Weaver
CONSTRUCTION MANAGEMENT
3679 S Huron Street, Suite 404 Englewood, Colorado 80110
Phone: (303) 789-4111 FAX: (303) 789-4310

SUBMITTAL TRANSMITAL

July 27, 2012

WCM Submittal No: 11373-001

PROJECT: **Harold Thompson Regional WRF**
Birdsall Rd.
Fountain, CO 80817
Job No. 2908

ENGINEER: **GMS, Inc.**
611 No. Weber St., #300
Colorado Springs, CO 80903
719-475-2935 Roger Sams

OWNER: **Lower Fountain Metropolitan Sewage Disposal District**
901 S. Santa Fe Ave.
Fountain, CO 80817
719-382-5303 James Heckman

CONTRACTOR: **HIS, Inc.**
7901 Hansen Rd.
Houston, TX 77061
713-947-1623 Colleen Orth

SUBJECT: Blowers High Speed Turbo Blowers ADB-1 through ADB-4

SPEC SECTION: 11373 Blowers

PREVIOUS SUBMISSION DATES: NA

DEVIATIONS FROM SPEC: ___ YES _X_ NO

CONTRACTOR'S STAMP: This submittal has been reviewed by Weaver Construction Management and, unless indicated otherwise, has been found to be in conformance with the intent of the contract documents.

Contractor's Stamp:	Engineer's Stamp:
Date: 7/26/12	
Reviewed by:	
() Reviewed Without Comments ( ) Reviewed With Comments	

ENGINEER'S
COMMENTS:_____
_____

7901 Hansen Rd., Houston, TX 77061

HIGH SPEED TURBO BLOWER

Submittal Package

PREPARED FOR:
Weaver Construction Management, Inc.

PO # 9103
HSI JOB # WO34756

June 27, 2012

Wednesday, July 25, 2012

John Jacob
Weaver Construction Management Inc.
3679 South Huron Street
Englewood, CO 80110-3496
STE 404

RE: Specifications for Approval for (4) New HSI Frame 4 Wheel 2.1 High Speed Turbo Blower Package - HSI Job WO#34756, Weaver Construction Management PO #9103

Dear John,

In reference to your recent purchase order for (4) new HSI 4 Wheel 2.1 High Speed Turbo Packages, I am enclosing the submittal package for your review.

Please indicate your agreement with the attached specifications by signing below and faxing a copy to me at 713-547-5508.

****By signing this form, you are approving the release of the order to production per the specifications herein submitted as well as verifying the following shipping address and instructions for physical delivery of the blowers and any accessories. ****

Ship To: Weaver Construction Management, Inc. 3679 South Huron Street STE 404 Englewood, CO 80110-3496
Via: Freight Billed Best-Way

In an effort to effectively and competitively ship your blower HSI arranges many shipments weeks and sometimes months in advance, changes to the shipping address at a later date will cause added delays and expense which will be for the purchasers account. In the event that the address listed above is incorrect, it is requested that you correct this issue and/or add any additional shipping instructions on this sheet before signing and returning. The addresses stated above will be relied on from here out unless changed in writing with acknowledgement from HSI in writing.

Delivery is tentatively 14 weeks after reception of signed approval.

Please note that the submittal does not constitute acceptance of any commercial terms and conditions besides what is contained herein. Terms and conditions are agreed to on a signed purchase order only.
****This submittal includes an internal passive harmonic filter. However, the original proposal did not include an internal passive harmonic filter. If an internal passive harmonic filter is still desired a signed change order will need to be sent for $5,100 per blower.****

Sincerely,

Dakota Turrentine
Project Manager

SIGNATURE _____ DATE _____

PRINT NAME _____ TITLE _____

Table of Contents

Section 1 – Project Specific Documentation

- Proposal Clarification and Exceptions
- UL Certification
- Warranty
- Startup Requirements
- Testing Requirements
- Factory Data Sheet
- GA Drawing

Proposal Clarification and Exceptions

Clarifications and Exceptions: High Speed Turbo Blowers

1. **Clarification:** Installation, piping and wiring to be done by others.
2. **Clarification:** The proposed pricing and scope of supply is to only cover those items listed and startup quoted, any additional items or additional startup will be subject to a cost adder.
3. **Clarification:** The proposed bid package is dependent upon HSI's standard terms and conditions. HSI is open to discussion and negotiation of terms.
4. **Clarification- 1.4 Anchor Bolts:** According to notes these items will be provided by the contractor.
5. **Clarification- 1.5.E Blower Operation:** The blowers can operate without surging at any point between 60% and 100% of the specified capacity at max conditions.
6. **Exception- 2.1A.8&9 Inlet and Outlet Size:** The proposed model will have a 12" inlet and 10" discharge.
7. **Exception- 2.1B.8&9 Inlet and Outlet Size:** The proposed model will have a 12" inlet and 10" discharge.
8. **Clarification- 2.3.C.6 VFD:** HSI will provide our standard Vacon Variable Frequency Drive.
9. **Exception-2.3.D.7 Exterior Surface:** The proposed model will be covered with HSI' standard of 2 coat green epoxy paint with powder coating.
10. **Clarification- 2.4. Spare Parts:** Due to the nature of the High Speed Turbo, the only necessary spare parts are replacement air filters. The proposed scope of supply includes one for each blower.

UL Certification

ONLINE CERTIFICATIONS DIRECTORY

QDGS.E331765
Compressors, Vacuum Pumps and Pneumatic Paint Sprayers

Page Bottom

Compressors, Vacuum Pumps and Pneumatic Paint Sprayers

See General Information for Compressors, Vacuum Pumps and Pneumatic Paint Sprayers

HOUSTON SERVICE INDUSTRIES INC E331765
7901 HANSEN RD
HOUSTON, TX 77061-3428 USA

Industrial Blowers, Models Frame 4, Frame 5.

