be salvaged such as carpeting, furniture and wallboard.
- Thoroughly dry all materials to be left in place by exposing them to circulated dry air.
- Follow with a thorough cleaning and removal of all contaminants.

Step 2. Kill

- Sanitize the affected porous and non-porous surfaces with the ready-to-use, EPA-registered Foster® 40-80™ Disinfectant/Sanitizer to clean, deodorize and remove any residual microbial contaminants.
- The surface should remain wet for 10 minutes.

Step 3. Coat

- Coat the surface with the appropriate Foster brand protective coating evenly and thoroughly. We recommend an airless sprayer for an even application.
- Ventilate well for proper drying. Continue ventilation using appropriate fans, negative air machines or air scrubbers until odors are reduced to acceptable levels.
- Always ensure the use of PPE (Proper Protective Equipment).

Foster™

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Aurora, IL 60504
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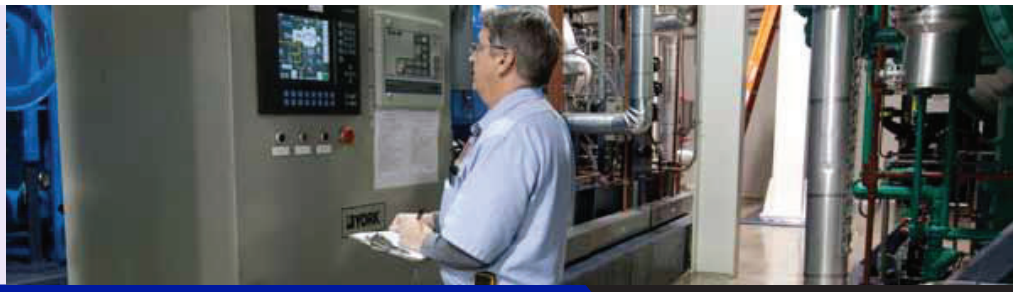


Houston Community College Case Study

Houston Community College Nets Sustainable Results

TDIndustries Puts its Skilled Team on Campus

Houston Community College (HCC) serves more than 70,000 students with 66 facilities covering 623 square miles. TDIndustries maintains and services all of HCC's campus facilities.

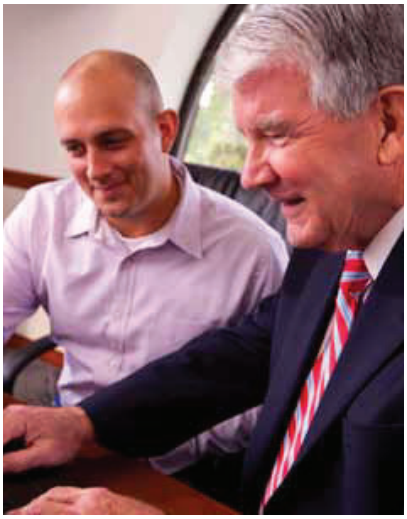
THE FACE OF INNOVATION

tdindustries.com

The Situation

More than 40 TD facility partners support the HCC system. They provide all mechanical, electrical and plumbing services, including:

- HVAC systems,
- general maintenance,
- preventive and corrective maintenance,
- elevators and wheelchair lifts,
- building automation systems (BAS),
- building energy management systems (BEMS),
- building security systems (BSS),
- fire life safety equipment (FLSE, and
- computerize maintenance management system (CMMS) .



With its large geographic area and customer base, TD's challenges include:

- Managing and controlling the budget,
- Serving multiple locations and reaching them in Houston's high traffic corridors,
- Keeping customers, including students, faculty, administrators and visitors, satisfied,
- Dealing with fast transitions of less than 30 days,
- Maintaining and improving system reliability, and
- Attracting and retaining good technically competent managers and technicians.

Along with on-site facilities support, TDIndustries provides incremental service and support from the company's Houston branch office. TD's goal with the HCC is to ensure a mutually responsive partnership that considers both short and long-term facilities needs and costs.

The Solution

For technical support, TD employs the Maximo Computerize Maintenance Management System (CMMS). TD has also designed and implemented a preventive maintenance program based on the reliability centered maintenance (RCM) approach. In addition, TD has implemented a do-it-now (DIN) team to respond to customer needs.

One of the greatest transitions for HCC was moving from outsourcing to multiple vendors to bringing their facilities work back in-house and using additional resources as needed. To effectively make this transition, TD met with existing suppliers and evaluated those outsourced activities versus on-site work.

TD recommended that the majority of the facilities work move back on-site with TD staff and M/WBE Business Partners. The outcome was a zone maintenance approach along with a highly skilled all zone Business System Group, M/WBE business partners and backup support from TD's Houston branch office. This team composition has enabled rapid response to on-site maintenance requirements.

In order to meet TAMU's requirements for HVAC components and installations, TD procured and installed the following:

- 5 Air Handling Units
- 1 Outside Air Handling Units
- 8 Fan Coil Units
- 16 Airflow Monitoring Stations
- Two 20 hp Chilled Water Pumps
- Two 7.5 hp Heating Hot Water Pumps
- 2 Sound Attenuators
- 107 Fan Powered Terminal Units
- 128 Single Duct VAV Terminal Units
- Siemens was subcontracted to perform the installation of the Building Automation System, and integrate it to the main network on campus.
- Sound and acoustical accommodations were made to the HVAC system and the vertical storm drain risers with added insulation.
- More than 170,000 pounds of ductwork including double wall spiral and over seven miles of piping were fabricated in TD's manufacturing facility.

The Success

The project was completed on time and on budget. Skanska USA and TAMU were impressed with TD's proactive communications, BIM leadership role and periodic safety audits conducted throughout the project.

TD was also recognized for the firm's professionalism in working with other trades and the owner's representatives.

THE FACE OF INNOVATION

tdindustries.com

TDIndustries

Texas A&M LAAH Building Case Study

Delivering a Sustainable Performance Facility for Texas A&M

TD Focuses on Best Practices for Higher Education Project

The Liberal Arts and Humanities Building (LAAH) is a five-story, 125,000 square-foot facility located in the historic core of Texas A&M University's flagship campus in College Station, Texas. The $46 million building is the first to be designed specifically for instruction and scholarship in the arts and humanities. Designed to meet LEED silver rating, it will contain faculty offices, classrooms, computer-based teaching classrooms, theater performance studios, music practice and rehearsal rooms, recording studios and music teaching labs.

THE FACE OF INNOVATION

tdindustries.com

The Situation

TThe Texas A&M University System's Office of Facilities Planning and Construction (OFPC) is committed to excellence in design and sustainability in the construction and renovation of buildings for all A&M System facilities. All new construction must meet Leadership in Energy and Environmental Design (LEED) Silver standards. The OFPC also develops guidelines that affect every aspect of a building's design, operations, maintenance, sustainability and energy performance.

In January 2011, Texas A&M University (TAMU) awarded Skanska USA the contract to build the LAAH facility with a targeted completion date of the summer of 2012. The building was designed by Brown Reynolds Watford (BRW) Architects. Shah Smith & Associates acted as the MEP Engineer. Skanska USA engaged TDIndustries under a hard bid or lump sum contract to provide HVAC services on the project.

TAMU's goals for the project were:

1. For the building to meet its sustainability guidelines;
2. For the project to be completed on time and on budget;
3. For a safe, clean jobsite; and
4. For construction to be conducted with as little disruption as possible to campus activities.

The building's location in the center of the campus created some logistical issues which required significant coordination of numerous trade subcontractors and the placement/storage of material and equipment. In addition, all trades had to allow for scheduling in order to meet TAMU's requirement that all trade contractors participate in its inspections and re-inspections during each phase of construction.

The Solution

TD prides itself in designing and constructing HVAC systems that meet the most stringent sustainability guidelines regarding air quality, acoustics, lighting, energy efficiency, system automation and controls and water conservation. TD is also adept in its use of Building Information Modeling (BIM) and takes a leadership role in leading the BIM process with other trades.

TDIndustries

Houston Community College Case Study

Houston Community College Nets Sustainable Results

TDIndustries Puts its Skilled Team on Campus

Houston Community College (HCC) serves more than 70,000 students with 66 facilities covering 623 square miles. TDIndustries maintains and services all of HCC's campus facilities.

THE FACE OF INNOVATION

tdindustries.com

The Success

By completing the majority of the work on-site with highly trained TD personnel, two major benefits were achieved for HCC:

1. Increased customer response time and satisfaction, and
2. Budget efficiencies.

TD helped HCC succeed in reducing costs and improving life cycle operations by redesigning HCC's current operations and applying new technologies and a skillful team of technicians to maintain and support HCC's facilities.

By improving reliability and system comfort, HCC has experienced fewer corrective calls due to TD's improved preventive maintenance system. Monthly reporting enables TD to manage costs and performance.

Best of all, savings per year has been $2 million with a projected $10 million over the life of the 5-year contract.

For large campus solutions, TD's truck-based service, fire and life safety department, building automation controls (BAS) and special projects departments provide the depth and resources that deliver sustainable results.

TDIndustries

Value Proposition around Reducing our Customers Utility Costs

Attachment B-17.1

Product Title	Building Type / Size	Typical Sales Leader	Sales Process
Energy Solutions	• Greater than 100,000 sq/ft • Multi Building Campus • Large Process Loads	• Special Projects, Business Development Manager	• Miller Heiman Sales Process
TDSaves	• Less than 100,000 sq/ft	• Truck Based Service, Business Development Manager	• Sandler Sales Process

This information outlines the "Go to market Strategies" Using Utility Savings as the Value Proposition

- It is to be used as a guideline helping you make the right decisions on the type of proposal, presentation and product offering.
- It also instructs you on which sales technique is appropriate for a given job opportunity.
- Following these guidelines as closely as possible increases the chances for better customer relations and higher margins.

Characteristics of a Sale

- Sold to Owners of Buildings
- Follows a Structured Sales Process that includes an Energy Audit
- Reduced operating costs pay for project and services
- Negotiated at the Executive Level
- Includes ongoing Measurement and Verification (M&V) of savings
- Can include an Energy Savings Guarantee
- Includes Multi-Year Support Services
- Often includes utility incentives and financing

Partial List of Energy Conservation Measures

HVAC
- Replace worn-out inefficient equipment
- Install variable frequency drives
- Perform retro-commissioning
- Install/upgrade, integrate building control systems
- Chiller Control Systems

Plumbing
- Water Saving Fixtures
- Intelligent Irrigation Controls
- Replace inefficient boilers and water heaters
- Solar Thermal

Electrical
- Lighting Fixture Retrofits
- Power Factor Correction
- Demand Response Program
- Solar PV

Support Services
- Service Agreements
- M&V Services
- Building Performance Management (utiliVisor)

14. Were all products/lines/services and pricing being made available under this contract provided in the attachment B and/or Appendix B, pricing sections?

Yes.

15. Does the respondent agree to offer all future product introductions at prices that are proportionate to contract pricing offered herein?

☒ Yes

☐ No

(If answer is no, attach a statement detailing how pricing for participants would be calculated.)

16. Does pricing submitted include the required administrative fee?

☒ Yes

☐ No

17. Define your standard terms of payment.

Net 30

18. Describe the types of funding/financing options and availability.

TDIndustries offers different types of funding and financial services both internally and externally. We offer pre-payment/prompt payment discounts and guaranteed savings as required by state statutes (Energy Savings Performance Contracting) or as required by customers.

19. States Covered - Respondent must indicate any and all states where products and services are being offered.

☐ 50 States & District of Columbia (Selecting this box is equal to checking all boxes below)

☐ Alabama	☐ Louisiana	☐ Oklahoma
☐ Alaska	☐ Maine	☐ Oregon
☒ Arizona	☐ Maryland	☐ Pennsylvania
☐ Arkansas	☐ Massachusetts	☐ Rhode Island
☐ California	☐ Michigan	☐ South Carolina
☐ Colorado	☐ Minnesota	☐ South Dakota
☐ Connecticut	☐ Mississippi	☐ Tennessee
☐ Delaware	☐ Missouri	☒ Texas
☐ District of Columbia	☐ Montana	☐ Utah
☐ Florida	☐ Nebraska	☐ Vermont
☐ Georgia	☐ Nevada	☐ Virginia
☐ Hawaii	☐ New Hampshire	☐ Washington
☐ Idaho	☐ New Jersey	☐ West Virginia
☐ Illinois	☐ New Mexico	☐ Wisconsin
☐ Indiana	☐ New York	☐ Wyoming
☐ Iowa	☐ North Carolina	
☐ Kansas	☐ North Dakota	
☐ Kentucky	☐ Ohio	

☐ All U.S. Territories & Outlying Areas (Selecting this box is equal to checking all boxes below)

☐ American Samoa	☐ Midway Islands	☐ U.S. Virgin Islands
☐ Federated States of Micronesia	☐ Northern Marina Islands	
☐ Guam	☐ Puerto Rico	

20. List the number and location of offices, or service centers for all states being proposed in solicitation.

TD provides services out of the following office locations.

- Dallas, TX
- Fort Worth, TX
- Richardson, TX
- Lubbock, TX
- San Antonio, TX
- Austin, TX
- Houston, TX
- Phoenix, AZ
- Tucson, AZ
- Denver, CO
- Midland, TX
- Amarillo, TX

21. Distribution Channel: Which best describes your company's position in the distribution channel:

☐ Manufacturer direct

☐ Authorized distributor

☒ Value-added reseller

☐ Certified education/government reseller

☐ Manufacturer marketing through reseller

☒ Other Service Provider

22. Provide relevant information regarding your ordering process including your firm's on-line catalog/ ordering website, and the ability for purchasing group members to verify they are receiving contract pricing.

TD's customers call our customer service line to request a technician or account managers to go out to check on whatever the customer needs. We get the customer a quote and if approved we schedule the work to be done. If the customer needs the job to be quoted through a cooperative contract then we make sure we quote keeping within our cooperative rates. We reference the cooperative contract # on the quote. If the customer needs to verify pricing, per our contract they can verify with the cooperative or with TD's cooperative contract coordinator.

23. Describe areas where downtime may occur with products and services provided, historical averages of that downtime, and how you resolve downtime issues when they do occur, particularly what the average downtime is for automated systems (For purposes of providing further clarity, examples of downtime might be a website ordering platform that goes offline, installed equipment that requires service or other products and services that can fail or go offline)

Daily progress meetings are held. The meetings focus on only the progress of the orders scheduled to be complete in the next four days. With information from the daily progress meeting, we try to provide our Customer a three day notice of any late deliveries. The only exceptions would be for orders placed with less than a three-day lead time.

24. Describe how your company monitors and reports savings achieved through system automation.

Energy Savings Performance Contracting (ESPC) Process and Experience TDIndustries has been in the energy/water savings business for more than 15 years. We are distinguished from many of our competitors by the fact that we self- perform most of the work and utilize as few sub-contractors as is feasible thus avoiding the multiple layers of profit margins you will see from our competitors. TDIndustries can provide the customer with the full range of ESPC services through a turnkey project offering, where TDIndustries personnel perform all key technical, management, and financial functions, rather than consultants, subcontractors, or partners. This allows for an efficient, costeffective, and seamless project delivery starting with the detailed energy audit and continuing throughout the ESPC term. It also means that the customer will enjoy streamlined communications with their energy partner through a single point of contact and a single point of responsibility for project performance, with no "finger pointing." The following brief descriptions highlight the ESPC services TDIndustries will provide to the customer as the project progresses through its phases:

1. Energy auditing and facility assessment
   a. Preliminary Audit - Expert modeling and analysis of baseline energy usage and savings
   b. Detailed Energy Audit - Project development and economic analysis
2. In-house design engineering and specification
3. Construction project management
   a. Procurement of materials and trade labor
   b. Safety coordination by our in-house certified safety professional and OSHA authorized trainer
4. Ongoing Commissioning - ex. utiliVisor, Clockworks
5. Monitoring Base Commissioning - ex. utiliVisor, Clockworks
6. Ongoing Maintenance and Support Services
7. Guaranteed Savings Performance Monitoring and Verification
   a. Performance guarantee backed by a history of financial strength, organizational longevity, and stability
8. Facility staff and occupant training
9. Financing procurement support, as well as identifying and securing all available grants, rebates, and incentives available to offset project costs

25. Describe your company's Customer Service Department (hours of operation, number of service centers, parts outlets, number of technicians, etc.) Clarify if the service centers are owned by your company of if they are a network of subcontractors.

Our TDPartners in the TD-owned Service Contact Center are available 24/7/365 to communicate the needs of our customers to our technicians – no answering machines, no outsourcing, no hassle. 294 Service Technicians are available company-wide to service any customer that needs our support. We can work during off-hours, at night, and on weekends to fit any business' schedule. More information and answers to any service/maintenance need can be found here: https://www.tdindustries.com/services/maintenance/truck-based-service.

26. Describe your company's ability to service emergency maintenance and repair requests.

To serve as a general reminder in regards to our capabilities, Partners (Employees) have access to a wide range of training opportunities at TDIndustries. Training begins with the new Partner's orientation period, with their first and second day dedicated to company culture, history, and safety. Training plans are developed for each Partner to continue to build and increase their skill sets throughout their careers. These are managed in the performance and development review process by their supervisors. In regards specifically to service emergency maintenance and repair requests, these are managed through ServiceLink. ServiceLink is technology that we utilize at TD as it extends the power of a central computer, which stores customer equipment and service history, to a compact GPS-enabled handset held by an assigned service technician onsite. The system is also fully accessible online by any Planned Maintenance customer. At every step along the way, ServiceLINK is fully accessible to our customers, so that they can review work in progress, compare current to past repairs, and much more. All of these technologies come together in ServiceLINK to bring our customers the outstanding level of service they deserve.

WORK ORDER PRIORITY	RESPONSE TIME	ON SITE CHECK-IN TIME
Emergency	15 mins	1 hour
Urgent	60 mins	Same Day
Normal	1 Day	3 Days
Scheduled	30 Days	30 Days

27. Provide your safety record, safety rating, EMR and worker's compensation rate where available

Please see the following page for a letter confirming TD's workers' compensation rate.

TDIndustries uses ISN for our safety compliance and to track safety ratings with our customers. Currently, TD's safety rating average is an A.

	EMR	LTIR	TRIR	TOTAL HOURS WORKED
2019	.63	.03	1.4	6,661,989
2018	.77	.3	2.3	6,136,430
2017	.7	.2	2	5,686,471
2016	.73	.2	2.3	4,671,298
2015	.68	.1	2	4,167,223

E. Dianne Epperson, CIC
Client Executive

Marsh USA Inc.
1717 Main Street
Suite 4400
Dallas, TX 75201
+1 214 303 8110
www.marsh.com

February 7, 2020

Subject: TDIndustries, Inc. - Workers' Compensation Experience Modifier

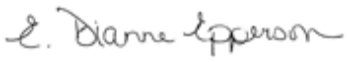
To Whom It May Concern:

This letter is to confirm historical Workers' Compensation modifiers for TDIndustries, Inc.:

ERM Effective Date	Mod Factor
03/01/2020	0.72
03/01/2019	0.63
03/01/2018	0.77
03/01/2017	0.71

If you have any questions, please feel free to contact me via email at dianne.epperson@marsh.com or my direct line (214) 303-8110.

Sincerely,



E. Dianne Epperson, CIC
Senior Vice President

28. Describe the capacity of your company to report monthly sales through this agreement.

TD's Cooperative Contract Coordinator will be responsible for keeping track of TD jobs for Equalis members and reporting successful sales in the month they are completed. The Cooperative Coordinator will be in communications with all TD business units to collect their completed sales and will compile to one report for Equalis Group.

29. Describe the capacity of your company to provide management reports, i.e. consolidated billing by location, time and attendance reports, etc. for each eligible agency.

TD's Cooperative Contract Coordinator will be coordinating with all TD locations on how, when, and what to report. TDIndustries already has a system in place for this kind of reporting.

30. Describe system security and other security measures in place, including network security, specific security protocols, firewalls, ND5, HTTPS, secure socket layer and any other service or measure put in place related to security.

Safeguarding your building is an area of expertise for us. That is why TD offers the most sophisticated systems available that include CCTV Camera Systems, Video Badging, Access Control and more. You can feel confident and secure that TD is watching out for you in every way.

31. Describe the warranty, including equipment, parts, labor, software, hardware and any other service or equipment that would require a warranty.

Warranties are typically one year, but could be longer depending on Customer acceptance of extended warranties.

All equipment warranties on all products installed by TDIndustries are captured in a master database - New Construction/Retrofit and Service replacements. Should a warranty claim arise, the database provides the feedback loop to our Project Managers to initiate the warranty claim with the appropriate manufacturer, dealer or distributor.

32. Describe training provided for all products and services provided.

TD encourages Partners to passionately pursue excellence through learning and continued education. For that reason, Partners and their supervisors are asked to document and agree upon training and continuing education plans as part of the four regular performance and development conversations that occur throughout the year. All full-time Partners are asked to complete 32 hours of company approved training each year.

Please see the following page for a letter from The Training Alliance for Educational Excellence that discusses continued trade services education for TD.

The
Training Alliance
for
Educational
Excellence

CONSTRUCTION
EDUCATION
FOUNDATION, INC.

P.O. Box 612107
(1401-A Royal Lane)
DFW Airport, TX
75261-2107

Phone
(972) 574-5200

Fax
(972) 574-3440

August 28, 2020

To Whom It May Concern:

TDIndustries has trained with Construction Education Foundation (CEF) and Associated Builders and Contractors (ABC) to promote workforce and safety training since 1980. TDInudustries was one of the founding companies of the Associated Builders and Contractors craft professional/apprenticeship training programs in 1980.

TDIndustries has had TDPartners/employees serve on every workforce development council; serve as craft and professional development instructors; and serve on the Executive Committee and Board of Directors of ABC and its training arm CEF.

TDIndustries holds the prestigious place as having been the Top ABC Training Company and/or in the Top Three training companies since the founding of ABC's program in 1980.

Many TDI students have medaled gold, silver and bronze in the ABC National Craft Championships.

TDIndustries continues to encourage Workfoce Development in their company. They currently have 100 plus employees in Craft/Apprenticeship training in the 2020 Fall semester which utilizes the NCCER curriculum.

Sincerely,

Jonna Noble

Jonna Noble
Director of Training
Construction Education Foundation, Inc.

33. What equipment/system support documents will your company provide?

Installation instructions, operation and maintenance manuals, and the manufacturer's recommendations for preventative maintenance.

34. Indicate your company's ability to provide temporary cooling when needed.

TDIndustries has relationships with Entech and Aggreko and other national providers of temporary chillers and other cooling/refrigeration equipment as well as other vendors who can provide cooling.

35. Please provide contact information and resumes for the person(s) who will be responsible for the following areas.

EXECUTIVE CONTACT	
Contact Person: Crystal Seiler	**Title:** Professional Services Team Manager
Company: TDIndustries, Inc.	**Email:** crystal.seiler@tdindustries.com
Phone: 713.996.3121	**Fax:** 972.888.9507
Address: 13850 Diplomat Drive, Dallas, Texas 75234	

ACCOUNT MANAGER/CONTRACT MANAGEMENT	
Contact Person: Lorraine Vuong	**Title:** Cooperative Contracts Coordinator
Company: TDIndustries, Inc.	**Email:** lorraine.vuong@tdindustries.com
Phone: 713.996.2437	**Fax:** 972.888.9507
Address: 13850 Diplomat Drive, Dallas, Texas 75234	

BILLS AND REPORTING/ACCOUNTS PAYABLE	
Contact Person: Lorraine Vuong	**Title:** Cooperative Contracts Coordinator
Company: TDIndustries, Inc.	**Email:** lorraine.vuong@tdindustries.com
Phone: 713.996.2437	**Fax:** 972.888.9507
Address: 13850 Diplomat Drive, Dallas, Texas 75234	

MARKETING	
Contact Person: Lorraine Vuong/TDMarketing	**Title:** Cooperative Contracts Coordinator
Company: TDIndustries, Inc.	**Email:** lorraine.vuong@tdindustries.com
Phone: 713.996.2437	**Fax:** 972.888.9507
Address: 13850 Diplomat Drive, Dallas, Texas 75234	

RESUME - PRIMARY CONTACT

LORRAINE VUONG, COOPERATIVE CONTRACTS COORDINATOR

Lorraine is TDIndustries' dedicated liaison with cooperative purchasing networks. Her role is to navigate the administrative and legal needs of both Equalis Group and Region 10 to help ensure that TD is delivering service excellence. Lorraine is completely dedicated to this type of business and has the experience and skill to coordinate and facilitate the execution of cooperative contracts.

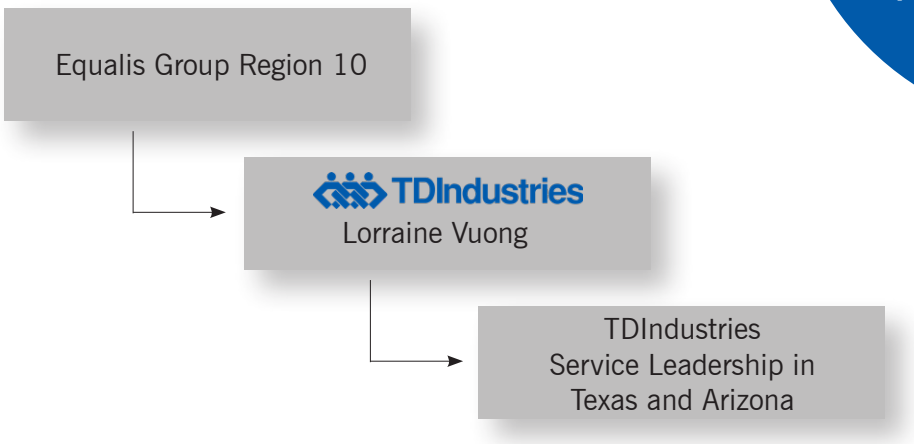
Lorraine's Experience

Years of Experience: 15
Education: Accounting Manager, Eldorado Business School
Relevant Training: TASBO Procurement Courses
COOP Experience:

- OMNIA Partners
- NCPA
- GSA
- TXMAS
- BuyBoard
- PACE
- 1 GPA

Equalis Group and Region 10 will have a single Point of Contact within TDIndustries, Lorraine Vuong. She will disseminate information and coordinate with the appropriate parties within TDIndustries.

Flow of Information



TDIndustries provides plumbing, HVAC and electrical maintenance, installation, renovation and preventive maintenance service and repair from twelve offices. We have nine offices in Texas: Dallas; Houston, Austin, San Antonio, Fort Worth, Lubbock, Midland, Amarillo and Richardson. We also serve the state of Arizona, with offices in the Phoenix Metro area and Tucson as well as Colorado with an office in Denver.

36. Provide a minimum of three (3) customer references for product and/or services of similar scope dating within the past 3 years. Please try to provide an equal number of references for K12, Higher Education and City/County entities. Provide the following information for each reference:

ARIZONA

City of Maricopa
Dan Leonard - Maintenance Coordinator Public Works
P: (602) 513-2495
E: Daniel.Leonard@maricopa-az.gov
Maricopa, AZ
Years Serviced: 5 years
Description: HVAC, Plumbing, Restaurant, Electrical, General Services, and Change Out Projects
Annual Volume: $340,381

HOUSTON

Houstonfirst Corporation
John Gonzalez - Vice President
P: (713) 853-8299
E: John.Gonzalez@Houstonfirst.com
Houston, TX
Years Serviced: 11+
Description: Full facilities contract
Annual Volume: $5.2 Million

FORT WORTH

Arlington ISD
David Jackson - HVAC Supervisor
P: (682) 867-7639
E: djackso7@aisd.net
Arlington, TX
Years Serviced: 3 years
Description: Boiler preventative maintenance , HVAC,and plumbing demand service, special project construction mechanical change outs
Annual Volume: $700,000

AUSTIN

Texas State University
Jeremy Stolfa Assistant Athletic Director
P: (512) 245-2023
E: stolfa@txstate.edu
San Marcos, TX
Years Serviced: 5 years
Description: HVAC & Commercial Refrigeration
Annual Volume: $150,000

DALLAS

Communities Foundation of Texas
Beverly Garner Senior Director, Property and Facilities
P: (817) 823-4884
E: Rbgarner@cftexas.org
Dallas, TX
Years Serviced: 6 years
Description: HVAC maintenance contract for Chiller, cooling towers, AHUS, Condenser Pumps, ect., T&M work for other trades also for Plumbing, CRFES, and electrical
Annual Volume: $91,000

SAN ANTONIO

Fort Stockton ISD
Robert Stallard - Director of Operations
P: (432) 336-4039
E: Robert.Stallard@FSISD.net
Fort Stockton, TX
Years Serviced: 1 year
Description: HVAC Services Contract
Annual Volume: $300,000

37. List all cooperative and/or government group purchasing organizations of which your company is currently a member below.

COOPERATIVE/GPO NAME	CONTRACT NUMBER	EXPIRATION DATE
NCPA	02-48 // 02-54 // 02-92	10/31/2021 // 3/31/2023 // 8/31/2025
PACE	PO0163	12/31/2023
1GPA	19-10P-05	3/31/2024
BuyBoard	552-17 // 558-18	11/30/2020 // 2/28/2021
OMNIA	R150501	12/31/2021
GSA	GS-21F-0118X	5/31/2031

38. Describe your company's implementation and success with existing cooperative purchasing programs, if any, and provide the cooperative's name(s), contact person(s) and contact information as reference(s).

Since all of our Equalis Group projects will be channeled through one contact (Lorraine Vuong), we have the ability to track the progress and report sales for all projects in a timely manner. We created internal estimate sheets that are based off of our current contract terms and conditions. This allows our estimators and service team to be sure they do not exceed the contract established labor rates, margins and to be sure they include equipment discounts. This process has been quite successful in allowing our customers to feel reassured they are receiving fair pricing.

TD has also used a quote/proposal numbering system that some of our cooperatives put in place that has been very beneficial to TD and our customers to show that we are being compliant. This could be beneficial for Equalis Group to consider implementing a system like this for their vendors and members.

NCPA - Jon Symko // 832-914-4499 // jsymko@ncpa.us

TD has had a great successful partnership with NCPA and Houston Community College

PACE - Jim Metzger // 210-370-5204 // jim.metzger@esc20.net

TD's Cooperative Coordinator was able to introduce PACE to all TD business units and TD's PACE contract to show how beneficial this contract can be for our maintenance agreements. We were able to grow these sales by 415.23% in one year.

1GPA - Jill Boyle // 512-970-0179 // jboyle@1gpa.org

OMNIA - Scott Wynne // 404-597-5409 // scott.wynne@omniapartners.com

TD has had a long partnership with OMNIA. TD has been a supportive vendor and throughout the changes with this cooperative, TD has had fluctuating sales and has been able to increase sales in the past two years by over 50% each year.

39. Provide a copy of all current licenses, registrations and certifications issued by federal, state and local agencies, and any other licenses, registrations or certifications from any other governmental entity with jurisdiction, allowing Respondent to perform the covered services including, but not limited to licenses, registrations or certifications. M/WBE, HUB, DVBE, small and disadvantaged business certifications and other diverse business certifications, as well as manufacturer certifications for sales and service must be included if applicable.

LICENSES

Below is a listing of applicable licenses. Copies of individual licenses will be provided upon request.

DALLAS:

- Larry Bartlett------Plumbing—M-16723
- Dennis Grissom—AC/Refrigeration/Process Piping—TACLA26339C
- Stephen Rogers---Electrical –EC-17889

FORT WORTH:

- David Hollowell—Plumbing—M-19925
- Lyn Freeman---- AC/Refrigeration/Process Piping—TACLA17611C
- Stephen Rogers---Electrical –EC- 17889

AUSTIN:

- Weslee Jones----Plumbing ---M-36838
- John C. McRae---AC/Refrigeration/Process Piping---TACLA27827C
- Greg Gillespie----Electrical---EC- 26107

SAN ANTONIO:

- Louis Menard – Plumbing-- M-42395
- Billy Wayne Sides -- AC/Refrigeration/Process Piping---TACLA00058529C
- Greg Gillespie---Electrical--- EC- 26107

HOUSTON:

- Alvin Schneider-- Plumbing--M-35508—
- Mark Gafford-----AC/Refrigeration/Process Piping---TACLA00060764C
- Stephen Rogers---Electrical—EC-17889

WEST TEXAS OFFICES: AMARILLO AND LUBBOCK (USING FORT WORTH LICENSES FOR NOW)

- David Hollowell—Plumbing—M-19925
- Lyn Freeman---- AC/Refrigeration/Process Piping—TACLA17611C

COLORADO:

Tony Dixon-- Plumbing—MP-185879

TDOwned-----Plumbing State Contactor---PC-2056 // TDOwned---City Mechanical HVAC—237339 // TDOwned---City Refrigerant A----237340 // TDOwned--- Plumbing Contractor----17500

ARIZONA:

TDOwned--- ROC246533-C-39 // TDOwned--- ROC246535-C-37 // TDOwned--- ROC264254-C-74 // TDOwned--- ROC323889-CR-11

FIRE LIFE SAFETY:

- ACR-3105 Alarm Contractor's Registration -TD Owned
- ECR-1944 Extinguisher Contractor's Registration- TD Owned
- SCR-G-1065 Sprinkler Contractor's Registration- TD Owned

40. Provide information regarding whether your firm, either presently or in the past, has been involved in any litigation, bankruptcy, or reorganization.

TDIndustries Legal Statement:

"The Company is a party to a number of legal proceedings arising in the ordinary course of business. In the opinion of management, the resolution of these proceedings will not have a material adverse effect on the financial position or results of operations of the Company."

Sheri L. Tillman

Sheri L. Tillman
Corporate Counsel
TDIndustries | www.tdindustries.com
Office 972-888-6844 |Cell 972-375-3603

41. Felony Conviction Notice – Please check applicable box:

☐ A publicly held corporation; therefore, this reporting requirement is not applicable
☒ Is not owned or operated by anyone who has been convicted of a felony.
☐ Is owned or operated by the following individual(s) who has/have been convicted of a felony.

*If the 3rd box is checked a detailed explanation of the names and convictions must be attached.

42. Detail how your organization plans to market this contract within the first 90 days of the award date. This may include but is not limited to:

a. A co-branded press release within first 30 days
b. Announcement of award through any applicable social media sites
c. Direct mail campaigns
d. Co-branded collateral pieces
e. Advertisement of contract in regional or national publications
f. Participation in trade shows
g. Dedicated Equalis Group and Region 10 ESC internet web-based homepage with:
i. Equalis Group and Region 10 ESC Logo
ii. Link to Equalis Group and Region 10 ESC website
iii. Summary of contract and services offered
iv. Due Diligence Documents including; copy of solicitation, copy of contract and any amendments, marketing materials
h. Announcement within your firm, including training of the agreement with your national sales force
i. Marketing the agreement to new and existing government customers

FIRST 30 DAYS

» In our first 30 days of being awarded, TD's Cooperative Contract Coordinator will notify all Service Sales Team Leaders that TD has been awarded the Equalis Group contract.
» TDIndustries marketing will announce to all TD partners that TD has been awarded for a new contract with Equalis Group. They will be informed of the new contract number and what TD services this contract covers.
» Marketing will work with Equalis Group marketing to create a co-branded blog announcement. We will also work with Equalis Group marketing team to promptly update our landing page for our new contract.

60 DAYS

» Create brochures and collateral pieces to incorporate the new contract in our cooperative capabilities.
» TDIndustries will work with Equalis Group to strategize an Equalis Group roadshow in each of our TX and AZ locations. In these roadshow meetings, the market opportunity, customer profiles, contract terms, and business processes will all be reviewed so that all TD partners get the message and are prepared to seize the opportunities. Equalis Group will be asked to participate in those meetings to provide answers to questions.
» Plan a meeting with TD Service Sales Team and Equalis Group Development Manager and Regional Managers to strategize a sales plan with all that Equalis Group has to offer.

90 DAYS

» We will participate in joint marketing activities that Equalis Group determines that TDIndustries should participate in, co-host, etc.…
» We will participate in trade shows and exhibitions where the government entities are likely to participate.

We will continuously train and have roundtable discussions with our TD partners to make certain they understand the program rules to better utilize our contracts and be compliant.

In person events and meetings are contingent on COVID-19 and related policies.

43. Acknowledge that your organization agrees to provide its company logo(s) to Region 10 ESC and agrees to provide permission for reproduction of such logo in marketing communications and promotions.

TDIndustries agrees to provide our company logo to Region 10 ESC and agrees to provide permission for reproduction of such logo in marketing communications and promotions.

44. Provide the agency spend that your organization anticipates each year for the first three (3) years of this agreement.

$____$1,500,000____ in year one

$____$2,500,000____ in year two

$____$5,000,000____ in year three

45. Please provide any suggested improvements and alternatives for doing business with your company that will make this arrangement more cost effective for your company and Participating Public Agencies.

Equalis could implement a quote/proposal system where vendors request a proposal number from Equalis for every quote to members. This will help Equalis be aware of all work being quoted through Equalis, it will show accountability and compliance to members. Monthly membership lists showing who signed up the member and when they signed up. This will help TD in reaching out to the right members for any events that may come up.

Hold an annual synergy meeting with Equalis and your vendors to network and share ideas on better using cooperative contracts and ways to better work with our cooperative representatives.

Hold small events with vendors and members to network, quarterly, semi annually or annually.