Last Updated on 2011-08-12

Questions? Print this page Notice of Disclaimer Page Top

NITW.E327840
Industrial Control Panels

Page Bottom

Industrial Control Panels

See General Information for Industrial Control Panels

HOUSTON SERVICE INDUSTRIES INC E327840
7901 HANSEN RD
HOUSTON, TX 77061-3428 USA

Industrial control panels.

Last Updated on 2009-02-26

Questions? Print this page Notice of Disclaimer Page Top

Warranty

HSI
WARRANTY AND LIMITATION OF LIABILITY

The seller hereby warrants the HT - Series Turbo Blower product manufactured by Houston Service Industries, Inc (HSI) to be free from defects in material and/or workmanship under normal use and service. The warranty will be for a period to begin with startup, beginning of beneficial use or achievement of substantial completion, whichever comes first, and will extend for a twenty four (24) month period. The warranty period will not exceed thirty (30) months after shipment.

This warranty applies to all standard equipment located within our standard enclosure. Standard equipment shall be limited to the product make, model, and design as determined by HSI and shall not cover any customer specified modifications or changes, nor does it cover ancillary components not located within the enclosure. Standard wear items used in routine maintenance are not covered the Seller will repair or replace any defective part or parts, FOB HSI Factory, at no charge.

Warranty shall be void if the product is repaired or tampered with in any manner other than by the Seller's authorized service personnel. If inspection does not disclose a defect covered by the warranty, the equipment will be returned to purchaser at its expense or, if purchaser elects, the seller will repair or replace the equipment and charge for such service at the regular rate.

The seller makes no warranties, expressed or implied, as to the merchantability or as to the suitability of the equipment for any particular purpose, and the seller does not warranty the equipment in any manner whatsoever except as expressly stated in this agreement.

Startup requirements

STARTUP REQUIREMENTS AND PROCEDURES

1. Pre-Startup forms must be filled out completely prior to HSI startup.
2. All wiring and piping must be completed prior to HSI's scheduled startup.
3. If startup is not located in the United States, pictures must be sent to HSI to confirm that piping and installation has been completed.
4. If HSI arrives on-site at the project location for startup and the site is not ready, the HSI trip will be billed according to the attached service rate sheet.
5. By signing the submittal, you are agreeing to the startup terms within.

The following Start-up trips, as described by the specifications and agreed to by the HSI proposal, is to be provided by HSI:

- (2) total trips for (1) days each*
    - for field inspection of installation, performance check
        - Performance check** requires monitoring and recording blower flow, inlet/discharge pressure, bearing/motor temperature, voltage, kW, and amps.
    - for post-startup training
    - Commissioning supervision

Notes:

*HSI is able to perform additional field service per the standard service rates.

**All equipment required for on-site testing shall be provided by others if not already a part of the HSI Scope of Supply

Testing Requirements

TESTING REQUIREMENTS

The following tests will be performed at HSI's factory in Houston, TX:

ASME PTC-10 Performance Test

1. The blower package will be fully assembled with motor, base, and controls.
2. Notification of performance testing will be at least two weeks in advance in accordance with specification section 11374.
3. Test reports will be generated and will be sent to the contractor for submission and review by the engineer where required.

Field testing:

To be performed during scheduled start-up. HSI will not be responsible for field testing other than what is provided during start-up. HSI will aid with field testing if available, but will not furnish any equipment, provide calculations, or take time away from contractual duties.

Factory Data Sheet

Houston Service Industries, Inc.

Factory Data Sheet

WO34756

Work Order ID	Part ID	Release	Want Date	Start Date	Finish Date	Qty	Drawing ID/Rev
WO34756/1		6/15/2012	10/8/2012			4.00	

Cust Order#: CO032772 WW100
Date: 6/27/2012
Ship Via: Best Way
Cust PO#: PJT NO. 9103
Contact : JOHN JACOB

Customer: WEAVERCON
WEAVER CONSTRUCTION MANAGEM
3679 SOUTH HURON STREET
STE 404
ENGLEWOOD , CO 80110-3498

Ship To:
Same

FACTORY DATA

(4) HSI FRAME4-WHEEL 2.1 HSTB PACKAGE - NEW
SERIAL NO(1) : 0612317-34756
SERIAL NO(2) : 0612318-34756
SERIAL NO(3) : 0612319-34756
SERIAL NO(4) : 0612320-34756

BLOWER SPECIFICATIONS

FRAME SIZE : 4
ENCLOSUR TYPE: NEMA 12 ELECTRICAL/NEMA 1 BLOWER
PAINT COLOR : HSI STANDARD POWDER COAT GREY/GREEN
AIREND CONFIG: PARALLEL
DIFFUSER : VANELESS
WHEEL #1 : 11050-CW
WHEEL #2 : 21050-CCW
INLT CONFIG : 12" FLANGED
DISCH EXPJNT : 10" GENERAL RUBBER 1015E
DISCH CONFIG : 10" OPEN ANSI 150# STANDARD
BOV VALVE : 6" LUGGED W/ MODULATING ACTUATOR
SILENCER POS.: POSITION 1
MOTOR COOLING: LIQUID COOLED
CABINET DIMNS: 86 21/32" X 40 1/8 X 75 13/16
CNTRL COOLING: SINGLE FAN ACROSS INVERTER
CONTROLS : LOCAL STANDARD/INTERFACE PLC
MAX POWER REQ: 182A/480V/60HZ/3PH
MAIN BREAKER : 250A ABB STANDARD
CNTRL MCB : CONTROL TRANSFORMER
INPUT TERMINL: SINGLE #6-350KCMIL
CNTRL INP TRM: SINGLE 18-4AWG PER TERMINAL, 1PH
INVERTER : 261A 480V VACON NXP LIQUID COOLED
SINE FILTER : 300A 480V HF
INT HARM FILT: 150HP 480V TCI HG7
TEMP SENSOR : CONAX RTD - INLET/DISCHARGE
PRES SENSOR : OMEGA 0-30 PSIA; OMEGA 0-30 PSIG
PRES SWITCH : OMEGA DELTA
HEAT EXCHANG : HSI INTERNAL STANDARD
INLT AIR FLTR: HSI 98% AT 10 MICRON STANDARD