TAB 2

TAB 2 CONTENTS:

APPENDIX B: PRICING

APPENDIX B: PRICING

Please see the excel sheet labeled “Attachment B” included separately. Pricing is **PROPRIETARY.**

Standard Hours: Standard hours are Monday - Friday 8:00 AM to 5:00 PM
Overtime Hours: Overtime hours begin at 5:00 PM and end at 8:00 AM and all-day Saturday, Sunday and Holidays
Per Diem: Standard Government per diem rates will apply

NOTES:

- All labor rates have been calculated to include the labor coefficient discount
- All labor rates are based on standard hours
- Overtime Rates for after hours, weekends and holidays
- Per Diem rates (except AK & HI)
- Rates will be adjusted 3% annually every beginning of the calendar year based on the following formula:
  a. 3% of field labor adjustment factor change from the previous year
  b. Material price index changes from the previous year
  c. Office and operating expense changes from the previous year
- Final approval upon Region 10 ESC’s discretion

Construction & Service Labor Descriptions

Exempt Positions

Labor Category	Position Description / Functional Responsibilities
Administrative Assistant	Assists the Project Manager and site personnel with administrative and general office support duties. Correspondence, agendas, meeting coordination, organizing and maintaining filing systems, data entry and spreadsheet/log development and updates. Gather and input weekly time sheets for the staff. Assist with coordination of required training schedules. **Minimum Experience:** Requires 4-7 years of experience. Excellent typing skills, proficiency with software programs, organization, accuracy and good time management skills with a strong interpersonal skills and the desire to help others on the team. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma.
Building Automation Systems Engineer	Design and engineering -control systems, knowledge control systems, utilizing knowledge of electronics, direct digital control, airflow, hydronic, refrigeration theory and control techniques. **Minimum Experience:** Requires 3 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Bachelor's degree or equivalent related experience in civil, electrical, mechanical, or industrial engineering; facilities management; or other related field.
Building Automation Systems Programmer	Design and Programming -control systems, knowledge control systems, utilizing knowledge of electronics, direct digital control, airflow, hydronic, refrigeration theory and control techniques. **Minimum Experience:** Requires 2 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Bachelor's degree or equivalent related experience in civil, electrical, mechanical, or industrial engineering; facilities management; or other related field.
Customer Service Representative	Answers telephone and coordinators work to ensure total coverage. Generate work orders from incoming messaged utilizing CMMS ensuring that to priority work requests are forwarded to the proper supervisor. Contacts vendors for service. Prepares routine reports in support of staffing equipment, performance and capacity levels. Responds to alarms and communicates to appropriate staff. Assists with administrative tasks. **Minimum Experience:** Requires 1-2 years of experience. Excellent typing skills, organization and telephone manner. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma.

Construction & Service Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
Drafting/Project Coordinator	Provides detail engineering drawings utilizing CADD type documents on complex assignments. **Minimum Experience:** Requires 3 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Energy Utilization Consulting	Energy Utilization Consultants are the experts in central utility plant operations and metering systems that serve in an analysis and design capacity. Responsibilities include monitoring central utility plants for energy savings opportunities and providing detailed recommendations on new plant operations strategies. In addition Energy Utilization Consultants design remotely read submetering systems for utility cost allocation purposes. **Minimum Experience:** Requires 4 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** BS in Engineering.
Engineering Design	Professional Licensed Engineer who lays out HVAC, Plumbing, Electrical, Structural or Civil Systems. **Minimum Experience:** Requires 1-3 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Plant Operations Analyst	Plant Operations Analysts are experts in central utility plant operations and metering systems that serve in an analysis and design capacity. Responsibilities include monitoring central utility plants for energy savings opportunities and providing detailed recommendations on new plant operations strategies. **Minimum Experience:** Requires 4 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** BS in Engineering
Project Manager	Schedules and monitors the overall facilities operations at a specific facility. Responsible for work assignments, reporting, customer interface and administrative paperwork at the assigned specific facility. Performs functions with only general guidelines, operating with wide latitude of managerial authority to make operational and personnel decisions, per company policy and culture. **Minimum Experience:** Requires 5-10 years of related experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Bachelor's degree or equivalent related experience in civil, electrical, mechanical, or industrial engineering; facilities management; or other related field.

Labor Category	Position Description / Functional Responsibilities
Project Administrator	Worker who provides administrative support to all technician skill levels and is responsible for all administrative functions of the project such as billings, contracts, work orders, legal requirements, purchase orders, sales tax certificates as well as proper record keeping. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Rate Consultant	Rates analysts are experts in utility cost allocation, through submetering, for commercial, industrial, high – end residential, and institutional real estate. Rates Analysts are charged with identifying problems with existing submeters, interpreting commercial leases to determine invoicing structure, analyzing utility rates and producing invoices for electric, water, steam, natural gas, and BTU cost redistribution. **Minimum Experience:** Requires 4 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** BS in Accounting

Non-Exempt Positions

Labor Category	Position Description / Functional Responsibilities
Commercial Chiller/Boiler Technician	Independently performs diagnoses, repairs, maintenance and installations of highly complex larger-sized commercial air conditioning, refrigeration, plumbing and/or electrical systems and/or equipment. Capable of working on larger commercial up to 3000 tons. Installs, services and repairs environmental-control systems in office buildings and other commercial establishments, utilizing knowledge of refrigeration theory, pipefitting and structural/mechanical layout. **Minimum Experience:** Requires 5 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Commercial Kitchen/Refrigeration	Capable of working on low temperature refrigeration equipment as well as small commercial equipment under 60 tons. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Delivery Personnel	Delivers materials to other HVAC personnel as well as work as a second man on jobs if necessary. **Minimum Experience:** Requires 6 months of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Electrician	Performs a variety of electrical trade functions such as the installation, maintenance, or repair of equipment for the generation, distribution, or utilization of electric energy. Work involves installing or repairing a variety of electrical equipment. **Minimum Experience:** Requires one year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

Construction & Service Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
Fire Life Safety Technician III	Independently performs diagnoses, repairs, maintenance and installations of highly complex alarm systems. Works with various types of tools, gauges, measuring equipment. Maintains all assigned tools and instruments in good working condition and calibrated as needed. Plans installation and completes small to large complex fire alarm projects. Works under minimal supervision and normally works independently. While procedures are well defined in multiple areas of expertise, this technician level interprets compliance requirements and assures standardization of work. Makes judgments and decisions, but these are based on the following of proscribed procedures and detailed specifications. **Minimum Experience:** Requires 5 years of experience and a state license. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification and state licensing.
HVAC Building Automation Technician	Inspection and repair of environmental-control systems, knowledge control systems, utilizing knowledge of electronics, direct digital control, airflow, hydronic, refrigeration theory and control techniques. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
HVAC Commercial A/C Technician	Capable of working on larger commercial up to 10000 tons. Installs, services and repairs environmental-control systems in office buildings and other commercial establishments, utilizing knowledge of refrigeration theory, pipefitting and structural/mechanical layout. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
HVAC Duct Installer	Installs ductwork. Assists with some equipment installation. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

Construction & Service Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
HVAC Filter Technician	Changes filters in all types of HVAC equipment as well as minor maintenance on light commercial equipment such as changing worn belts. **Minimum Experience:** Requires 6 months of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
HVAC Helper	Worker who can assist a commercial or refrigeration technician as well as perform minor analysis and repairs on equipment under 30 tons. **Minimum Experience:** Requires 6 months of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
HVAC Refrigeration Technician	Capable of working on low temperature refrigeration equipment as well as small commercial equipment under 60 tons. **Minimum Experience:** Requires 1-3 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Pipefitter	Trained worker who installs and repairs piping systems, chilled water piping & hot water (boiler) piping, pneumatic tubing controls, chillers, boilers & associated mechanical equipment. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Plumber	Construction: Assembles, installs and repairs pipes, fittings and fixtures of heating, water, and drainage systems, plumbing fixtures, such as sinks, commodes, bathtubs, water heaters, hot water tanks, garbage disposal units, dishwashers, and water softeners according to specifications and plumbing codes. Studies building plans and working drawings to determine work aids required and sequence of installations. **Minimum Experience:** Requires one year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

Labor Category	Position Description / Functional Responsibilities
Plumbing Technician	Service/Maintenance: Assembles, installs and repairs pipes, fittings and fixtures of heating, water, and drainage systems, plumbing fixtures, such as sinks, commodes, bathtubs, water heaters, hot water tanks, garbage disposal units, dishwashers, and water softeners according to specifications and plumbing codes. Studies building plans and working drawings to determine work aids required and sequence of installations. **Minimum Experience:** Requires one year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Project Foreman	Supervises, coordinates, inspects and performs the assembly, installation and repair of components, subsystems and systems for the appropriate trade during the construction, tenant finish-out or remodel of commercial buildings and industrial facilities. Reports to a Trade or Job Superintendent. Performs other job and Foreman related duties as required. **Minimum Experience:** Requires 5 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Project Superintendent	Usually supervises multiple jobs. Schedules, coordinates and supervises craft employee activity. Usually involves supervising one or more trade groups (plumbers, sheet metal workers, pipe fitters, instruments and start-up). Performs other job and Superintendent related duties as required. May report to either a Business Unit Manager or Production Manager. **Minimum Experience:** Requires 5-7 years of related experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Associate's degree or equivalent related experience in civil, electrical, mechanical, or industrial engineering; facilities management; or other related field.
Service Supervisor	Provides leadership and supervision to a team of 10 to 15 service technicians. The Service Manager interacts with the Senior Service Manager and other Service Managers to help implement the team's business responsibilities, training commitments and business activities as directed by the Senior Service Manager. Completes job assignments and duties in complete autonomy. Work is typically of a complex nature and requires creative solutions. Uses independent judgment to resolve issues and arrive at decisions. Reports to and performs other duties as assigned by a Senior Service Manager, Operations Manager or Business Unit Manager. Performs other duties and responsibilities as required. **Minimum Experience:** Requires 5 years of related experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Associate's degree or equivalent related experience in civil, electrical, mechanical, or industrial engineering; facilities management; or other related field.

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Facilities Maintenance Labor Descriptions

Exempt Positions

Labor Category	Position Description / Functional Responsibilities
Administrative Assistant	Assists the Project Manager and site personnel with administrative and general office support duties. Correspondence, agendas, meeting coordination, organizing and maintaining filing systems, data entry and spreadsheet/log development and updates. Gather and input weekly time sheets for the staff. Assist with coordination of required training schedules. **Minimum Experience:** Requires 4-7 years of experience. Excellent typing skills, proficiency with software programs, organization, accuracy and good time management skills with a strong interpersonal skills and the desire to help others on the team. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma.
Customer Service Representative	Answers telephone and coordinators work to ensure total coverage. Generate work orders from incoming messaged utilizing CMMS ensuring that to priority work requests are forwarded to the proper supervisor. Contacts vendors for service. Prepares routine reports in support of staffing equipment, performance and capacity levels. Responds to alarms and communicates to appropriate staff. Assists with administrative tasks. **Minimum Experience:** Requires 1-2 years of experience. Excellent typing skills, organization and telephone manner. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma.
Engineering Design	Professional Licensed Engineer who lays out HVAC, Plumbing, Electrical, Structural or Civil Systems. **Minimum Experience:** Requires 1-3 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Project Manager	Schedules and monitors the overall facilities operations at a specific facility. Responsible for work assignments, reporting, customer interface and administrative paperwork at the assigned specific facility. Performs functions with only general guidelines, operating with wide latitude of managerial authority to make operational and personnel decisions, per company policy and culture. **Minimum Experience:** Requires 5-10 years of related experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Bachelor's degree or equivalent related experience in civil, electrical, mechanical, or industrial engineering; facilities management; or other related field.
Project Administrator	Worker who provides administrative support to all technician skill levels and is responsible for all administrative functions of the project such as billings, contracts, work orders, legal requirements, purchase orders, sales tax certificates as well as proper record keeping. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

Non-Exempt Positions

Labor Category	Position Description / Functional Responsibilities
Boilermaker	Worker who assembles boilers, tanks, vats and pressure vessels. The duties of the boilermaker include welding acetylene burning, riveting, caulking, rigging, fitting up, grounding, reaming and impact machine operating. Operate and maintain stationary engines and mechanical equipment to provide utilities for buildings or industrial processes. Adjusts controls and valves on equipment to provide power and regulate and set operations of system and industrial processes. **Minimum Experience:** Requires 1-3 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Carpenter	Builds wood structures or structures of any material which has replaced wood. Including rough & finish carpentry, hardware and trim. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Carpet Layer/Floor Installer	Installs carpet and/or floor coverings-vinyl tile. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Concrete Finisher	Floats, trowels and finishes concrete. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.

Facilities Maintenance Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
Data Comm/Telecom Installer	Installs data/telephone & television cable & associated equipment and accessories **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Delivery Personnel	Delivers materials to other HVAC personnel as well as work as a second man on jobs if necessary. **Minimum Experience:** Requires 6 months of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Drafting	Provides detail engineering drawings utilizing CADD type documents. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Drywall/Ceiling Installer	Worker who installs metal framed walls & ceilings, drywall coverings, ceiling grids & ceilings. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Electrician	Performs a variety of electrical trade functions such as the installation, maintenance, or repair of equipment for the generation, distribution, or utilization of electric energy. Work involves installing or repairing a variety of electrical equipment. **Minimum Experience:** Requires one year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

Facilities Maintenance Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
Elevator Mechanic	Craftsman skilled in the installation & maintenance of elevators. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Fire Life Safety Technician III	Independently performs diagnoses, repairs, maintenance and installations of highly complex alarm systems. Works with various types of tools, gauges, measuring equipment. Maintains all assigned tools and instruments in good working condition and calibrated as needed. Plans installation and completes small to large complex fire alarm projects. Works under minimal supervision and normally works independently. While procedures are well defined in multiple areas of expertise, this technician level interprets compliance requirements and assures standardization of work. Makes judgments and decisions, but these are based on the following of proscribed procedures and detailed specifications. **Minimum Experience:** Requires 5 years of experience and a state license. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification and state licensing.
Fire Proofing Installer	Worker who sprays or applies fire proofing materials. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
General Maintenance Technician	Performs general maintenance and repair of equipment and buildings requiring practical skill and knowledge (but not proficiency) in such trades as painting, carpentry, plumbing, masonry, and electrical work. Work involves a variety of the following duties: Replacing electrical receptacles, wires, switches, fixtures, and motors; using plaster or compound to patch minor holes and cracks in walls and ceilings; repairing or replacing sinks, water coolers, and toilets; painting structures and equipment; repairing or replacing concrete floors, steps, and sidewalks; replacing damaged paneling and floor tiles; hanging doors and installing door locks; replacing broken window panes; and performing general maintenance on equipment and machinery. **Minimum Experience:** Requires one year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or as required per task order.

Facilities Maintenance Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
Geothermal Well Field Labor	Worker who lays coiled pipe and tests and connects to HVAC equipment in earthen trench. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Glazier	Worker who installs glass, glozing and glass framing. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Heavy Equipment Operator	Includes, but not limited to, all Cat tractors, all derrick-powered, all power operated cranes, back-hoe, back filler, power operated shovel, winch truck, all trenching machines. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
HVAC Building Automation Technician	Inspection and repair of environmental-control systems, knowledge control systems, utilizing knowledge of electronics, direct digital control, airflow, hydronics, refrigeration theory and control techniques. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
HVAC Commercial A/C Technician	Capable of working on larger commercial up to 3000 tons. Installs, services and repairs environmental-control systems in office buildings and other commercial establishments, utilizing knowledge of refrigeration theory, pipefitting and structural/mechanical layout. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

Facilities Maintenance Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
HVAC Duct Installer	Installs ductwork. Assists with some equipment installation. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
HVAC Filter Technician	Changes filters in all types of HVAC equipment as well as minor maintenance on light commercial equipment such as changing worn belts. **Minimum Experience:** Requires 6 months of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
HVAC Helper	Worker who can assist a commercial or refrigeration technician as well as perform minor analysis and repairs on equipment under 30 tons. **Minimum Experience:** Requires 6 months of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
HVAC Light Commercial	Capable of working on small commercial up to 25 tons. **Minimum Experience:** Requires 1-3 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
HVAC Maintenance Technician	Installs, services and repairs environmental-control systems in office buildings and other commercial establishments, utilizing knowledge of refrigeration theory, pipefitting and structural/mechanical layout. **Minimum Experience:** Requires 1-3 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

Facilities Maintenance Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
HVAC Refrigeration Technician	Capable of working on low temperature refrigeration equipment as well as small commercial equipment under 60 tons. **Minimum Experience:** Requires 1-3 years of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Infrared Technician	Worker who utilizes infrared photography to determine location of thermal heat losses. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Insulator	Worker who applies, sprays or installs insulation. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification** Possesses a high school diploma or equivalent work experience or as required per task order.
Iron Worker	Skilled craftsman who erects structural steel framing & installs structural concrete rebar. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Laborer/Helper	Worker qualified for only unskilled or semi-skilled work. Lifting, carrying materials and tools, hauling, digging, clean-up. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.

Facilities Maintenance Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
Lather/Plasterer	Worker who installs metal framing & lath. Worker who applies plaster to lathing & installs associated accessories. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Light Equipment Operator	Includes, but not limited to, air compressors, truck crane driver, flex plane, building elevator, form grader, concrete mixer (less than 14cf), and conveyor. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Mason; Bricklayer	Craftsman who works with masonry products, stone, brick, block or any material substituting for those materials and accessories. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Metal Building Assembler	Worker who assembles pre-made metal buildings. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification** Possesses a high school diploma or equivalent work experience or as required per task order.
Millwright	Mechanic specializing in the installation of heavy machinery, conveyance, wrenches, dock levelers, hydraulic lifts & align pumps. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

Facilities Maintenance Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
Painter/Wall Covering Inst.	Paints and redecorates walls, woodwork and fixtures. Work involves the following: Knowledge of surface peculiarities and types of paint required for different applications; preparing surface for painting by removing old finish or by placing putty or filler in nail holes and interstices; and applying paint with spray gun or brush. May mix colors, oils, white lead, and other paint ingredients to obtain proper color and/or consistency. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Pipefitter	Trained worker who installs and repairs piping systems, chilled water piping & hot water (boiler) piping, pneumatic tubing controls, chillers, boilers & associated mechanical equipment. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Plumber	Assembles, installs and repairs pipes, fittings and fixtures of heating, water, and drainage systems, plumbing fixtures, such as sinks, commodes, bathtubs, water heaters, hot water tanks, garbage disposal units, dishwashers, and water softeners according to specifications and plumbing codes. Studies building plans and working drawings to determine work aids required and sequence of installations. **Minimum Experience:** Requires one year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Roofer	Worker who installs roofing materials, Bitumen (asphalt & coal tar) felts, flashings, all types roofing membranes & associated products. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Sheet Metal Worker	Worker who install sheet metal products. Roof metal, flashings & curbs, ductwork, mechanical equipment and associated metals. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

Facilities Maintenance Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
Site Supervisor/HVAC Field Supervisor	Schedules, completes work and monitors the overall facilities operations at less complex specific facilities with a smaller staff. Responsible for work assignments, reporting, customer interface and administrative paperwork at the assigned specific facility. Performs functions within specific guidelines, operating with limited latitude of managerial authority to make operational and personnel guidance and direction. **Minimum Experience:** Requires 3-5 years of related experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Associate's degree or equivalent related experience in civil, electrical, mechanical, or industrial engineering; facilities management; or other related field.
Sprinkler Fitter	Worker who installs fire sprinkler systems & fire protection equipment. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Terrazzo Worker	Craftsman who places & finishes Terrazzo. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Test & Balance Technician	Certified technician per AABC or NEBB standards trained to perform water and air balance. Also provides sound and vibration testing and preparing of certified reports. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.
Tile Setter	Worker who prepares wall and/or floor surfaces & applies VCT, other forms of tile products and ceramic tiles to these surfaces. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.

Facilities Maintenance Labor Descriptions

Labor Category	Position Description / Functional Responsibilities
Water proofer/Caulker	Worker who applies water proofing material to buildings. Products include sealant, caulk, sheet membrane, liquid membranes, sprayed, rolled or brushed. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or equivalent work experience or as required per task order.
Water Treatment Technician	Certified technician who is trained to evaluate analytical test results on boiler system water, condenser water, and chill water samples and to make appropriate recommendations regarding residual levels, cycles, and feed rates. **Minimum Experience:** Requires 1 year of experience or as required per task order. **Minimum Education / Degree / Training Or Certification:** Possesses a high school diploma or Equivalent Technical Certification or as required per task order.

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TAB 3

TAB 3 CONTENTS:

APPENDIX C: CERTIFICATES

APPENDIX C: CERTIFICATES

LICENSES

Below is a listing of applicable licenses. Copies of individual licenses will be provided upon request.

DALLAS:

- Larry Bartlett------Plumbing—M-16723
- Dennis Grissom—AC/Refrigeration/Process Piping—TACLA26339C
- Stephen Rogers---Electrical –EC-17889

FORT WORTH:

- David Hollowell—Plumbing—M-19925
- Lyn Freeman---- AC/Refrigeration/Process Piping—TACLA17611C
- Stephen Rogers---Electrical –EC- 17889

AUSTIN:

- Weslee Jones----Plumbing ---M-36838
- John C. McRae---AC/Refrigeration/Process Piping---TACLA27827C
- Greg Gillespie----Electrical---EC- 26107

SAN ANTONIO:

- Louis Menard – Plumbing-- M-42395
- Billy Wayne Sides -- AC/Refrigeration/Process Piping---TACLA00058529C
- Greg Gillespie---Electrical--- EC- 26107

HOUSTON:

- Alvin Schneider-- Plumbing--M-35508—
- Mark Gafford-----AC/Refrigeration/Process Piping---TACLA00060764C
- Stephen Rogers---Electrical—EC-17889

WEST TEXAS OFFICES: AMARILLO AND LUBBOCK (USING FORT WORTH LICENSES FOR NOW)

- David Hollowell—Plumbing—M-19925
- Lyn Freeman---- AC/Refrigeration/Process Piping—TACLA17611C

COLORADO:

Tony Dixon-- Plumbing—MP-185879

TDOwned-----Plumbing State Contractor---PC-2056 // TDOwned---City Mechanical HVAC—237339 // TDOwned---City Refrigerant A----237340 // TDOwned--- Plumbing Contractor----17500

ARIZONA:

TDOwned--- ROC246533-C-39 // TDOwned--- ROC246535-C-37 // TDOwned--- ROC264254-C-74 // TDOwned--- ROC323889-CR-11

FIRE LIFE SAFETY:

- ACR-3105 Alarm Contractor's Registration- TD Owned
- ECR-1944 Extinguisher Contractor's Registration- TD Owned
- SCR-G-1065 Sprinkler Contractor's Registration- TD Owned

Copies of each license can be provided if needed.

TAB 4

TAB 4 CONTENTS:

APPENDIX D: VALUE ADD

APPENDIX D: VALUE ADD

Facilities Maintenance and Operations/Facilities Management Services **Please see Attachment "G-1"**	Type: Full Facility Operations and Maintenance Our Customers: » Airports » Higher Education » Convention and Entertainment » Corporate Environment » Data Centers/Critical Environments » Government » Healthcare » School Districts Personnel: All work performed by TD Partners Detailed Features and Benefits: Your buildings serve a deeper purpose; it provides a welcoming, safe environment that houses your customers, staff, and students. We tailor facilities management service to support your business goals. With a local on-site highly qualified team and a wide range of services, we stand ready to flex with your business needs. » Mechanical system operation and maintenance » Vertical transportation » Security systems » Renovation and retrofit » Fire Life and Safety » Lighting » Energy Management » Cost containment » LEED certification

APPENDIX D: VALUE ADD

Installation and Services **Please see Attachment "G-5"**	Type: We offer complete Refrigeration, HVAC, Plumbing, and Electrical repair and maintenance services.
	Personnel: All work performed by TD Partners
	Detailed Features and Benefits: We offer a wide variety of superior services ready for immediate response and resolution of jobs of all sizes and complexity. Our comprehensive truck based services, ServiceLink technology, and our broad spectrum of service and repair plans are just a few of the ways we support our commitment to service.
Refrigeration **Please see Attachment "G-5"**	Type: Commercial Refrigeration Installation, Repair and Maintenance
	Personnel: All work performed by TD Partners
	TD works with a variety of manufacturers to offer you the best possible costs on equipment and parts. We also provide preventative maintenance contracts to increase the efficiency and extend the life of your equipment. Our employees are highly trained and experienced to install and service commercial refrigeration systems and are on call 24/7/365 to provide your company with emergency repairs. We support a variety of equipment with low temperature needs and HVAC (heating, ventilation, and air conditioning) sales and service. A sample of the types of facilities we service: » Supermarkets » Colleges and Schools » Convenience Stores » Restaurants » Taverns & Bars » Manufacturing Facilities » Refrigerated Warehouses

APPENDIX D: VALUE ADD

HVAC **Please see Attachment "G-5"**	Type: Commercial Heating & Air Conditioning System Services
	Personnel: All work performed by TD Partners
	Detailed Features and Benefits: TD offers comprehensive services for boilers, chillers, air handlers, pumping systems, control systems, and water treatment. Our performance guarantees are unmatched by any other company in this industry. Not only is your exposure to risk reduced, but the quality of service you can expect is superior as well. Regularly scheduled inspections, 24- hour emergency service, full-service maintenance and repairs all extend the life of your systems.
Electrical **Please see Attachment "G-5"**	Type: Electrical Repair Services
	Personnel: All work performed by TD Partners
	Detailed Features and Benefits: TD is Equipped to handle all of your electrical needs with highly skilled technicians who are licensed and certified in the latest national electrical codes, city codes, and OSHA safety regulations. our service professionals are empowered to give on-site quotes for providing: » Interior Finish-Out » Industrial Systems » Electrical Controls » Infrared Imaging Services » Lighting Contracts » Multifamily Services » Outdoor Lighting » Retrofits and Upgrades
Plumbing **Please see Attachment "G-5"**	Type: Commercial Plumbing Services
	Personnel: All work performed by TD Partners
	Detailed Features and Benefits: For the total lifecycle of your facility - repairs, replacements, renovations, or retrofits - TD has the resources in place. Fully licensed plumbers are available 24 hours a day, seven days a week, to provide: » Boiler/Chiller System Repair and Maintenance » Hydro-Jet Service » Water System Repair and Maintenance » Sewer System Repair and Maintenance » Gas System Repair and Maintenance » Certified Backflow Testing » OSHA Certified Confined Entry » Certified Medical Gas Installation and Repair » Electronic Leak Detection » Electronic Line Location » Pro-Temp Service and Maintenance

APPENDIX D: VALUE ADD

ATTACHMENT "G-1"

FACILITY MAINTENANCE / MANAGEMENT SERVICE

EXECUTIVE SUMMARY

Thank you for giving TDIndustries the opportunity to provide our proposal for Facility Maintenance Service. We are excited by the opportunity to serve The Cooperative Purchasing Network. TDIndustries has the knowledge, experience, capabilities and flexibility to mobilize a workforce to meet the facility challenges facing Equalis Group.

The need for innovation and continuous improvement methods has never been greater. With our leadership and training programs, we will put in place a highly trained, competent site manager backed by professional management and a dedicated facility support and local service team. We will further develop a total facility service plan around your facility needs and support our onsite Supervisor with additional local technicians as needed. We will make the transition to TDIndustries seamless and provide ongoing service with no disruption to Equalis Group.

Our staffing plan is built on flexibility. The billable cost presented in the Pricing Section covers staffing as required in the RFP.

Benefit to the Agency Members of Equalis Group—You get the benefit of our experience and capabilities in Facilities Management to develop and implement a staffing plan to meet your needs, at no additional charge.

MANAGEMENT AND TECHNICAL EXPERTISE

TDIndustries proposes a manager that will proactively and effectively manage all aspects of facility services. He will be supported by an Operations Manager and our Professional Services Group. Our organization is specifically designed for efficiency with the flexibility to comply with both Equalis Group and TDIndustries' operational requirements.

Benefit to the Agency Members of Equalis Group—With TDIndustries' leadership and knowledge of facilities, policies and procedures, the transition period will be short with no disruptions—which will increase efficiencies and save you money.

CERTIFICATION/TRAINING OF MULTI-SKILLED WORKFORCE

TDIndustries utilizes highly-skilled technicians at all of our continuous-presence mechanical and facilities services sites. Each TDIndustries employee is tested using TDIndustries' Progression Program. This training and certification program focuses on written and hands-on criteria to determine employee skill levels. The employee then enters the program with the full support of management to continue their career development in as many crafts as desired.

Benefit to the Agency Members of Equalis Group—You will not waste any time or money developing a new certification /training program. You will also have the assurance that the people performing your repair work have the necessary skills for the job to be performed in a safe, efficient, and correct manner.

APPENDIX D: VALUE ADD

ATTACHMENT "G-1"

FACILITY MAINTENANCE / MANAGEMENT SERVICE

EXECUTIVE SUMMARY

FULL-SERVICE SUPPLIER

TDIndustries is a full-service supplier of engineering, construction and maintenance service. By selecting TDIndustries, you will have over 2,000 professionals and skilled technicians available to you. This includes specialty services such as total facilities and HVAC repair.

Benefit to the Agency Members of Equalis Group—Any need you might have associated with repairs, maintenance and capital projects is one phone call away.

MAINTENANCE EXPERIENCE

TDIndustries performs over $141,000,000 annually at continuous-presence and service/facilities maintenance revenue. We bring the successful programs from these operations to you. They include safety, benchmarking, cost control, quality, equipment availability, management model, employee leadership, community involvement and long term relationships.

Benefit to the Agency Members of Equalis Group—You get the benefit of our management processes, procedures and expertise to develop and implement these programs at no additional charge.

SAFETY

TDIndustries is firmly committed to providing excellence in safety. From the CEO to the field supervisor to the technician, every employee recognizes and accepts the requirement to make safety our most important responsibility.

Within TDIndustries, safety and health are not priorities, but values instilled in our employees at all levels.

TDIndustries is focused on getting everyone to automatically think about safety first.

Benefit to the Agency Members of Equalis Group—You will not waste any time or money dealing with the issues that arise from developing a new safety program for your mechanical and facility maintenance operation or from someone being injured in the workplace. These safety programs and policies already exist and produce excellent results.

TRANSITION PLAN

TDIndustries has the experience to implement a smooth transition. We have a structured transition plan with proven processes and procedures refined over hundreds of project startups.

Benefit to the Agency Members of Equalis Group—You get the benefit of TDIndustries' transition expertise to help ensure no disruption of service at your buildings.

ATTACHMENT "G-5"

HVAC, ELECTRICAL, AND PLUMBING

EXECUTIVE SUMMARY

TRUCK BASED SERVICES

TD has a wide variety of superior services ready for immediate response and resolution of jobs of all sizes and complexity, the core of which is based in our comprehensive Truck-Based Services.

In addition to truck-based services, real-time operations are what drive this excellent offering, the foundation of which is a proprietary, state-of-the-art Tier 1 database. This world-class, highly secure knowledge base is comprised of everything that can possibly be logged from the day we begin your service: start-up dates, service numbers, statistics, strategic plans, LEED reports, energy calculations and more.

More than 65 years of experience has led us to consistently offer you the following tangible benefits:

- Technical expertise – extensively trained, experienced TD Partners
- Self-performed delivery
- Customer Contact Center – 24/7 live operator and dispatch
- Large truck fleet – 300+ available at all times
- Broad geographic coverage

Planned Maintenance Services / Select Capital Projects / Scheduled Repair and Replace Services / Emergency On-Demand Service

Benefit to the Agency Members of Equalis Group — We are available 24 hours a day, seven days a week, 365 days a year. For service that extends beyond a one-tome visit, we offer Diagnostic Evaluation and Problem Resolution. Also, our service plans have no manufacturer bias. TD will research all manufacturers for the absolute best value and application when replacing system components. We work with you to give you the best solutions because we have your best interests in mind.

APPENDIX D: VALUE ADD

ATTACHMENT "G-5"

HVAC, ELECTRICAL, AND PLUMBING

EXECUTIVE SUMMARY

REFRIGERATION

TDIndustries is a local service provider with a wide range of capabilities that include Commercial Kitchen repairs and maintenance. TDIndustries' local team is comprised of licensed technicians in HVAC, Plumbing, and Electrical adding to total capabilities. The TD commercial kitchen group has extensive experience with a variety of equipment.

This type of equipment includes but is not limited to:

- Coolers
- Ice machines
- Ovens
- Steamers
- Warmers
- Fryers
- Grills and Griddles
- Beverage Dispensers
- Exhaust Systems
- Walk-in Coolers
- Batch Freezers
- Commercial and Industrial Refrigeration

TDIndustries is familiar with numerous purchasing cooperatives allowing TD to streamline purchasing needs on special projects that may be time sensitive. As a local service provider staffed with a 24-hr service call line we are available with response times typically between 2-4 hours and in some cases sooner.

Our Industrial Refrigeration and Food and Beverage Equipment technicians service both hot-side as well as cold-side equipment in food service and industrial or commercial operations.

ELECTRICAL

Whether replacing a light switch, rebuilding a 1,000-amp service in the middle of the night, or providing major service upgrades, TD is equipped to handle your electrical needs. Here are the benefits of our services:

- Highly skilled technicians that are licensed, certified and trained in the latest national electrical codes, city codes and OSHA safety regulations
- Service professionals empowered to give on-site quotes, offering you competitive estimates
- Expert installers that deliver interior finish-out and system upgrades

Plus, TD responds 24 hours a day, seven days a week to provide:

- Electrical Controls
- Industrial Systems
- Infrared Camera Services
- Lighting Contracts
- Multi-family Service
- Outdoor Lighting
- Retrofits and Upgrades
- Surge Protection

APPENDIX D: VALUE ADD

ATTACHMENT "G-5"

HVAC, ELECTRICAL, AND PLUMBING

EXECUTIVE SUMMARY

PLUMBING

From emergency repairs to a major renovation, a small or large commercial industrial or multi-family installation, TD has the resources. Years of extensive experience, training and education programs enable us to fully understand what it takes to keep your specific system operating at its peak efficiency. Fully licensed plumbers are available 24 hours a day, seven days a week for your convenience. Among the highly specialized plumbing services available are:

- Boiler/Chiller System Repair and Maintenance
- Hydro-Jet Service
- Water System Repair and Maintenance
- Sewer System Repair and Maintenance
- Gas System Repair and Maintenance
- Certified Backflow Testing
- OSHA-Certified Confined Entry
- Certified Medical Gas Installation and Repair
- Electronic Leak Detection
- Electronic Line Location
- Sewer Pipe Video Inspection
- Pro-Temp Service and Maintenance

HVAC

TD offers expert, comprehensive services that include everything from boilers, chillers, and air handlers to pumping systems, control systems and water treatment. Our performance guarantees are admittedly unmatched by any other company, so it reduces your risk. You can also expect regularly scheduled inspections, 24-hour emergency service, and full-service maintenance and repairs that extend the life of your systems.

TD's strength in commercial HVAC service is based upon the coupling of high-level thinking with high concept technology. It's a powerful dynamic that empowers expert, brand-savvy TD professionals to investigate and swiftly uncover the root causes of building system failures. And then offer exceptional commercial HVAC solutions you can trust in the technology arena, TD leverages:

- Special leak-detection tools, which mean faster and less disruptive repairs
- Infrared imaging that identifies potentially dangerous situations in your electrical circuitry
- Vibration analysis that reduces your equipment downtime and extends equipment life

Overall, TD's ability for solving air-conditioning and refrigeration problems is respected throughout the industry. Why? It all comes down to customer trust, which is based on putting you first.

TAB 5

TAB 5 CONTENTS:

APPENDIX E: VENDOR CONTRACT AND SIGNATURE FORM

Appendix E: VENDOR CONTRACT AND SIGNATURE FORM

This Vendor Contract and Signature Form ("Contract") is made as of _____, by and between _____ _____("Vendor")and Region 10 Education Service Center ("Region 10 ESC") for the purchase of HVAC & Facility Systems, Automation, Installation, Service and Related Products & Services ("the products and services").

RECITALS

WHEREAS, both parties agree and understand that the following pages will constitute the contract between the successful vendor(s) and Region 10 ESC, having its principal place of business at ***Education Service Center, Region 10, 400 E Spring Valley Rd, Richardson, TX 75081***

WHEREAS, Vendor agrees to include, in writing, any required exceptions or deviations from these terms, conditions, and specifications; and it is further understood that if agreed to by Region 10 ESC, said exceptions or deviations will be incorporated into the final contract "Vendor Contract."

WHEREAS, this contract consists of the provisions set forth below, including provisions of all attachments referenced herein. In the event of a conflict between the provisions set forth below and those contained in any attachment, the provisions set forth below shall control.

WHEREAS, the Vendor Contract will provide that any state, county, special district, local government, school district, private K-12 school, technical or vocational school, higher education institution (including community colleges, colleges and universities, both public and private), other government agencies or non-profit organization may purchase products and services at prices indicated in the Vendor Contract upon registering and becoming a member with Region 10 ESC; and it being further understood that Region 10 ESC shall act as the Lead Agency with respect to all such purchase agreements.

WHEREAS, Equalis Group has the administrative and legal capacity to administer purchases on behalf of Region 10 ESC under the Vendor Contract with participating public agencies and entities, as permitted by applicable law.

ARTICLE 1- GENERAL TERMS AND CONDITIONS

1.1 Equalis Group shall be afforded all of the rights, privileges and indemnifications afforded to Region 10 ESC under the Vendor Contract, and such rights, privileges and indemnifications shall accrue and apply with equal effect to Equalis Group, including, without limitation, Vendor's obligation to provide insurance and other indemnifications to Lead Agency.

1.2 Awarded vendor shall perform all duties, responsibilities and obligations, set forth in this agreement, and required under the Vendor Contract.

1.3 Equalis Group shall perform its duties, responsibilities and obligations as administrator of purchases, set forth in this agreement, and required under the Vendor Contract.

1.4 **Customer Support**: The vendor shall provide timely and accurate technical advice and sales support to Region 10 ESC staff, Equalis Group staff and participating agencies. The vendor shall respond to such requests within one (1) working day after receipt of the request.

ARTICLE 2- ANTICIPATED TERM OF AGREEMENT

☒ **Term:** The term of the Contract shall commence upon award and shall remain in effect for a period of three (2) years, unless terminated, canceled or extended as otherwise provided herein. The Contractor agrees that Region 10 ESC shall have the right, at its sole option, to renew the Contract for four (3) additional one-year periods or portions thereof. In the event that Region 10 ESC exercises such rights, all terms, conditions and provisions of the original Contract shall remain the same and apply during the renewal period with the possible exception of price and minor scope additions and/or deletions.

☒ **Automatic Renewal:** Renewal will take place automatically for one (1) year unless Region 10 ESC gives written notice to the awarded supplier at least ninety (90) days prior to the expiration.

TD is fine with either term of agreement.

ARTICLE 3- REPRESENTATIONS AND COVENANTS

Scope: This contract is based on the need to provide the economic benefits of volume purchasing and reduction in administrative costs through cooperative purchasing to schools and other members.