ADDITIONAL COMPONENTS

INLT AIR FLTR: (4) HSI 98% AT 10 MICRON STANDARD (SPARE)
(4) INSTALLED IN CABINETS
LEVELING BASE: (24) SUNNEX LEVELING FEET
BOV SILENCER : (4) UNIVERSAL SU5-6" W/ SCREEN & HARDWARE
CHECK VALVE : (4) TECHNO 10" 5118
B/FLY VALVE : (4) BRAY 10" WAFER WITH LEVER
EXP JOINT : (4) GENERAL RUBBER 12" 1015E (INLET)
FILT SILENCER: (4) CCS-12 12" WITH FELT ELEMENT

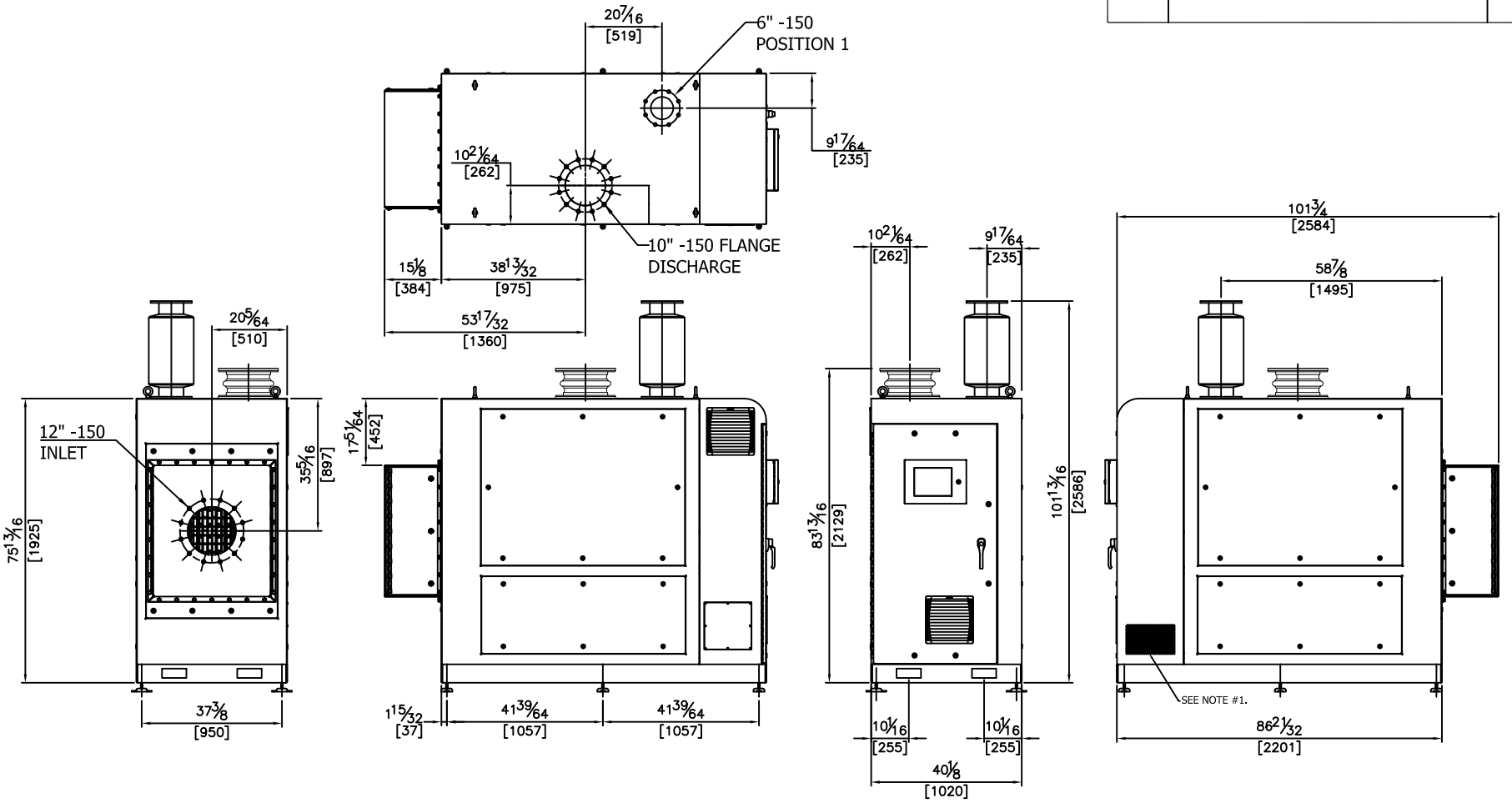
COMMENTS

1) NON WITNESSED ASME PTC-10 FOR EACH BLOWER
2) SPARE: (1) EA 0.6OZ BOTTLE GREY/GREEN TOUCH-UP PAINT

3) STARTUP: (2) TRIPS FOR (1) DAYS EACH
4) FREIGHT TO JOBSITE INCLUDED

GA Drawing

REVISIONS			
REV.	DESCRIPTION	DATE	BY



NOTE:
1. THE HOLE FOR THE POWER CORD SHOULD BE DRILLED BY CUSTOMERS WITHIN THE SHADED REGION
2. NO ADDITIONAL LOAD ALLOWED ON INLET OR DISCHARGE FLANGES.
3. ALL DIMENSIONS ARE SUBJECT TO CHANGE
4. ENCLOSURE P/N 3140006103N12, PIPING; BOV,ELBOW P/N 31400001111232; BOV, OFFSET P/N 31400001111221
5. VALVE ASSEMBLY P/N 210651135; SILENCER P/N 10SU5-6