Compliance: Cooperative Purchasing Agreements between Equalis Group and its Members have been established under state procurement law.

Respondent's promise: Respondent agrees all prices, terms, warranties, and benefits granted by Respondent to Members through this contract are comparable to or better than the equivalent terms offered by Respondent to any present customer meeting the same qualifications or requirements.

ARTICLE 4- FORMATION OF CONTRACT

4.1. **Respondent contract documents**: Region 10 ESC will review proposed Respondent contract documents. Vendor's contract document shall not become part of Region 10 ESC's contract with vendor unless and until an authorized representative of Region 10 ESC reviews and approves it.

4.2. **Form of contract**: The form of contract for this solicitation shall be the Request for Proposal, the awarded proposal(s) to the lowest responsible Respondent(s), and properly issued and reviewed purchase orders referencing the requirements of the Request for Proposal. If a firm submitting a proposal requires Region 10 ESC and/or Member to sign an additional agreement, a copy of the proposed agreement must be included with the proposal.

4.3. **Entire Agreement (Parol evidence)**: The contract, as specified above, represents the final written expression of agreement. All agreements are contained herein and no other agreements or representations that materially alter it are acceptable.

4.4. **Assignment of Contract**: No assignment of contract may be made without the prior written approval of Region 10 ESC. Purchase orders and payment can only be made to awarded vendor unless otherwise approved by Region 10 ESC. Awarded vendor is required to notify Region 10 ESC when any material change in operations is made that may adversely affect members (i.e. awarded vendor bankruptcy, change of ownership, merger, etc.).

4.5. **Contract Alterations**: No alterations to the terms of this contract shall be valid or binding unless authorized and signed with a "wet signature" by a Region 10 ESC staff member.

4.6. **Order of precedence**: In the event of a conflict in the provisions of the contract as accepted by Region 10 ESC, the following order of precedence shall prevail:

- General terms and conditions
- Specifications and scope of work
- Attachments and exhibits
- Documents referenced or included in the solicitation

4.8 **Supplemental Agreements**: The entity participating in the Region 10 ESC contract and awarded vendor may enter into a separate supplemental agreement to further define the level of service requirements over and above the minimum defined in this contract i.e. invoice requirements, ordering requirements, specialized delivery, etc. Any supplemental agreement developed as a result of this contract is exclusively between the participating entity and awarded vendor. Neither Region 10 ESC, Equalis Group, its agents, members and employees shall be made party to any claim for breach of such agreement.

ARTICLE 5- TERMINATION OF CONTRACT

5.1. **Cancellation for non-performance or contractor deficiency:** Region 10 ESC may terminate any contract if Members have not used the contract, or if purchase volume is determined to be low volume in any 12-month period. Region 10 ESC reserves the right to cancel the whole or any part of this contract due to failure by contractor to carry out any obligation, term or condition of the contract. Region 10 ESC may issue a written deficiency notice to contractor for acting or failing to act in any of the following:

i. Providing material that does not meet the specifications of the contract;
ii. Providing work and/or material that was not awarded under the contract;
iii. Failing to adequately perform the services set forth in the scope of work and specifications;
iv. Failing to complete required work or furnish required materials within a reasonable amount of time;
v. Failing to make progress in performance of the contract and/or giving Region 10 ESC reason to believe that contractor will not or cannot perform the requirements of the contract; and/or
vi. Performing work or providing services under the contract prior to receiving a Region 10 ESC reviewed purchase order for such work.

Upon receipt of a written deficiency notice, contractor shall have ten (10) days to provide a satisfactory response to Region 10 ESC. Failure to adequately address all issues of concern may result in contract cancellation. Upon cancellation under this paragraph, all goods, materials, work, documents, data and reports prepared by contractor under the contract shall become the property of the Member on demand.

5.2 **Termination for cause**: If, for any reason, the Vendor fails to fulfill its obligation in a timely manner, or if the vendor violates any of the covenants, agreements, or stipulations of this contract, Region 10 ESC reserves the right to terminate the contract immediately and pursue all other applicable remedies afforded by law. Such termination shall be effective by delivery of notice, to the vendor, specifying the effective date of termination. In such event, all documents, data, studies, surveys, drawings, maps, models and reports prepared by vendor for this solicitation may become the property of the participating agency or entity. If such event does occur then vendor will be entitled to receive just and equitable compensation for the satisfactory work completed on such documents.

5.3 **Delivery/Service failures**: Failure to deliver goods or services within the time specified or within a reasonable time period as interpreted by the purchasing agent, or failure to make replacements or corrections of rejected articles/services when so requested shall constitute grounds for the contract to be terminated. In the event that the participating agency or entity must purchase in an open market, contractor agrees to reimburse the participating agency or entity, within a reasonable time period, for all expenses incurred.

5.4 **Force Majeure**: If by reason of Force Majeure, either party hereto shall be rendered unable wholly or in part to carry out its obligations under this Agreement then such party shall give notice and full particulars of Force Majeure in writing to the other party within a reasonable time after occurrence of the event or cause relied upon, and the obligation of the party giving such notice, so far as it is affected by such Force Majeure, shall be suspended during the continuance of the inability then claimed, except as hereinafter provided, but for no longer period, and such party shall endeavor to remove or overcome such inability with all reasonable dispatch.

The term Force Majeure as employed herein, shall mean acts of God, strikes, lockouts, or other industrial disturbances, act of public enemy, orders of any kind of government of the United States or the State of Texas or any civil or military authority; insurrections; riots; epidemics; landslides; lighting; earthquake; fires; hurricanes; storms; floods; washouts; droughts; arrests; restraint of government and people; civil disturbances; explosions, breakage or accidents to machinery, pipelines or canals, or other causes not reasonably within the control of the party claiming such inability. It is understood and agreed that the settlement of strikes and lockouts shall be entirely within the discretion of the party having the difficulty, and that the above requirement that any Force Majeure shall be remedied with all reasonable dispatch shall not require the settlement of strikes and lockouts by acceding to the demands of the opposing party or parties when such settlement is unfavorable in the judgment of the party having the difficulty

5.5 **Standard Cancellation**: Either party may cancel this contract in whole or in part by providing written notice. The cancellation will take effect 90 business days after the other party receives the notice of cancellation. After the 90th business day all work will cease following completion of final purchase order. Region 10 ESC reserves the right to request additional items not already on contract at any time.

ARTICLE 6- LICENSES

6.1 **Duty to keep current license:** Vendor shall maintain in current status all federal, state and local licenses, bonds and permits required for the operation of the business conducted by vendor. Vendor shall remain fully informed of and in compliance with all ordinances and regulations pertaining to the lawful provision of services under the contract. Region 10 ESC reserves the right to stop work and/or cancel the contract of any vendor whose license(s) expire, lapse, are suspended or terminated.

6.2 **Suspension or Debarment**: Respondent shall provide a letter in the proposal notifying Region 10 ESC of any debarment, suspension or other lawful action taken against them by any federal, state, or local government within the last five (5) years that precludes Respondent or its employees from participating in any public procurement activity. The letter shall state the duration of the suspension or action taken, the relevant circumstances and the name of the agency imposing the suspension. Failure to supply or disclose this information may be grounds for cancellation of contract.

6.3 **Survival Clause:** All applicable software license agreements, warranties or service agreements that were entered into between Vendor and Customer/participating member under the terms and conditions of the Contract shall survive the expiration or termination of the Contract. All Purchase Orders issued and accepted by Order Fulfiller shall survive expiration or termination of the Contract.

ARTICLE 7- DELIVERY PROVISIONS

7.1 **Delivery**: Vendor shall deliver said materials purchased on this contract to the participating member issuing a Purchase Order. Conforming product shall be shipped within 7 days of receipt of Purchase Order. If delivery is not or cannot be made within this time period the vendor must receive authorization from the purchasing agency for the delayed delivery. At this point the participating entity may cancel the order if estimated shipping time is not acceptable.

7.2 **Inspection & Acceptance**: If defective or incorrect material is delivered, purchasing agency may make the determination to return the material to the vendor at no cost to the purchasing agency. The vendor agrees to pay all shipping costs for the return shipment. Vendor shall be responsible for arranging the return of the defective or incorrect material.

7.3 **Responsibility for supplies tendered:** Vendor shall be responsible for the materials or supplies covered by this contract until they are delivered to the designated delivery point.

7.4 **Shipping Instructions**: Unless otherwise specified, each case, crate, barrel, package, etc, delivered under this contract must be plainly labeled, securely tagged, stating Vendor's name, purchase order number, quantity contained therein, and delivery address as indicated in the order. Deliveries must be made within the hours of 8:00 am – 4:00 pm. Deliveries at any other time (including Saturdays, Sundays and holidays) will not be accepted unless arrangements have been made in advance with the receiver at the delivery point. Vendor understands that it is their responsibility to ensure compliance with the delivery instructions outlined in this agreement.

7.5 **Additional charges**: Unless bought on F.O.B. "shipping point" and Vendor prepays transportation, no delivery charges shall be added to invoices except when express delivery is authorized and substituted on orders for the method specified in the contract. In such cases, the difference between freight or mail and express charges may be added to the invoice.

7.6 **Buyer's delays**: Region 10 ESC will not be responsible for any late fees due the prime contractor by the participating member. The prime contractor will negotiate with the participating agency for the recovery of damages related to expenses incurred by the vendor for a delay for which the Region 10 ESC member is responsible, which is unreasonable, and which was not within the contemplation of the parties to the contract between the two parties.

ARTICLE 8- BILLING AND REPORTING

8.1 **Payments**: The participating entity using the contract will make payments directly to the awarded vendor.
Payment shall be made after satisfactory performance, in accordance with all provisions thereof, and upon receipt of a properly completed invoice.

8.2 **Tax Exempt Status**: Since this is a national contract, knowing the tax laws in each state is the sole responsibility of the Vendor.

8.3 **Reporting**: Vendor shall electronically provide Equalis Group with a detailed line item monthly report showing the dollar volume of all member product sales under the contract for the previous month. Reports shall be sent via e-mail to Equalis Group offices at info@equalisgroup.org. Reports are due on the **fifteenth (15th)** day after the close of the previous month. It is the responsibility of the awarded vendor to collect and compile all sales under the contract from participating members and submit one (1) report. Fields below marked as *required indicate a required field. All other fields are preferred, but not required:

Member Data	Equalis Member ID
	Vendor Customer Number *required (or Equalis Member ID)
	Customer Name *required
	Customer Street Address *required
	Customer City *required
	Customer Zip Code *required
	Customer State *required
Distributor Data	Distributor Name
	Distributor ID
	Distributor Street Address
	Distributor City
	Distributor Zip Code
	Distributor State
Product Data	Product Category level 1
	Distributor Product Number
	Manufacturer Product Number
	Product Description
	Product Brand Name
	Product packaging Unit of Measure level 1
	Product packaging Unit of Measure level 2
	Product packaging Unit of Measure level 3

Spend Data	Purchase Unit of Measure
	Purchase Quantity
	Distributor Landed Cost Total $ (without deviations)
	Distributor Landed Cost Total $ (with mfr deviations)
	Customer Purchase Total $ *required

	Admin Fee % *required
	Admin Fee $ *required

ARTICLE 9- PRICING

9.1 **Market competitive guarantee**: Vendor agrees to provide market competitive pricing, based on the value offered upon award, to Region 10 ESC and its participating public agencies throughout the duration of the contract.

9.2 **Price increase**: Should it become necessary or proper during the term of this contract to make any change in design or any alterations that will increase expense, Region 10 ESC must be notified immediately. Price increases must be approved by Lead Agency and no payment for additional materials or services, beyond the amount stipulated in the contract, shall be paid without prior approval. All price increases must be supported by manufacture documentation, or a formal cost justification letter.

Vendor must honor previous prices for thirty (30) days after approval and written notification from Region 10 ESC if requested.

It is Vendor's responsibility to keep all pricing up to date and on file with Region 10 ESC. All price changes must be provided to Region 10 ESC, using the same format as was accepted in the original contract.

9.3 **Additional Charges**: All deliveries shall be freight prepaid, F.O.B. destination and shall be included in all pricing offered unless otherwise clearly stated in writing.

9.4 **Price reduction and adjustment:** Price reduction may be offered at any time during contract and shall become effective upon notice of acceptance from Region 10 ESC. Special, time-limited reductions are permissible under the following conditions: 1) reduction is available to all Members equally; 2) reduction is for a specific time period, normally not less than thirty (30) days; 3) original price is not exceeded after the time-limit; and 4) Region 10 ESC has approved the new prices prior to any offer of the prices to a Member. Vendor shall offer Region 10 ESC any published price reduction during the contract period.

9.5 **Prevailing Wage**: It shall be the responsibility of the Vendor to comply, when applicable, with the prevailing wage legislation in effect in the jurisdiction of the purchaser (Region 10 ESC or its Participating Members). It shall further be the responsibility of the Vendor to monitor the prevailing wage rates as established by the appropriate Department of Labor for any increase in rates during the term of this contract and adjust wage rates accordingly.

9.6 **Administrative Fees:** The Vendor agrees to pay administrative fees to Equalis Group based on the terms set in Attachment A. All pricing submitted to Region 10 ESC shall include the administrative fee to be remitted to Equalis Group by the awarded vendor.

9.7 **Price Calculation:** Cost plus a percentage as a primary mechanism to calculate pricing is not allowed. Pricing may either be in the form of line item pricing, defined as a specific individual price on a product or service, or a percentage discount from a verifiable catalog or price list. Other discounts or incentives may be offered.

ARTICLE 10- PRICING AUDIT

10.1 **Audit rights:** Vendor shall, at Vendor's sole expense, maintain appropriate due diligence of all purchases made by Region 10 ESC and any participating entity that accesses this Agreement. Equalis Group and Region 10 ESC each reserve the right to audit the accounting for a period of three (3) years from the time such purchases are made. This audit right shall survive termination of this Agreement for a period of one (1) year from the effective date of termination. In the State of New Jersey, this audit right shall survive termination of this Agreement for a period of five (5) years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request. Region 10 ESC shall have the authority to conduct random audits of Vendor's pricing that is offered to eligible entities at Region 10 ESC's sole cost and expense. Notwithstanding the foregoing, in the event that Region 10 ESC is made aware of any pricing being offered to eligible agencies that is materially inconsistent with the pricing under this agreement, Region 10 ESC shall have the ability to conduct an extensive audit of Vendor's pricing at Vendor's sole cost and expense. Region 10 ESC may conduct the audit internally or may engage a third-party auditing firm. In the event of an audit, the requested materials shall be provided in the format and at the location designated by Region 10 ESC or Equalis Group.

ARTICLE 11- PROPOSER PRODUCT LINE REQUIREMENTS

11.1 **Current products**: Proposals shall be for materials and equipment in current production and marketed to the general public and education/government agencies at the time the proposal is submitted.

11.2 **Discontinued products**: If a product or model is discontinued by the manufacturer, Vendor may substitute a new product or model if the replacement product meets or exceeds the specifications and performance of the discontinued model and if the discount is the same or greater than the discontinued model.

11.3 **New products/Services**: New products and/or services that meet the scope of work may be added to the contract. Pricing shall be equivalent to the percentage discount for other products. Vendor may replace or add product lines to an existing contract if the line is replacing or supplementing products on contract, is equal or superior to the original products offered, is discounted in a similar or to a greater degree, and if the products meet the requirements of the solicitation. No products and/or services may be added to avoid competitive procurement requirements. Region 10 ESC may require additions to be submitted with documentation from Participating Members demonstrating an interest in, or a potential requirement for, the new product or service. Region 10 ESC may reject any additions without cause.

11.4 **Options**: Optional equipment for products under contract may be added to the contract at the time they become available under the following conditions: 1) the option is priced at a discount similar to other options; 2) the option is an enhancement to the unit that improves performance or reliability.

11.5 **Product line**: Vendors with a published catalog may submit the entire catalog. Region 10 ESC reserves the right to select products within the catalog for award without having to award all contents. Region 10 ESC may reject any addition of equipment options without cause.

11.6 **Warranty conditions**: All supplies, equipment and services shall include manufacturer's minimum standard warranty and one (1) year labor warranty unless otherwise agreed to in writing.

11.7 **Buy American requirement:** (for New Jersey and all other applicable States) Vendors may only use unmanufactured construction material mined or produced in the United States, as required by the Buy American Act. Where trade agreements apply, to the extent permitted by applicable law, then unmanufactured construction material mined or produced in a designated country may also be used. Vendors are required to check state specific requirements to ensure compliance with this requirement.

ARTICLE 12- SITE REQUIREMENTS

12.1 **Cleanup**: Vendor shall clean up and remove all debris and rubbish resulting from their work as required or directed by Member. Upon completion of the work, the premises shall be left in good repair and an orderly, neat, clean and unobstructed condition conducive to the Member's business purpose.

12.2 **Site Preparation**: Vendor shall not begin a project for which Participating Member has not prepared the site, unless Vendor does the preparation work at no cost, or until Participating Member includes the cost of site preparation in a purchase order to the contractor. Site preparation includes, but is not limited to moving furniture, moving equipment or obstructions to the work area, installation of wiring for networks or any other necessary pre-installation requirements.

12.3 **Registered sex offender restrictions**: For work to be performed at schools, Vendor agrees that no employee or employee of a subcontractor who has been adjudicated to be a registered sex offender will perform work at any time when students are or are reasonably expected to be present. Vendor agrees that a violation of this condition shall be considered a material breach and may result in the cancellation of the purchase order at the Participating Member's discretion. Vendor must identify any additional costs associated with compliance of this term. If no costs are specified, compliance with this term will be provided at no additional charge. Vendor is also responsible for ensuring that their employees or contractors who have direct contact with students are properly fingerprinted and background checked in accordance with local state law, if applicable.

12.4 **Safety measures**: Vendor shall take all reasonable precautions for the safety of employees on the worksite, and shall erect and properly maintain all necessary safeguards for protection of workers and the public. Vendor shall post warning signs against all hazards created by its operation and work in progress. Proper precautions shall be taken pursuant to state law and standard practices to protect workers, general public and existing structures from injury or damage.

12.5 **Smoking/Tobacco**: Persons working under the contract shall adhere to local tobacco and smoking (including e-cigarettes/vaping) policies. Smoking will only be permitted in posted areas or off premises.

12.6 **Stored materials**: Upon prior written agreement between the vendor and Member, payment may be made for materials not incorporated in the work but delivered and suitably stored at the site or some other location, for installation at a later date. An inventory of the stored materials must be provided to Participating Member with the application for payment seeking compensation for stored materials. Such materials must be stored and protected in a secure location, and be insured for their full value by the vendor against loss and damage. Vendor agrees to provide proof of coverage and/or addition of Participating Member as an additional insured upon Participating Member's request. Additionally, if stored offsite, the materials must also be clearly identified as property of buying Participating Member and be separated from other materials. Participating Member must be allowed reasonable opportunity to inspect and take inventory of stored materials, on or offsite, as necessary.

Until final acceptance by the Participating Member, it shall be the Vendor's responsibility to protect all materials and equipment. Vendor warrants and guarantees that title for all work, materials and equipment shall pass to the Member upon final acceptance.