MATERIAL:		
DRAWN BY	PSC	11/14/11
CHK. BY	JH	11/14/11
APRV. BY	JG	11/14/11

HSI Blowers
7901 HANSEN, HOUSTON, TX 77061

TITLE: HSI FRAME 4 SERIES (12" FLGN) BOV, SILENCER POSITION-1

SIZE	PART NO.	REV.
B	GA3140006103N12-POSITION-1	0

DO NOT SCALE DRAWING | SHEET: 1 OF 1

WINDOW 98 SE
AUTOCAD R14.0

Section 2 – High Speed Turbo Blower Specs

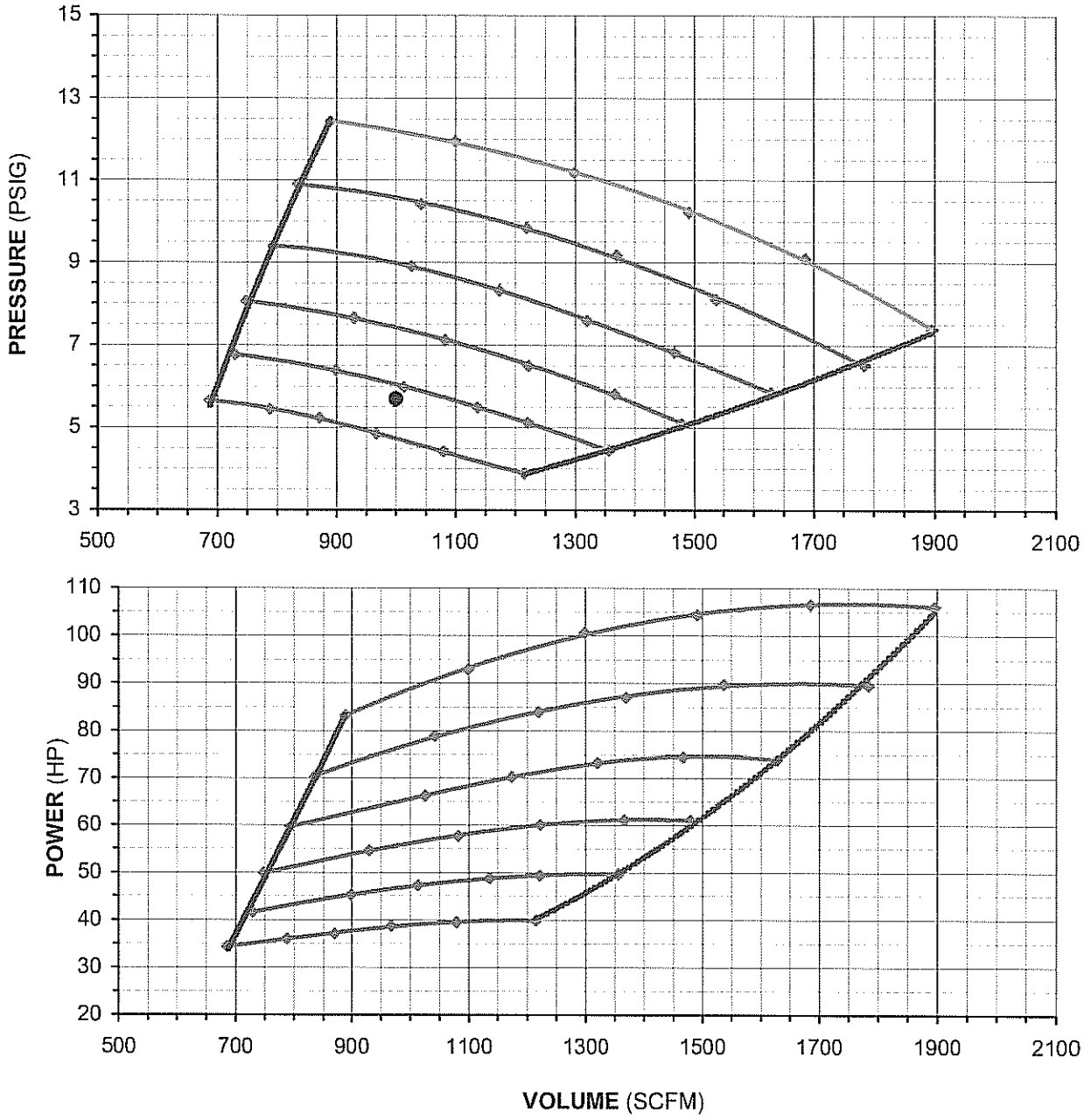
- Blower Predicted Performance Curve
- Motor
- Variable Frequency Drive
- Blower Brochure
- Powder Coat Specifications
- Air Filter
- Blower Pressure Sensor
- RTD
- Leveling Mounts
- Main Circuit Breaker
- Harmonic Filter