12.7 **Maintenance Facilities and Support**: It is preferred that each contractor should have maintenance facilities and a support system available for servicing and repair of product and/or equipment. If a third party is to be used to provide maintenance and support to the participating member, Respondent must notify Region 10 ESC of that third party information. All technicians, applicators, installers shall be fully certified, trained and licensed to perform said duties.

ARTICLE 13- MISCELENOUS

13.1 **Funding Out Clause**: Any/all contracts exceeding one (1) year shall include a standard "funding out" clause. A contract for the acquisition, including lease, of real or personal property is a commitment of the entity's current revenue only, provided the contract contains either or both of the following provisions:

"Retains to the entity the continuing right to terminate the contract at the expiration of each budget period during the term of the contract and is conditioned on a best efforts attempt by the entity to obtain appropriate funds for payment of the contract in the subsequent fiscal year."

13.2 **Disclosures**: Vendor affirms that he/she has not given, offered to give, nor intends to give at any time hereafter any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor or service to a public servant in connection with this contract.

Vendor has a continuing duty to disclose a complete description of any and all relationships that might be considered a conflict of interest in doing business with participants in Equalis Group.

Vendor affirms that, to the best of his/her knowledge, the offer was arrived at independently, and was submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over other vendors in the award of this contract.

13.3 **Indemnity**: Vendor shall protect, indemnify, and hold harmless both Region 10 ESC and Equalis Group and its participants, administrators, employees and agents against all claims, damages, losses and expenses arising out of or resulting from the actions of Vendor, Vendor employees or Vendor subcontractors in the preparation of the solicitation and the later execution of the contract, including any supplemental agreements with members. Any litigation involving either Region 10 ESC or Equalis Group, its administrators and employees and agents shall be in a court of competent jurisdiction in Dallas County, Texas. Texas law shall apply to any such suit, without giving effect to its choice of laws provisions. Any litigation involving Equalis Group participating members shall be in the jurisdiction of the participating agency.

13.4 **Franchise Tax**: Vendor hereby certifies that he/she is not currently delinquent in the payment of any required franchise taxes, and shall remain current on any such franchise taxes throughout the term of this contract.

13.5 **Marketing**: Vendor agrees to allow Region 10 ESC and Equalis Group to use their name and logo within website, marketing materials and advertisement. Any use of the Region 10 ESC or Equalis Group name and logo

or any form of publicity, inclusive of press releases, regarding this contract by Vendor must have prior approval from Region 10 ESC.

13.6 **Insurance**: Unless otherwise modified elsewhere in this document, prior to commencing services under this contract for a participating member, contractor shall procure, provide and maintain during the life of this agreement comprehensive public liability insurance to include course of construction insurance and automobile liability, providing limits of not less than $1,000,000.00 per occurrence. The insurance form will be an "all risk" type of policy with standard exclusions. Coverage will include temporary structures, scaffolding, temporary office trailers, materials, and equipment. Contractor shall pay for the deductibles required by the insurance provided under this agreement.

Certificates of insurance shall be delivered to the participant prior to commencement of work. The insurance company shall be licensed to do business and write the appropriate lines of insurance in the applicable state in which work is being conducted. Vendor shall give the participating entity a minimum of ten (10) days notice prior to any modifications or cancellation of policies. Vendor shall require all subcontractors performing any work to maintain coverage as specified.

Prior to commencing any work under this contract, any subcontractor shall also procure, provide, and maintain, at its own expense until final acceptance of the work performed, insurance coverage in a form acceptable to the prime contractor. All subcontractors shall provide worker's compensation insurance which waives all subrogation rights against the prime contractor and member.

13.7 **Subcontracts/Sub Contractors**: If Vendor serves as prime contractor, it shall not enter into any subcontract subject to this solicitation without prior approval from Region 10 ESC. Any/all subcontractors shall abide by the terms and conditions of this contract and the solicitation.

No subcontract relationships shall be entered into with a party not licensed to do business in the jurisdiction in which the work will be performed. Contractor must use subcontractors openly, include such arrangements in the proposal, and certify upon request that such use complies with the rules associated with the procurement codes and statutes in the state in which the contractor is conducting business.

Contractor agrees to pay subcontractors in a timely manner. Failure to pay subcontractors for work faithfully performed and properly invoiced may result in suspension or termination of this contract. Prior to participating member's release of final retained amounts, Contractor shall produce verified statements from all subcontractors and material suppliers that those entities have been paid in full amounts due and owing to them.

13.8 **Legal Obligations**: It is the Respondent's responsibility to be aware of and comply with all local, state, and federal laws governing the sale of products/services identified in this RFP and any awarded contract and shall comply with all while fulfilling the RFP. Applicable laws and regulation must be followed even if not specifically identified herein.

13.9 **Boycott Certification:** Respondents hereby certify that during the term of any Agreement, it does not boycott Israel and will not boycott Israel. "Boycott" means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes.

13.10 **Venue:** All parties agree that venue for any litigation arising from this contract shall lie in Richardson, Dallas County, Texas, and that the laws of the State of Texas shall govern the rights of the parties and the validity

and interpretation of any purchase order, contract, or service agreement that shall arise from and include this proposal request.

[Remainder of Page Intentionally Left Blank- Signatures follow on Signature Form]

CONTRACT SIGNATURE FORM

The undersigned hereby proposes and agrees to furnish goods and/or services in strict compliance with the terms, specifications and conditions at the prices proposed within response unless noted in writing. The undersigned further certifies that he/she is an officer of the company and has authority to negotiate and bind the company named below and has not prepared this proposal in collusion with any other Respondent and that the contents of this proposal as to prices, terms or conditions of said proposal have not been communicated by the undersigned nor by any employee or agent to any person engaged in this type of business prior to the official opening of this proposal.

Prices are guaranteed: **120 days**

Company name	TDIndustries, Inc.
Address	9525 Derrington Road
City/State/Zip	Houston, Texas 77064
Telephone No.	972.888.9500
Fax No.	972.888.9507
Email address	crystal.seiler@tdindustries.com
Printed name	Crystal Seiler
Position with company	PST, Manager
Authorized signature	

Term of contract _____ **to** _____

Unless otherwise stated, all contracts are for a period of three (2) years with an option to renew annually for an additional four (3) years if agreed to by Region 10 ESC. Vendor shall honor all administrative fees for any sales made based on the contract whether renewed or not.

_____ _____

Region 10 ESC Authorized Agent Date

_____

Print Name

Equalis Group Contract Number _____

TAB 6

TAB 6 CONTENTS:

APPENDIX F: ADDITIONAL REQUIRED DOCUMENTS

OPEN RECORDS POLICY ACKNOWLEDGMENT AND ACCEPTANCE

Be advised that all information and documents submitted will be subject to the Public Information Act requirements governed by Chapter 552 of the Texas Government Code.

Because contracts are awarded by a Texas governmental entity, all responses submitted are subject to release as public information after contracts are executed. If a Respondent believes that its response, or parts of its response, may be exempted from disclosure to the public, the Respondent must specify page-by-page and line-by-line the parts of the response, which it believes, are exempted from disclosure. In addition, the Respondent must specify which exception(s) are applicable and provide detailed reasons to substantiate the exception(s). Respondent must provide this information on the "Acknowledgement and Acceptance to Region 10 ESC's Public Information Act Policy" form found on the next page of this solicitation. Any information that is unmarked will be considered public information and released, if requested under the Public Information Act.

The determination of whether information is confidential and not subject to disclosure is the duty of the Office of Attorney General (OAG). Region 10 ESC must provide the OAG with the information requested in order for the OAG to render an opinion. In such circumstances, Respondent will be notified in writing that the material has been requested and delivered to the OAG. Respondent will have an opportunity to make arguments to the OAG in writing regarding the exception(s) to the TPIA that permit the information to be withheld from public disclosure. Respondents are advised that such arguments to the OAG must be specific and well-reasoned--vague and general claims to confidentiality by the Respondent are generally not acceptable to the OAG. Once the OAG opinion is received by Region 10 ESC, Region 10 ESC must comply with the opinions of the OAG. Region 10 ESC assumes no responsibility for asserting legal arguments on behalf of any Respondent. Respondents are advised to consult with their legal counsel concerning disclosure issues resulting from this procurement process and to take precautions to safeguard trade secrets and other proprietary information.

After completion of award, these documents will be available for public inspection.

Signature below certifies complete acceptance of Region 10 ESC's Open Records Policy, except as noted below (additional pages may be attached, if necessary). Check one of the following responses to the Acknowledgment and Acceptance of Region 10 ESC's Open Records Policy below:

☒ We acknowledge Region 10 ESC's Public Information Act policy and declare that no information submitted with this proposal, or any part of our proposal, is exempt from disclosure under the Public Information Act.

(*Note: All information believed to be a trade secret or proprietary must be listed below. It is further understood that failure to identify such information, in strict accordance with the instructions below, will result in that information being considered public information and released, if requested under the Public Information Act.)*

☐ We declare the following information to be a trade secret or proprietary and exempt from disclosure under the Public Information Act.

(Note: Respondent must specify page-by-page and line-by-line the parts of the response, which it believes, are exempt. In addition, Respondent must specify which exception(s) are applicable and provide detailed reasons to substantiate the exception(s).

September 2, 2020
Date

PST, Manager
Authorized Signature & Title

ATTACHMENT A: Requirements for Lead Agency Agreement To be administered by Equalis Group

The following exhibits are used in evaluating and administering Lead Agency Agreements and are preferred by Equalis Group. Redlined copies of the exhibits should not be submitted with the response. Should a respondent be recommended for award, these exhibits will be negotiated and executed between Equalis Group and the respondent. **Respondents must select one of the following options for submitting their response and submit this page only**.

☒ Respondent agrees to all terms and conditions outlined in each of the following exhibits

☐ Respondent wishes to negotiate directly with Equalis Group on terms and conditions outlined in each of the following exhibits. Negotiations will commence after sealed bids are opened and Region 10 has determined the respondent met all requirements in their response and may be eligible for award.

- Equalis Group Exhibit A – EQUALIS GROUP RESPONSE FOR LEAD AGENCY AGREEMENT
- Equalis Group Exhibit B – EQUALIS GROUP ADMINISTRATION AGREEMENT
- Equalis Group Exhibit C – EQUALIS GROUP MASTER INTERGOVERNMENTAL COOPERATIVE PURCHASING AGREEMENT
- Equalis Group Exhibit D – EQUALIS GROUP CONTRACT SALES REPORTING TEMPLATE Equalis Group

Appendix F: ADDITIONAL REQUIRED DOCUMENTS

- DOC #1 Clean Air and Water Act
- DOC #2 Debarment Notice
- DOC #3 Lobbying Certification
- DOC #4 Contractors Requirements
- DOC #5 Antitrust Certification Statement
- DOC #6 Implementation of House Bill 1295
- DOC #7 Boycott Certification
- DOC #8 Terrorist State Certification
- DOC #9 Resident Certification
- DOC #10 Federal Funds Certification Form

FOR VENDORS INTENDING TO DO BUSINESS IN ARIZONA:

- DOC #11 Arizona Contractor Requirements

FOR VENDORS INTENDING TO DO BUSINESS IN NEW JERSEY:

- DOC #12 Ownership Disclosure Form
- DOC #13 Non-Collusion Affidavit
- DOC #14 Affirmative Action Affidavit
- DOC #15 Political Contribution Disclosure Form
- DOC #16 Stockholder Disclosure Form

GENERAL TERMS & CONDITIONS ACCEPTANCE FORM

- DOC #17 General Terms & Conditions and Acceptance Form

New Jersey vendors are also required to comply with the following New Jersey statutes when applicable:

- All anti-discrimination laws, including those contained in N.J.S.A. 10:2-1 through N.J.S.A. 10:2-14, N.J.S.A. 10:5-1, and N.J.S.A. 10:5-31 through 10:5-38.
- Compliance with Prevailing Wage Act, N.J.S.A. 34:11-56.26, for all contracts within the contemplation of the Act.
- Compliance with Public Works Contractor Registration Act, N.J.S.A. 34:11-56.26
- Bid and Performance Security, as required by the applicable municipal or state statutes.

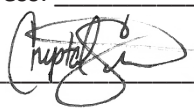
DOC #1 CLEAN AIR AND WATER ACT

I, the Vendor, am in compliance with all applicable standards, orders or regulations issued pursuant to the Clean Air Act of 1970, as Amended (42 U.S. C. 1857 (h), Section 508 of the Clean Water Act, as amended (33 U.S.C. 1368), Executive Order 117389 and Environmental Protection Agency Regulation, 40 CFR Part 15 as required under OMB Circular A-102, Attachment O, Paragraph 14 (1) regarding reporting violations to the grantor agency and to the United States Environment Protection Agency Assistant Administrator for the Enforcement.

Potential Vendor: TDIndustries, Inc.

Title of Authorized Representative: Crystal Seiler - PST, Manager

Mailing Address: 9525 Derrington Road, Houston, Texas 77064

Signature: 

DOC #2 DEBARMENT NOTICE

I, the Vendor, certify that my company has not been debarred, suspended or otherwise ineligible for participation in Federal Assistance programs under Executive Order 12549, “Debarment and Suspension”, as described in the Federal Register and Rules and Regulations.

Potential Vendor: TDIndustries, Inc.

Title of Authorized Representative: Crystal Seiler - PST, Manager

Mailing Address: 9525 Derrington Road, Houston, Texas 77064

Signature: 

DOC #3 LOBBYING CERTIFICATION

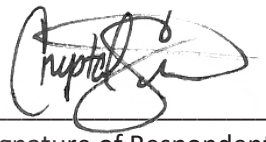
Submission of this certification is a prerequisite for making or entering into this transaction and is imposed by Section 1352, Title 31, U.S. Code. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Any person who fails to file the required certification shall be subject to civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

The undersigned certifies, to the best of his/her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of a Federal contract, the making of a Federal grant, the making of a Federal loan, the entering into a cooperative agreement, and the extension, continuation, renewal, amendment, or modification of a Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract or cooperative agreement, the undersigned shall complete and submit Standard Form LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all covered sub-awards exceeding $100,000 in Federal funds at all appropriate tiers and that all sub-recipients shall certify and disclose accordingly.



Signature of Respondent

August 30, 2020

Date

DOC #4 CONTRACTOR CERTIFICATION REQUIREMENTS

Contractor's Employment Eligibility

By entering the contract, Contractor warrants compliance with the Federal Immigration and Nationality Act (FINA), and all other federal and state immigration laws and regulations. The Contractor further warrants that it is in compliance with the various state statutes of the states it will operate this contract in.

Participating Government Entities including School Districts may request verification of compliance from any Contractor or subcontractor performing work under this Contract. These Entities reserve the right to confirm compliance in accordance with applicable laws.

Should the Participating Entities suspect or find that the Contractor or any of its subcontractors are not in compliance, they may pursue any and all remedies allowed by law, including, but not limited to: suspension of work, termination of the Contract for default, and suspension and/or debarment of the Contractor. All costs necessary to verify compliance are the responsibility of the Contractor.

The Respondent complies and maintains compliance with the appropriate statutes which requires compliance with federal immigration laws by State employers, State contractors and State subcontractors in accordance with the E-Verify Employee Eligibility Verification Program.

Contractor shall comply with governing board policy of the Region 10 ESC Participating entities in which work is being performed.

Fingerprint & Criminal Background Checks

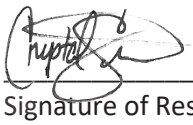
If required to provide services on school district property at least five (5) times during a month, contractor shall submit a full set of fingerprints to the school district if requested of each person or employee who may provide such service. Alternately, the school district may fingerprint those persons or employees. An exception to this requirement may be made as authorized in Governing Board policy. The district shall conduct a fingerprint check in accordance with the appropriate state and federal laws of all contractors, subcontractors or vendors and their employees for which fingerprints are submitted to the district. Contractor, subcontractors, vendors and their employees shall not provide services on school district properties until authorized by the District.

The Respondent shall comply with fingerprinting requirements in accordance with appropriate statutes in the state in which the work is being performed unless otherwise exempted.

Contractor shall comply with governing board policy in the school district or Participating Entity in which work is being performed.

Business Operations in Sudan, Iran

In accordance with A.R.S. 35-391 and A.R.S. 35-393, the Contractor hereby certifies that the contractor does not have scrutinized business operations in Sudan and/or Iran.



Signature of Respondent

August 30, 2020

Date

DOC #5 ANTITRUST CERTIFICATION STATEMENTS
(Tex. Government Code § 2155.005)

I affirm under penalty of perjury of the laws of the State of Texas that:

(1) I am duly authorized to execute this contract on my own behalf or on behalf of the company, corporation, firm, partnership or individual (Company) listed below;

(2) In connection with this proposal, neither I nor any representative of the Company has violated any provision of the Texas Free Enterprise and Antitrust Act, Tex. Bus. & Comm. Code Chapter 15;

(3) In connection with this proposal, neither I nor any representative of the Company has violated any federal antitrust law; and

(4) Neither I nor any representative of the Company has directly or indirectly communicated any of the contents of this proposal to a competitor of the Company or any other company, corporation, firm, partnership or individual engaged in the same line of business as the Company.

VENDOR TDIndustries, Inc.

ADDRESS 9525 Derrington Road

Houston, Texas 77064

PHONE 972.888.9500

FAX 972.888.9507

RESPONDANT

Signature

Lorraine Vuong
Printed Name

Cooperative Contracts Coordinator
Position with Company

AUTHORIZING OFFICIAL

Signature

Crystal Seiler
Printed Name

PST, Manager
Position with Company

CERTIFICATE OF INTERESTED PARTIES

FORM 1295

Complete Nos. 1 - 4 and 6 if there are interested parties.
Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.

OFFICE USE ONLY
CERTIFICATION OF FILING

Certificate Number:
2020-663342

Date Filed:
09/01/2020

Date Acknowledged:

1 Name of business entity filing form, and the city, state and country of the business entity's place of business.
TDIndustries, Inc.
Houston, TX United States

2 Name of governmental entity or state agency that is a party to the contract for which the form is being filed.
Region 10 ESC

3 Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the services, goods, or other property to be provided under the contract.
R10-1102
HVAC & Facility Systems, Automation, Installation, Service and Related Products & Services

4 Name of Interested Party	City, State, Country (place of business)	Nature of interest (check applicable)	
		Controlling	Intermediary

5 Check only if there is NO Interested Party. [X]

6 UNSWORN DECLARATION

My name is Crystal Seiler, and my date of birth is 10-16-85.

My address is 9525 Derrington Rd. (street), Houston (city), TX (state), 77064 (zip code), USA (country).

I declare under penalty of perjury that the foregoing is true and correct.

Executed in Harris County, State of Texas, on the 1 day of July (month), 2020 (year).

Signature of authorized agent of contracting business entity
(Declarant)

DOC #7 BOYCOTT CERTIFICATION

Respondents must certify that during the term of any Agreement, it does not boycott Israel and will not boycott Israel. “Boycott” means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes.

DOC #8 TERRORIST STATE CERTIFICATION

In accordance with Texas Government Code, Chapter 2252, Subchapter F, REGION 10 ESC is prohibited from entering into a contract with a company that is identified on a list prepared and maintained by the Texas Comptroller or the State Pension Review Board under Texas Government Code Sections 806.051, 807.051, or 2252.153. By execution of any agreement, the respondent certifies to REGION 10 ESC that it is not a listed company under any of those Texas Government Code provisions. Responders must voluntarily and knowingly acknowledge and agree that any agreement shall be null and void should facts arise leading the REGION 10 ESC to believe that the respondent was a listed company at the time of this procurement.