Blower Predicted Performance Curve

Houston Service Industries, Inc.
7901 Hansen, Houston, TX 77061

HIGH SPEED TURBO BLOWER PERFORMANCE CURVE

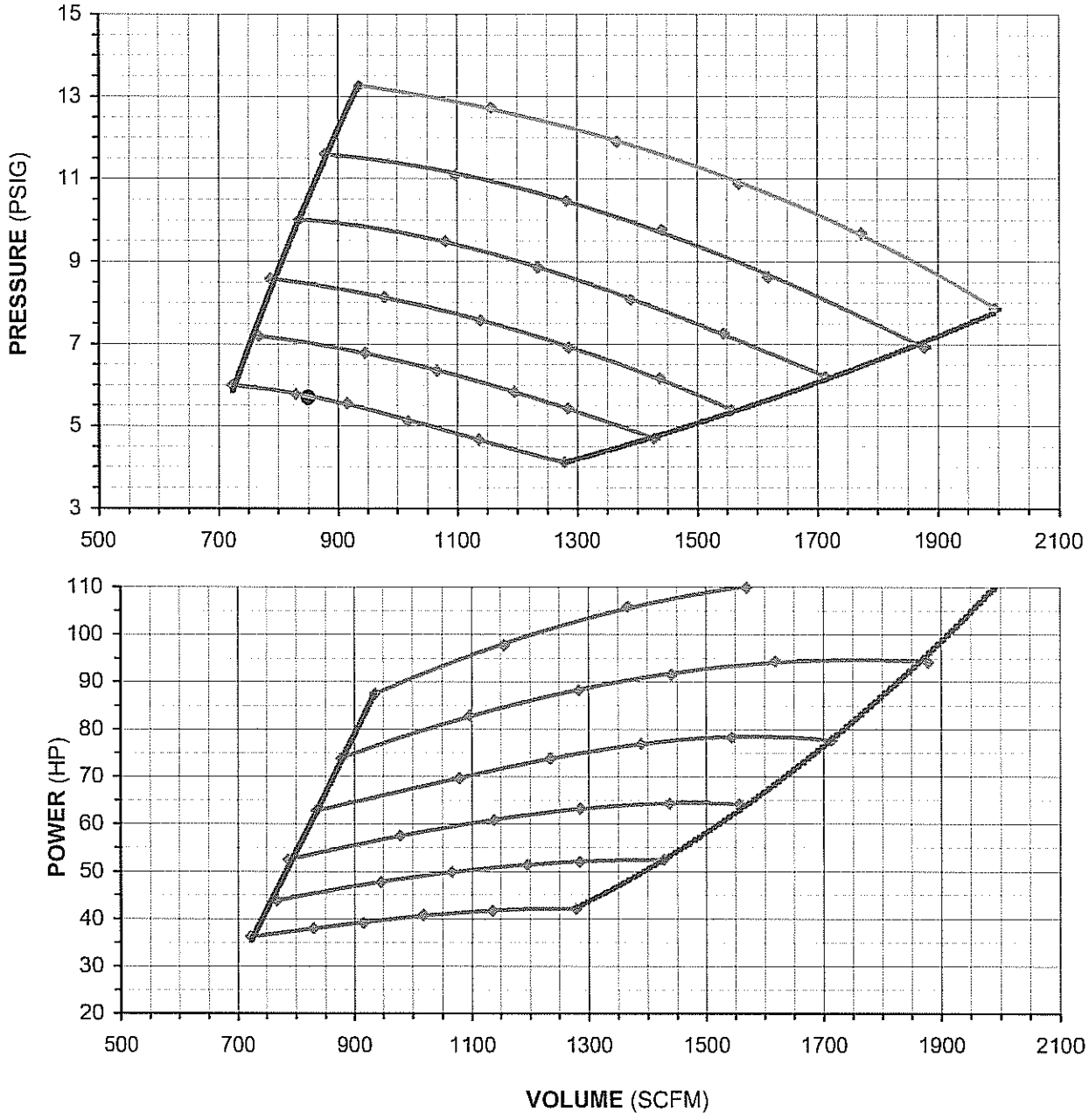
BLOWER DATA		DESIGN POINT		INLET CONDITIONS	
Model	: Frame 4	Inlet Volume (CFM)	: 1185.35	Bar Press (PSI)	: 12.039
Impeller(s)	: Wheel 2.1	Volume (CFM)	: 1000.00	Inlet Press (PSI)	: 12.039
Date	: 4/17/2012	Diff Press (PSI)	: 5.700	Inlet Temp (°F)	: 50.00
Project	: Fountain, CO	Disch Press (PSIG)	: 5.700	Relative Hum.	: 30%
Aerobic Sludge		Power (HP)	: 44.92	Molecular Wgt	: 28.921
Spring/Fall Low Flow		Power (kW)	: 33.53	Isentropic Exp	: 1.399



Houston Service Industries, Inc.
7901 Hansen, Houston, TX 77061

HIGH SPEED TURBO BLOWER PERFORMANCE CURVE

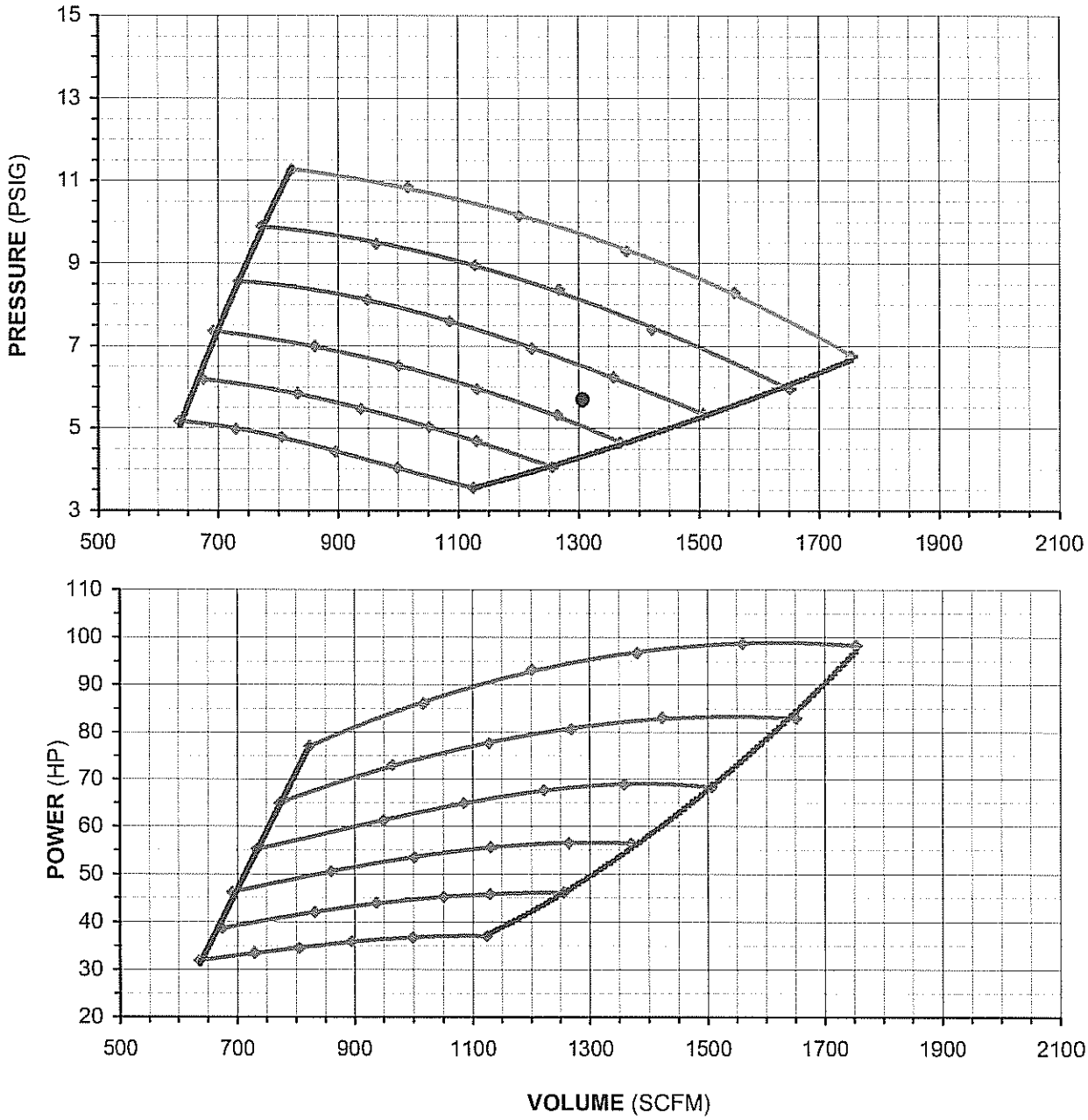
BLOWER DATA		DESIGN POINT		INLET CONDITIONS	
Model	: Frame 4	**Inlet Volume (CFM)**	: 957.53	**Bar Press (PSI)**	: 12.039
Impeller(s)	: Wheel 2.1	**Volume (CFM)**	: 850.00	**Inlet Press (PSI)**	: 12.039
Date	: 4/17/2012	**Diff Press (PSI)**	: 5.700	**Inlet Temp (°F)**	: 25.00
Project	: Fountain, CO	**Disch Press (PSIG)**	: 5.700	**Relative Hum.**	: 50%
	Aerobic Sludge	**Power (HP)**	: 38.01	**Molecular Wgt**	: 28.940
	Winter	**Power (kW)**	: 28.37	**Isentropic Exp**	: 1.400



Houston Service Industries, Inc.
7901 Hansen, Houston, TX 77061

HIGH SPEED TURBO BLOWER PERFORMANCE CURVE

BLOWER DATA		DESIGN POINT		INLET CONDITIONS	
Model	: Frame 4	Inlet Volume (CFM)	: 1549.00	Bar Press (PSI)	: 12.039
Impeller(s)	: Wheel 2.1	Volume (CFM)	: 1307.00	Inlet Press (PSI)	: 12.039
Date	: 4/17/2012	Diff Press (PSI)	: 5.700	Inlet Temp (°F)	: 85.00
Project	: Fountain, CO	Disch Press (PSIG)	: 5.700	Relative Hum.	: 70%
	Aerobic Sludge	Power (HP)	: 61.98	Molecular Wgt	: 28.601
	Summer	Power (kW)	: 46.26	Isentropic Exp	: 1.397



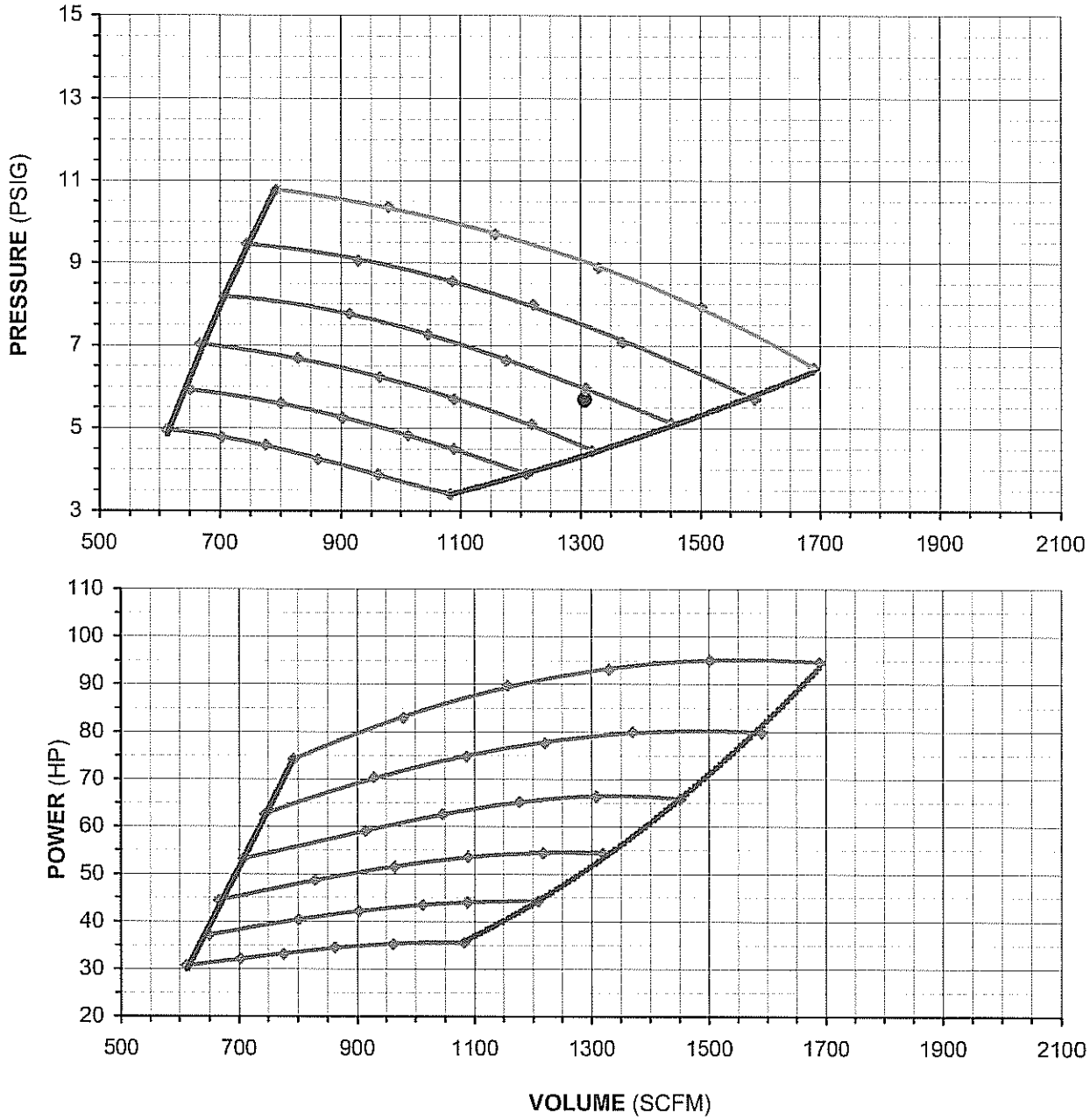
Houston Service Industries, Inc.
7901 Hansen, Houston, TX 77061