DOC #9 RESIDENT CERTIFICATION:

This Certification Section must be completed and submitted before a proposal can be awarded to your company. This information may be placed in an envelope labeled "Proprietary" and is not subject to public view. In order for a proposal to be considered, the following information must be provided. Failure to complete may result in rejection of the proposal:

As defined by Texas House Bill 602, a "nonresident Bidder" means a Bidder whose principal place of business is not in Texas, but excludes a contractor whose ultimate parent company or majority owner has its principal place of business in Texas.

Texas or Non-Texas Resident

- ☒ I certify that my company is a **"resident Bidder"**
- ☐ I certify that my company qualifies as a **"nonresident Bidder"**

If you qualify as a "nonresident Bidder," you must furnish the following information:

What is your resident state? (The state your principal place of business is located.)

TDIndustries, Inc. 9525 Derrington Road

Company Name Address

Houston, Texas 77064

City State Zip

DOC #10 FEDERAL FUNDS CERTIFICATION FORM

When a participating agency seeks to procure goods and services using funds under a federal grant or contract, specific federal laws, regulations, and requirements may apply in addition to those under state law. This includes, but is not limited to, the procurement standards of the Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards, 2 CFR 200 (sometimes referred to as the "Uniform Guidance" or "EDGAR" requirements). All Vendors submitting proposals must complete this Federal Funds Certification Form regarding Vendor's willingness and ability to comply with certain requirements which may be applicable to specific participating agency purchases using federal grant funds. This completed form will be made available to participating agencies for their use while considering their purchasing options when using federal grant funds. Participating agencies may also require Vendors to enter into ancillary agreements, in addition to the contract's general terms and conditions, to address the member's specific contractual needs, including contract requirements for a procurement using federal grants or contracts.

For each of the items below, Vendor should certify Vendor's agreement and ability to comply, where applicable, by having Vendor's authorized representative complete and initial the applicable lines after each section and sign the acknowledgment at the end of this form. If a vendor fails to complete any item in this form, Region 10 ESC will consider the Vendor's response to be that they are unable or unwilling to comply. A negative response to any of the items may, if applicable, impact the ability of a participating agency to purchase from the Vendor using federal funds.

1. Vendor Violation or Breach of Contract Terms:
Contracts for more than the simplified acquisition threshold currently set at $150,000, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 USC 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

Any Contract award will be subject to Region 10 ESC General Terms and Conditions, as well as any additional terms and conditions in any Purchase Order, participating agency ancillary contract, or Member Construction Contract agreed upon by Vendor and the participating agency which must be consistent with and protect the participating agency at least to the same extent as the Region 10 ESC Terms and Conditions.

The remedies under the Contract are in addition to any other remedies that may be available under law or in equity. By submitting a Proposal, you agree to these Vendor violation and breach of contract terms.

Does vendor agree? CS _____
(Initials of Authorized Representative)

2. Termination for Cause or Convenience:
When a participating agency expends federal funds, the participating agency reserves the right to immediately terminate any agreement in excess of $10,000 resulting from this procurement process in the event of a breach or default of the agreement by Offeror in the event Offeror fails to: (1) meet schedules, deadlines, and/or delivery dates within the time specified in the procurement solicitation, contract, and/or a purchase order; (2) make any payments owed; or (3) otherwise perform in accordance with the contract and/or the procurement solicitation. participating agency also reserves the right to terminate the contract immediately, with written notice to offeror, for convenience, if participating agency believes, in its sole discretion that it is in the best interest of participating agency to do so. Offeror will be compensated for work performed and accepted and goods accepted by participating agency as of the termination date if the contract is terminated for convenience of participating agency. Any award under this procurement process is not exclusive and participating agency reserves the right to purchase goods and services from other offerors when it is in participating agency's best interest.

Does vendor agree? CS _____
(Initials of Authorized Representative)

3. Equal Employment Opportunity:

Except as otherwise provided under 41 CFR Part 60, all participating agency purchases or contracts that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 shall be deemed to include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR Part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

The equal opportunity clause provided under 41 CFR 60-1.4(b) is hereby incorporated by reference. Vendor agrees that such provision applies to any participating agency purchase or contract that meets the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 and Vendor agrees that it shall comply with such provision.

Does vendor agree? CS _____
(Initials of Authorized Representative)

4. Davis-Bacon Act:
When required by Federal program legislation, Vendor agrees that, for all participating agency prime construction contracts/purchases in excess of $2,000, Vendor shall comply with the Davis-Bacon Act (40 USC 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, Vendor is required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determinate made by the Secretary of Labor. In addition, Vendor shall pay wages not less than once a week.

Current prevailing wage determinations issued by the Department of Labor are available at www.wdol.gov. Vendor agrees that, for any purchase to which this requirement applies, the award of the purchase to the Vendor is conditioned upon Vendor's acceptance of the wage determination.

Vendor further agrees that it shall also comply with the Copeland "Anti-Kickback" Act (40 USC 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled.

Does vendor agree? CS _____
(Initials of Authorized Representative)

5. Contract Work Hours and Safety Standards Act:
Where applicable, for all participating agency contracts or purchases in excess of $100,000 that involve the employment of mechanics or laborers, Vendor agrees to comply with 40 USC 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 USC 3702 of the Act, Vendor is required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 USC 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

Does vendor agree? CS _____
(Initials of Authorized Representative)

6. Right to Inventions Made Under a Contract or Agreement:
If the participating agency's Federal award meets the definition of "funding agreement" under 37 CFR 401.2(a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance or experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

Vendor agrees to comply with the above requirements when applicable.

Does vendor agree? CS _____
(Initials of Authorized Representative)

7. Clean Air Act and Federal Water Pollution Control Act:
Clean Air Act (42 USC 7401-7671q.) and the Federal Water Pollution Control Act (33 USC 1251-1387), as amended –Contracts and subgrants of amounts in excess of $150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act (42 USC 7401-7671q.) and the Federal Water Pollution Control Act, as amended (33 USC 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

When required, Vendor agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act and the Federal Water Pollution Control Act.

Does vendor agree? CS _____
(Initials of Authorized Representative)

8. Debarment and Suspension:
Debarment and Suspension (Executive Orders 12549 and 12689) – A contract award (see 2 CFR 180.220) must not be made to parties listed on the government-wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR Part 1966 Comp. p. 189) and 12689 (3CFR Part 1989 Comp. p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

Vendor certifies that Vendor is not currently listed on the government-wide exclusions in SAM, is not debarred, suspended, or otherwise excluded by agencies or declared ineligible under statutory or regulatory authority other than Executive Order 12549. Vendor further agrees to immediately notify the Cooperative and all participating agencies with pending purchases or seeking to purchase from Vendor if Vendor is later listed on the government-wide exclusions in SAM, or is debarred, suspended, or otherwise excluded by agencies or declared ineligible under statutory or regulatory authority other than Executive Order 12549.

Does vendor agree? CS _____
(Initials of Authorized Representative)

9. Byrd Anti-Lobbying Amendment:
Byrd Anti-Lobbying Amendment (31 USC 1352) -- Vendors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 USC 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award. As applicable, Vendor agrees to file all certifications and disclosures required by, and otherwise comply with, the Byrd Anti-Lobbying Amendment (31 USC 1352).

Does vendor agree? CS _____
(Initials of Authorized Representative)

10. Procurement of Recovered Materials:
For participating agency purchases utilizing Federal funds, Vendor agrees to comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act where applicable and provide such information and certifications as a participating agency may require to confirm estimates and otherwise comply. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory

level of competition, where the purchase price of the item exceeds $10,000 or the value of the quantity acquired during the preceding fiscal year exceeded $10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery, and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

Does vendor agree? CS
(Initials of Authorized Representative)

11. Profit as a Separate Element of Price:
For purchases using federal funds in excess of $150,000, a participating agency may be required to negotiate profit as a separate element of the price. See, 2 CFR 200.323(b). When required by a participating agency, Vendor agrees to provide information and negotiate with the participating agency regarding profit as a separate element of the price for a particular purchase. However, Vendor agrees that the total price, including profit, charged by Vendor to the participating agency shall not exceed the awarded pricing, including any applicable discount, under Vendor's Cooperative Contract.

Does vendor agree? CS
(Initials of Authorized Representative)

12. General Compliance and Cooperation with Participating Agencies:
In addition to the foregoing specific requirements, Vendor agrees, in accepting any Purchase Order from a participating agency, it shall make a good faith effort to work with participating agencies to provide such information and to satisfy such requirements as may apply to a particular participating agency purchase or purchases including, but not limited to, applicable recordkeeping and record retention requirements.

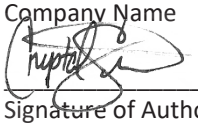
Does vendor agree? CS
(Initials of Authorized Representative)

13. Applicability to Subcontractors
Offeror agrees that all contracts it awards pursuant to the Contract shall be bound by the foregoing terms and conditions.

Does vendor agree? CS
(Initials of Authorized Representative)

By signature below, I certify that the information in this form is true, complete, and accurate and that I am authorized by my company to make this certification and all consents and agreements contained herein.

TDIndustries, Inc.
Company Name


Signature of Authorized Company Official

Crystal Seiler
Printed Name

PST, Manager
Title

August 30, 2020
Date

DOC #11 ADDITIONAL ARIZONA CONTRACTOR REQUIREMENTS

AZ Compliance with Federal and state requirements: Contractor agrees when working on any federally assisted projects with more than $2,000.00 in labor costs, to comply with all federal and state requirements, as well as Equal Opportunity Employment requirements and all other federal and state laws, statutes, etc. Contractor agrees to post wage rates at the work site and submit a copy of their payroll to the member for their files. Contractor must retain records for three years to allow the federal grantor agency access to these records, upon demand. Contractor also agrees to comply with the Arizona Executive Order 75-5, as amended by Executive Order 99-4.
When working on contracts funded with Federal Grant monies, contractor additionally agrees to comply with the administrative requirements for grants, and cooperative agreements to state, local and federally recognized Indian Tribal Governments.

AZ Compliance with workforce requirements: Pursuant to ARS 41-4401, Contractor and subcontractor(s) warrant their compliance with all federal and state immigration laws and regulations that relate to their employees, and compliance with ARS 23-214 subsection A, which states, …"every employer, after hiring an employee, shall verify the employment eligibility of the employee through the E-Verify program"
Region 10 ESC reserves the right to cancel or suspend the use of any contract for violations of immigration laws and regulations. Region 10 ESC and its members reserve the right to inspect the papers of any contractor or subcontract employee who works under this contract to ensure compliance with the warranty above.

AZ Contractor Employee Work Eligibility: By entering into this contract, contractor agrees and warrants compliance with A.R.S. 41-4401, A.R.S. 23-214, the Federal Immigration and Nationality Act (FINA), and all other Federal immigration laws and regulations. Region 10 ESC and/or Region 10 ESC members may request verification of compliance from any contractor or sub contractor performing work under this contract. Region 10 ESC and Region 10 ESC members reserve the right to confirm compliance. In the event that Region 10 ESC or Region 10 ESC members suspect or find that any contractor or subcontractor is not in compliance, Region 10 ESC may pursue any and all remedies allowed by law, including but not limited to suspension of work, termination of contract, suspension and/or debarment of the contractor. All cost associated with any legal action will be the responsibility of the contractor.

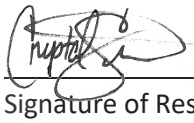
AZ Non-Compliance: All federally assisted contracts to members that exceed $10,000.00 may be terminated by the federal grantee for noncompliance by contractor. In projects that are not federally funded, Respondent must agree to meet any federal, state or local requirements as necessary. In addition, if compliance with the federal regulations increases the contract costs beyond the agreed on costs in this solicitation, the additional costs may only apply to the portion of the work paid by the federal grantee.

Registered Sex Offender Restrictions (Arizona): For work to be performed at an Arizona school, contractor agrees that no employee or employee of a subcontractor who has been adjudicated to be a registered sex offender will perform work at any time when students are present, or reasonably expected to be present. Contractor agrees that a violation of this condition shall be considered a material breach and may result in the cancellation of the purchase order at the Region 10 ESC member's discretion. Contractor must identify any additional costs associated with compliance to this term. If no costs are specified, compliance with this term will be provided at no additional charge.

Offshore Performance of Work Prohibited: Due to security and identity protection concerns, direct services under this contract shall be performed within the borders of the United States.

Terrorism Country Divestments: In accordance with A.R.S. 35-392, Region 10 ESC and Region 10 ESC members are prohibited from purchasing from a company that is in violation of the Export Administration Act. By entering into the contract, contractor warrants compliance with the Export Administration Act.

The undersigned hereby accepts and agrees to comply with all statutory compliance and notice requirements listed in this document.



August 30, 2020

Signature of Respondent Date

DOC #12 ***OWNERSHIP DISCLOSURE FORM*** **(N.J.S. 52:25-24.2)**

Pursuant to the requirements of P.L. 1999, Chapter 440 effective April 17, 2000 (Local Public Contracts Law), the Respondent shall complete the form attached to these specifications listing the persons owning 10 percent (10%) or more of the firm presenting the proposal.

Company Name: N/A - TD does not do work in New Jersey.

Street: _____

City, State, Zip Code: _____

Complete as appropriate:

I _____ , certify that I am the sole owner of _____ , that there are no partners and the business is not incorporated, and the provisions of N.J.S. 52:25-24.2 do not apply.

OR:

I _____ , a partner in _____ , do hereby certify that the following is a list of all individual partners who own a 10% or greater interest therein. I further certify that if one (1) or more of the partners is itself a corporation or partnership, there is also set forth the names and addresses of the stockholders holding 10% or more of that corporation's stock or the individual partners owning 10% or greater interest in that partnership.

OR:

I _____ , an authorized representative of _____ , a corporation, do hereby certify that the following is a list of the names and addresses of all stockholders in the corporation who own 10% or more of its stock of any class. I further certify that if one (1) or more of such stockholders is itself a corporation or partnership, that there is also set forth the names and addresses of the stockholders holding 10% or more of the corporation's stock or the individual partners owning a 10% or greater interest in that partnership.

(Note: If there are no partners or stockholders owning 10% or more interest, indicate none.)

Name	**Address**	**Interest**

I further certify that the statements and information contained herein, are complete and correct to the best of my knowledge and belief.

_____ _____

Authorized Signature and Title ***Date***

DOC #13 NON-COLLUSION AFFIDAVIT

Company Name:
Street:
City, State, Zip Code:

N/A - TD does not do work in New Jersey.

State of New Jersey

County of _____

I, _____ of the _____
Name City

in the County of _____, State of _____ of full age, being duly sworn according to law on my oath depose and say that:

I am the _____ of the firm of _____
Title Company Name

the Respondent making the Proposal for the goods, services or public work specified under the Harrison Township Board of Education attached proposal, and that I executed the said proposal with full authority to do so; that said Respondent has not directly or indirectly entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free, competitive bidding in connection with the above proposal, and that all statements contained in said bid proposal and in this affidavit are true and correct, and made with full knowledge that the Harrison Township Board of Education relies upon the truth of the statements contained in said bid proposal and in the statements contained in this affidavit in awarding the contract for the said goods, services or public work.

I further warrant that no person or selling agency has been employed or retained to solicit or secure such contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, except bona fide employees or bona fide established commercial or selling agencies maintained by

_____ _____
Company Name *Authorized Signature & Title*

Subscribed and sworn before me

this _____ day of _____, 20____

_____
Notary Public of New Jersey
My commission expires , 20____

SEAL

DOC #14 AFFIRMATIVE ACTION AFFIDAVIT (P.L. 1975, C.127)

Company Name: N/A - TD does not do work in New Jersey.
Street: _____
City, State, Zip Code: _____

Bid Proposal Certification:

Indicate below your compliance with New Jersey Affirmative Action regulations. Your proposal will be accepted even if you are not in compliance at this time. No contract and/or purchase order may be issued, however, until all Affirmative Action requirements are met.

Required Affirmative Action Evidence:

Procurement, Professional & Service Contracts (Exhibit A)
Vendors must submit with proposal:

1. *A photo copy of their Federal Letter of Affirmative Action Plan Approval* _____

OR

2. *A photo copy of their Certificate of Employee Information Report* _____

OR

3. *A complete Affirmative Action Employee Information Report (AA302)* _____

Public Work – Over $50,000 Total Project Cost:

A. *No approved Federal or New Jersey Affirmative Action Plan. We will complete Report Form AA201-A upon receipt from the Harrison Township Board of Education* _____

B. *Approved Federal or New Jersey Plan – certificate enclosed* _____

I further certify that the statements and information contained herein, are complete and correct to the best of my knowledge and belief.

_____ _____
Authorized Signature and Title ***Date***

P.L. 1995, c. 127 (N.J.A.C. 17:27)
MANDATORY AFFIRMATIVE ACTION LANGUAGE

PROCUREMENT, PROFESSIONAL AND SERVICE CONTRACTS

During the performance of this contract, the contractor agrees as follows:

The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation. The contractor will take affirmative action to ensure that such applicants are recruited and employed, and that employees are treated during employment, without regard to their age, race, creed, color,

national origin, ancestry, marital status, sex, affectional or sexual orientation. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this non-discrimination clause.

The contractor or subcontractor, where applicable will, in all solicitations or advertisement for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation.

The contractor or subcontractor, where applicable, will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer pursuant to P.L. 1975, c. 127, as amended and supplemented from time to time and the Americans with Disabilities Act.

The contractor or subcontractor agrees to attempt in good faith to employ minority and female workers trade consistent with the applicable county employment goal prescribed by N.J.A.C. 17:27-5.2 promulgated by the Treasurer pursuant to P.L. 1975, C.127, as amended and supplemented from time to time or in accordance with a binding determination of the applicable county employment goals determined by the Affirmative Action Office pursuant to N.J.A.C. 17:27-5.2 promulgated by the Treasurer pursuant to P.L. 1975, C.127, as amended and supplemented from time to time.

The contractor or subcontractor agrees to inform in writing appropriate recruitment agencies in the area, including employment agencies, placement bureaus, colleges, universities, labor unions, that it does not discriminate on the basis of age, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation, and that it will discontinue the use of any recruitment agency which engages in direct or indirect discriminatory practices.

The contractor or subcontractor agrees to revise any of it testing procedures, if necessary, to assure that all personnel testing conforms with the principles of job-related testing, as established by the statutes and court decisions of the state of New Jersey and as established by applicable Federal law and applicable Federal court decisions.

The contractor or subcontractor agrees to review all procedures relating to transfer, upgrading, downgrading and lay-off to ensure that all such actions are taken without regard to age, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation, and conform with the applicable employment goals, consistent with the statutes and court decisions of the State of New Jersey, and applicable Federal law and applicable Federal court decisions.

The contractor and its subcontractors shall furnish such reports or other documents to the Affirmative Action Office as may be requested by the office from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Affirmative Action Office for conducting a compliance investigation pursuant to Subchapter 10 of the Administrative Code (NJAC 17:27).