HIGH SPEED TURBO BLOWER PERFORMANCE CURVE

BLOWER DATA	
Model	: Frame 4
Impeller(s)	: Wheel 2.1
Date	: 4/17/2012
Project	: Fountain, CO
Aerobic Sludge	
Max Flow at Max Conditions	

DESIGN POINT	
Inlet Volume (CFM)	: 1794.00
Volume (CFM)	: 1307.00
Diff Press (PSI)	: 5.700
Disch Press (PSIG)	: 5.700
Power (HP)	: 64.08
Power (kW)	: 47.82

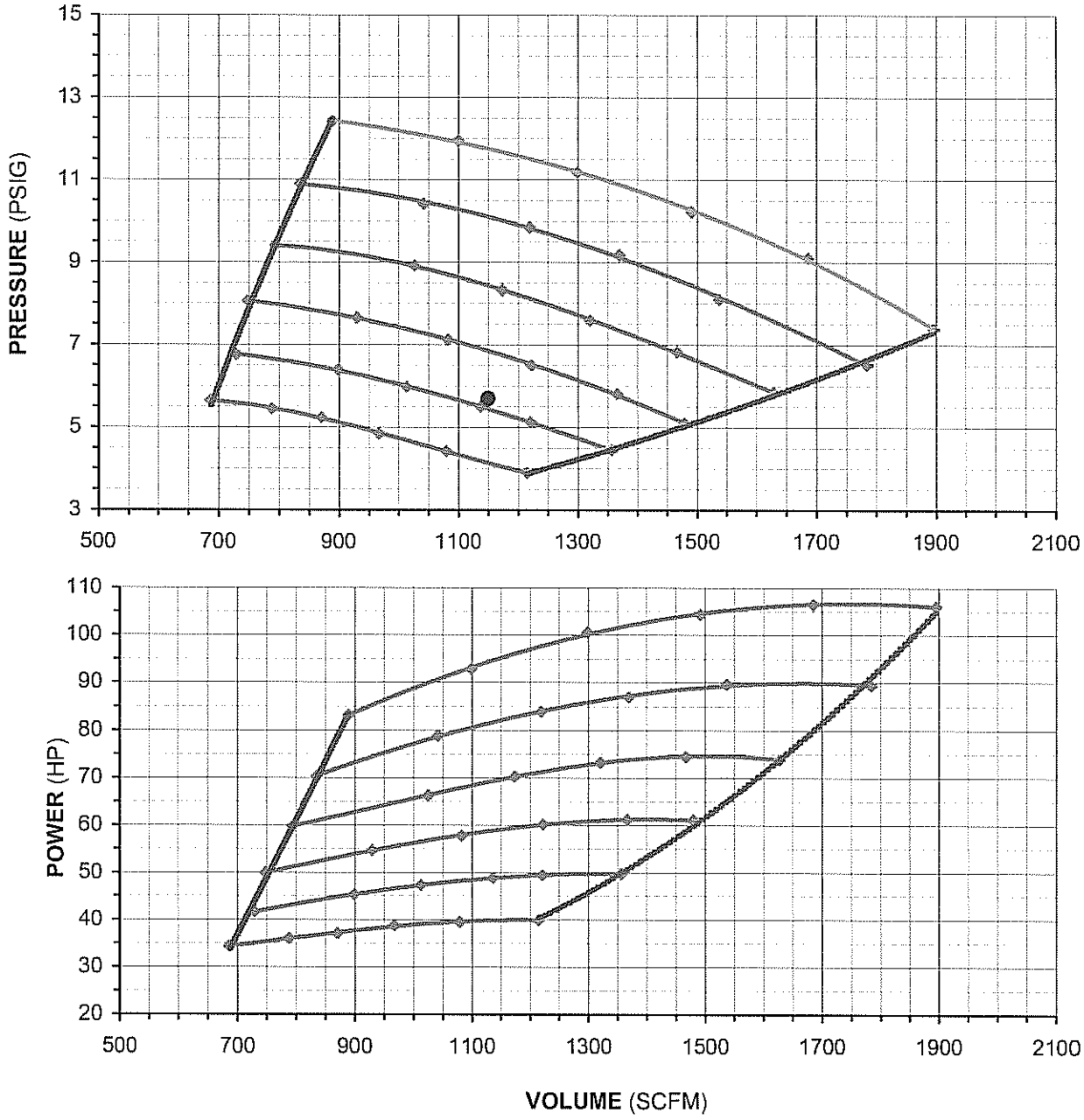
INLET CONDITIONS	
Bar Press (PSI)	: 12.039
Inlet Press (PSI)	: 12.039
Inlet Temp (°F)	: 100.00
Relative Hum.	: 80%
Molecular Wgt	: 28.307
Isentropic Exp	: 1.395