_____

Signature of Procurement Agent

DOC #15 C. 271 POLITICAL CONTRIBUTION DISCLOSURE FORM

Public Agency Instructions N/A - TD does not do work in New Jersey.

This page provides guidance to public agencies entering into contracts with business entities that are required to file Political Contribution Disclosure forms with the agency. **It is not intended to be provided to contractors.** What follows are instructions on the use of form local units can provide to contractors that are required to disclose political contributions pursuant to N.J.S.A. 19:44A-20.26 (P.L. 2005, c. 271, s.2). Additional information is available in Local Finance Notice 2006-1 (https://www.nj.gov/dca/divisions/dlgs/resources/lfns_2006.html).

1. The disclosure is required for all contracts in excess of $17,500 that are **not awarded** pursuant to a "fair and open" process (N.J.S.A. 19:44A-20.7).
2. Due to the potential length of some contractor submissions, the public agency should consider allowing data to be submitted in electronic form (i.e., spreadsheet, pdf file, etc.). Submissions must be kept with the contract documents or in an appropriate computer file and be available for public access. **The form is worded to accept this alternate submission.** The text should be amended if electronic submission will not be allowed.
3. The submission must be **received from the contractor and** on file at least 10 days prior to award of the contract. Resolutions of award should reflect that the disclosure has been received and is on file.
4. The contractor must disclose contributions made to candidate and party committees covering a wide range of public agencies, including all public agencies that have elected officials in the county of the public agency, state legislative positions, and various state entities. The Division of Local Government Services recommends that contractors be provided a list of the affected agencies. This will assist contractors in determining the campaign and political committees of the officials and candidates affected by the disclosure.
   a) The Division has prepared model disclosure forms for each county. They can be downloaded from the "County PCD Forms" link on the Pay-to-Play web site at https://www.state.nj.us/dca/divisions/dlgs/programs/pay_2_play.html They will be updated from time-to-time as necessary.
   b) A public agency using these forms **should edit them to properly reflect the correct legislative district**(s). As the forms are county-based, **they list all legislative districts** in each county. **Districts that do not represent the public agency should be removed from the lists.**
   c) Some contractors may find it easier to provide a single list that covers all contributions, regardless of the county. These submissions are appropriate and should be accepted.
   d) The form may be used "as-is", subject to edits as described herein.
   e) The "Contractor Instructions" sheet is intended to be provided with the form. It is recommended that the Instructions and the form be printed on the same piece of paper. The form notes that the Instructions are printed on the back of the form; where that is not the case, the text should be edited accordingly.
   f) The form is a Word document and can be edited to meet local needs, and posted for download on web sites, used as an e-mail attachment, or provided as a printed document.
5. It is recommended that the contractor also complete a "Stockholder Disclosure Certification." This will assist the local unit in its obligation to ensure that contractor did not make any prohibited contributions to the committees listed on the Business Entity Disclosure Certification in the 12 months prior to the contract. (See Local Finance Notice 2006-7 for additional information on this obligation) A sample Certification form is part of this package and the instruction to complete it is included in the Contractor Instructions. **NOTE: This section is not applicable to Boards of Education.**

C. 271 POLITICAL CONTRIBUTION DISCLOSURE FORM
Contractor Instructions

Business entities (contractors) receiving contracts from a public agency that are NOT awarded pursuant to a "fair and open" process (defined at N.J.S.A. 19:44A-20.7) are subject to the provisions of P.L. 2005, c. 271, s.2 (N.J.S.A. 19:44A-20.26). This law provides that 10 days prior to the award of such a contract, the contractor shall disclose contributions to:

4. any State, county, or municipal committee of a political party
5. any legislative leadership committee*
6. any continuing political committee (a.k.a., political action committee)
7. any candidate committee of a candidate for, or holder of, an elective office:
    1. of the public entity awarding the contract
    2. of that county in which that public entity is located
    3. of another public entity within that county
    4. or of a legislative district in which that public entity is located or, when the public entity is a county, of any legislative district which includes all or part of the county. The disclosure must list reportable contributions to any of the committees that exceed $300 per election cycle that were made during the 12 months prior to award of the contract. See N.J.S.A. 19:44A-8 and 19:44A-16 for more details on reportable contributions.

N.J.S.A. 19:44A-20.26 itemizes the parties from whom contributions must be disclosed when a business entity is not a natural person. This includes the following:

8. individuals with an "interest" ownership or control of more than 10% of the profits or assets of a business entity or 10% of the stock in the case of a business entity that is a corporation for profit
9. all principals, partners, officers, or directors of the business entity or their spouses
10. any subsidiaries directly or indirectly controlled by the business entity
11. IRS Code Section 527 New Jersey based organizations, directly or indirectly controlled by the business entity and filing as continuing political committees, (PACs). When the business entity is a natural person, "a contribution by that person's spouse or child, residing therewith, shall be deemed to be a contribution by the business entity." [N.J.S.A. 19:44A-20.26(b)] The contributor must be listed on the disclosure. Any business entity that fails to comply with the disclosure provisions shall be subject to a fine imposed by ELEC in an amount to be determined by the Commission which may be based upon the amount that the business entity failed to report. The enclosed list of agencies is provided to assist the contractor in identifying those public agencies whose elected official and/or candidate campaign committees are affected by the disclosure requirement. It is the contractor's responsibility to identify the specific committees to which contributions may have been made and need to be disclosed. The disclosed information may exceed the minimum requirement. The enclosed form, a content-consistent facsimile, or an electronic data file containing the required details (along with a signed cover sheet) may be used as the contractor's submission and is disclosable to the public under the Open Public Records Act. The contractor must also complete the attached Stockholder Disclosure Certification. This will assist the agency in meeting its obligations under the law.

NOTE: This section does not apply to Board of Education contracts.

N.J.S.A. 19:44A-3(s): "The term "legislative leadership committee" means a committee established, authorized to be established, or designated by the President of the Senate, the Minority Leader of the Senate, the Speaker of the General Assembly or the Minority Leader of the General Assembly pursuant to section 16 of P.L.1993, c.65 (C.19:44A-10.1) for the purpose of receiving contributions and making expenditures."

C. 271 POLITICAL CONTRIBUTION DISCLOSURE FORM

N/A - TD does not do work in New Jersey.

Required Pursuant To N.J.S.A. 19:44A-20.26

This form or its permitted facsimile must be submitted to the local unit no later than 10 days prior to the award of the contract.

Part I – Vendor Information

Vendor Name:			
Address:			
City:		State:	Zip:

The undersigned being authorized to certify, hereby certifies that the submission provided herein represents compliance with the provisions of N.J.S.A. 19:44A-20.26 and as represented by the Instructions accompanying this form.

_____ _____ _____

Signature Printed Name Title

Part II – Contribution Disclosure

Disclosure requirement: Pursuant to N.J.S.A. 19:44A-20.26 this disclosure must include all reportable political contributions (more than $300 per election cycle) over the 12 months prior to submission to the committees of the government entities listed on the form provided by the local unit.

☐ Check here if disclosure is provided in electronic form.

Contributor Name	Recipient Name	Date	Dollar Amount
			$

☐ Check here if the information is continued on subsequent page(s)

Continuation Page

C. 271 POLITICAL CONTRIBUTION DISCLOSURE FORM

Required Pursuant To N.J.S.A. 19:44A-20.26

Page ___ of _____

Vendor Name:

Contributor Name	Recipient Name	Date	Dollar Amount
			$

☐ Check here if the information is continued on subsequent page(s)

List of Agencies with Elected Officials Required for Political Contribution Disclosure
N.J.S.A. 19:44A-20.26
County Name:
State: Governor, and Legislative Leadership Committees
Legislative District #s:
State Senator and two members of the General Assembly per district.

County:

Freeholders	County Clerk	Sheriff
{County Executive}	Surrogate	

Municipalities (Mayor and members of governing body, regardless of title):

USERS SHOULD CREATE THEIR OWN FORM, OR DOWNLOAD FROM WWW.NJ.GOV/DCA/LGS/P2P A COUNTY-BASED, CUSTOMIZABLE FORM.

DOC #16 **STOCKHOLDER DISCLOSURE CERTIFICATION** N/A - TD does not do work in New Jersey.

Name of Business:

☐ I certify that the list below contains the names and home addresses of all stockholders holding 10% or more of the issued and outstanding stock of the undersigned.

OR

☐ I certify that no one stockholder owns 10% or more of the issued and outstanding stock of the undersigned.

Check the box that represents the type of business organization:

☐ Partnership
☐ Sole Proprietorship
☐ Limited Partnership
☐ Limited Liability Partnership
☐ Corporation
☐ Limited Liability Corporation
☐ Subchapter S Corporation

Sign and notarize the form below, and, if necessary, complete the stockholder list below.

Stockholders:

Name: Home Address:	Name: Home Address:
Name: Home Address:	Name: Home Address:
Name: Home Address:	Name: Home Address:
Subscribed and sworn before me this ___ day of _____, 2 __. (Notary Public) My Commission expires:	_____ (Affiant) _____ (Print name & title of affiant) (Corporate Seal)

DOC #17 GENERAL TERMS & CONDITIONS ACCEPTANCE FORM

Signature on the Vendor Contract Signature form certifies complete acceptance of the General Terms and Conditions in this solicitation, except as noted below (additional pages may be attached, if necessary).

Check one of the following responses to the General Terms and Conditions:

☒ We take no exceptions/deviations to the general terms and conditions

(*Note: If none are listed below, it is understood that no exceptions/deviations are taken.)*

☐ We take the following exceptions/deviations to the general terms and conditions. All exceptions/deviations must be clearly explained. Reference the corresponding general terms and conditions that you are taking exceptions/deviations to. Clearly state if you are adding additions terms and conditions to the general terms and conditions. Provide details on your exceptions/deviations below:

(*Note: Unacceptable exceptions shall remove your proposal from consideration for award. Region 10 ESC shall be the sole judge on the acceptance of exceptions/deviations and the decision shall be final.*)

ATTACHMENTS

ATTACHMENT A: Equalis Group Exhibits
ATTACHMENT B: Pricing
ATTACHMENT C: State Notice

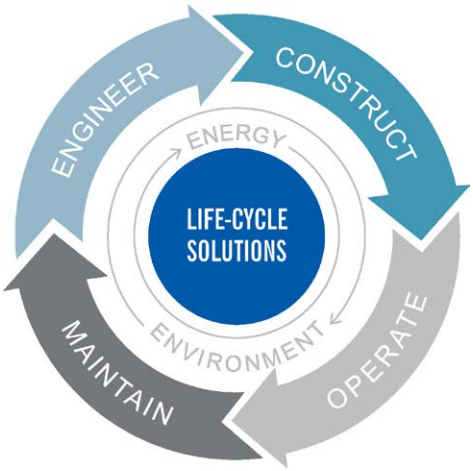
APPENDIX

APPENDIX:

ADDITIONAL QUALIFICATIONS AND EXPERIENCE

QUALIFICATIONS AND EXPERIENCE

Additional Relevant Information



LIFE-CYCLE SOLUTIONS

Unlike most mechanical construction providers, TDIndustries is also a full service design, facility management and demand-service provider.

By being a life-cycle mechanical contractor we are able to offer our customers a “one-stop shop” solution for our customers. We understand the unique requirements of critical operating systems.

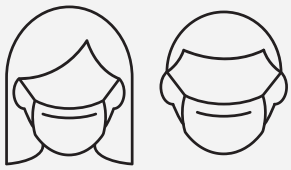
SAFETY

COVID-19 PROTOCOL

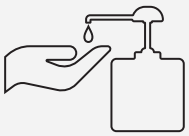
With COVID-19 affecting the economy in a negative way, companies have found themselves in a recession-like situation, faster and earlier than expected. With the unknown ahead, TD is proactively working to keep partners safe and clients happy.

To stay ahead of the pandemic and to help ensure the safety of others, TD has implemented protocol for COVID-19 on every jobsite including:

SOCIAL DISTANCING



FACE COVERINGS



HANDWASHING STATIONS

SAFETY AWARDS

TDIndustries continues to be acknowledged as a leader in safety at the local, regional and national levels, most recently by the Associated General Contractors (AGC) of America where TDIndustries won the Second Place National Construction Safety Excellence Award for a Specialty Contractor with Over 1 Million Work Hours. The award was earned based on results, risk mitigation, hazard identification and control, training and a comprehensive safety program. For many years, those results (EMR, TRIR and other measurements) tell the same story - TD is a leader in the Specialty Contracting Industry. Our safety metrics have consistently been among the best in the country.

In 2019 TDIndustries’ Safety Culture was recognized by both AGC and ABC:

- ABC Pinnacle Safety Award
- Second Place National Construction Safety Excellence Award by the Associated General Contractors of America (AGC)

TD'S WORLD-CLASS SAFETY PROGRAM

Our commitment to safety is reflected in our Core Values. Our Partners are the most valued assets of the company and the welfare of everyone is of the highest importance. We continually and aggressively communicate our safety programs to our Partners and subcontractors.

TDIndustries remains committed to continuously improving our safety programs and culture. In an effort to become a world-class safety focused organization, we began to practice behavioral-based safety. Following this process leads to a more proactive approach, focusing on safe behaviors to prevent injuries. In 2016, we debuted the TD Safety Observation Training (TSOT) program for behavior-based safety training. All leaders from the CEO to foremen have underwent TSOT education.

Safety Observations are the key to improving safety performance by addressing the lead measure indicators and behaviors before they manifest as incidents. These tools will be incorporated into our safety program for this project as well. All local Partners attend our safety orientations which cover all major safety topics for construction sites.

TDIndustries

DRUG-FREE WORKPLACE

To help ensure a drug-free workplace, we have a comprehensive drug testing program including: pre-employment drug screen, post-incident drug screen, random drug screens and screening upon probable cause. In addition, we require weekly safety meetings, as well as a "Pre-Task Safety Plan" which consists of an outline of individual tasks, any required PPE and how to perform the task safely.

RECENT SAFETY DATA

	EMR	LTIR	TRIR	TOTAL HOURS WORKED
2019	.63	.03	1.4	6,661,989
2018	.77	.3	2.3	6,136,430
2017	.7	.2	2	5,686,471
2016	.73	.2	2.3	4,671,298
2015	.68	.1	2	4,167,223

A SAMPLE OF TD TRAININGS AND CERTIFICATIONS FOR SUPERINTENDENTS, SUPERVISORS, AND MORE

All field supervisors or leads are required to take TEXO Safety First, OSHA 10-hour safety training, as well as other TD required training such as PPE, Fall Protection, EEW, Lockout-Tagout, etc.

FIRST AID/CPR

PPE

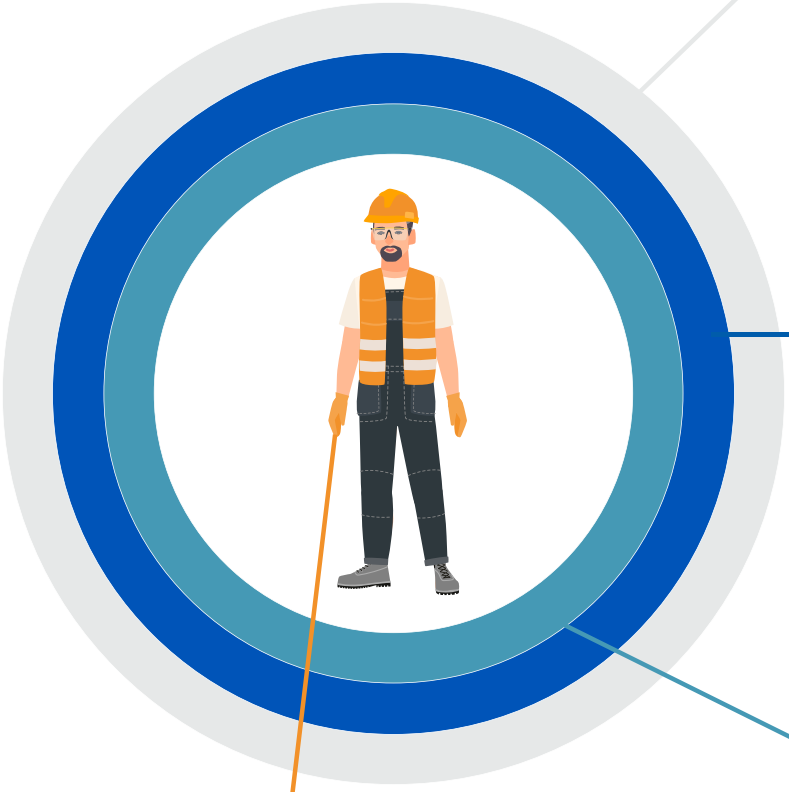
LADDER

TEXO SAFETY FIRST

OSHA TRAINING

WHAT IS THE VALUE OF TD'S SAFETY RESOURCES?

LAYERS OF PROTECTION



1. Culture

TD is partner-owned, and family-oriented. Partners consistently watch out for each other, and leaders encourage open communication and safety practices.

2. Protocol

When partners are first hired, each of them go through TD's safety protocol and training.

3. Training

Not only does TD train their employees, we also pay for the necessary certifications, and offer resources on our internal website to reference safety as well as on each jobsite.

4. PPE

This should be the last layer of protection. If everything mentioned prior including culture, protocol and training is being followed, PPE should not be needed. Nonetheless, TD recognizes that things happen, and we make sure our Partners and subcontractors are prepared with the necessary PPE when on a jobsite.

HOW DOES TD STAY UP TO DATE?

SAFETY APP

TD teamed with application developer, SmartTagIt, to utilize a new real-time and integrated safety app to send notifications, share pre-task safety plans, inspections, observations, and safety alerts.

The system offers robust reporting and safety metrics. The alerts and observations include Partner feedback on their own severity-level rating of the condition or behavior observed.

The safety app helps make TD's safety processes:

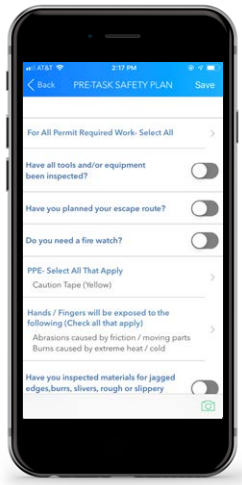
- Easier to follow
- More effective
- More engaging

The app brings better awareness of hazards and improved planning. It is used by 900+ Partners, including all field leadership and up, plus all service technicians. Partners performing either safety inspections or safety observations have been provided SmartTagIt accounts.

The app will also:

- Manage the safety performance on all job sites
- Fix hazards
- Provide tools to stop unsafe working behaviors

Engage in proactive safety processes consistently and often



Sample Pre-Task Safety Plan

DIVERSITY PROGRAMS

Do you currently have a diversity program or any diversity partners that you do business with? Yes No

(If the answer is yes, attach a statement detailing the structure of your program, along with a list of your diversity alliances and a copy of their certifications.)

Valuing differences has always been one of TD's basic values. And that belief is practiced among our Partners, customers, suppliers and vendors, and within our community. TD understands that the diversity among us is our greatest strength and is critical to our continued success. Our CEO, Harold MacDowell, continuously strives for representation and inclusion at all levels of the organization. TD recognizes that diversity and inclusion are not only the right things to do, but are strategic pillars to achieving our success and growth for the future

At the Heart of Your Building