Houston Service Industries, Inc.
7901 Hansen, Houston, TX 77061

HIGH SPEED TURBO BLOWER PERFORMANCE CURVE

BLOWER DATA		DESIGN POINT		INLET CONDITIONS	
Model	: Frame 4	Inlet Volume (CFM)	: 1363.00	Bar Press (PSI)	: 12.039
Impeller(s)	: Wheel 2.1	Volume (CFM)	: 1150.00	Inlet Press (PSI)	: 12.039
Date	: 4/17/2012	Diff Press (PSI)	: 5.700	Inlet Temp (°F)	: 50.00
Project	: Fountain, CO	Disch Press (PSIG)	: 5.700	Relative Hum.	: 30%
Aerobic Sludge		Power (HP)	: 51.09	Molecular Wgt	: 28.921
Spring/Fall High Flow		Power (kW)	: 38.12	Isentropic Exp	: 1.399



Motor

HSI MOTOR PERFORMANCE DATA SHEET (FRAME 4 – 150 HP – 567 HERTZ)

GENERAL					
HSI HSTB FRAME SIZE	**MOTOR TYPE**	**HORSEPOWER**	**VOLTAGE**	**RATED FREQUENCY**	**NUMBER OF PHASES**
4	Permanent Magnet AC Synchronous	150	460V Line to Line	567	3
RATED CURRENT	**AMBIENT TEMPERATURE**	**DUTY CYCLE**	**SERVICE FACTOR**	**INSULATION RATING**	**NUMBER OF POLES**
182 AMPS	40°C	Continuous	1.15	Class H	2

PERFORMANCE					
LOAD	**HORSEPOWER**	**AMPERES**	**RPM**	**POWER FACTOR**	**EFFICIENCY**
NO LOAD	0	17	34,000	0.07	0%
1/4	37.5	45	34,000	0.96	96.8%
2/4	75	87	34,000	0.99	98.2%
3/4	112.5	132	34,000	0.99	98.6%
FULL LOAD	150	182	34,000	0.98	98.7%
5/4	187.5	237	34,000	0.96	98.7%

SPEED-TORQUE				
PARAMETER	**AMPERES**	**RPM**	**TORQUE**	**% FULL LOAD**
LOCKED ROTOR	370	0	38 ft-lb	165
BREAKDOWN	370	0	38 ft-lb	165
FULL LOAD	182	34,000	23.1 ft-lb	100

Variable Frequency Drive

VACON NXP LIQUID COOLED POWERDRIVES FOR EXTREME CONDITIONS

VACON
DRIVEN BY DRIVES

ULTIMATE PERFORMANCE

The Vacon NXP liquid cooled drive is the most space-saving AC drive in the market, well suited for locations where air cooling would be difficult, expensive or impractical or where the installation space is at a premium.

As no air ducts are required, the liquid cooled drives are extremely compact and suitable for different kinds of industries, e.g. the marine and offshore, the pulp and paper, as well as for the mining and metal industries. The Vacon NXP liquid cooled drive is today available from 7.5 kW up to 5000 kW at 380 to 690 VAC supply voltages. The Vacon NXP liquid cooled drive is an advanced AC drive for induction and permanent magnet motors.

Designed reliability

- Proven technology, high-quality electrical components
- Modularity
- No galvanic contact between coolant and live parts
- Fulfils international safety and functionality standards, as well as classification requirements
- Liquid cooling guarantees more stable conditions
- Uninfluenced by variations in the environment
- Enclosure temperature level can be high without risk of overheating
- Adequate sizing sustains long life
- Extensive and full power final testing on motor for whole drive system
- All IGBTs are protected against overtemperature and overload
- Double-shielded cooling circuitry

Wide application area

All applications for the air cooled Vacon NXP are also available for the Vacon NX liquid cooled drives. As a high degree of protection (IP54 or higher) can easily be achieved with these drives, they can be installed almost anywhere in the production area. This also reduces the load on the air-conditioning system in the electrical rooms – in many retrofit applications this is an important consideration. As the liquid cooled drives do not require large cooling fans, they are also quiet.

Vacon DriveSynch, fully redundant control of high-power drives

The Vacon DriveSynch, Vacon's new control concept for high-power drives, provides a high degree of redundancy in processes controlled by AC drives. It allows the control of one motor by means of 2, 3 or 4 power units of 100 - 2,500 kW each. The Vacon DriveSynch is suited for the control of single- and multi-winding AC motors.

The Vacon DriveSynch brings major benefits especially for system integrators that design and deliver systems to demanding environments where redundancy is of utmost importance.

VACON NXP LIQUID COOLED
CH5

VACON NXP LIQUID COOLED
CH61/CH62

VACON NXP LIQUID COOLED
CH72

OPTIMIZED, ULTRA COMPACT SOLUTION

Customer-oriented

- High power density, e.g, a 12-pulse CH74 is the smallest in the world; the rectifier, inverter and optional brake chopper in the same package.
- Extensive operating conditions, temperatures up to 50°C without derating, RH 5...96%, vibrations up to 1 G
- Less investments in infrastructure
- No need for filtered cooling air or for a large air conditioning system
- Substantial energy savings on the cooling arrangement
- Takes less floor space
- The most silent AC drive in the market, no large fans
- High IP rating possible for severe and harsh environments
- Heat losses to air less than 0.1...0.15%
- Separated motor cabling stands
- High switching frequency reduces current ripple for motor, improving motor loadability in AC drive applications

Exclusively designed for liquid cooling

The Vacon NXP dissipates less than 5% of its total heat losses to air, only 0.1...0.15% of drive the rated load. A high-tech cooling heatsink enables better cooling efficiency and makes the cooling utilization ratio of the components higher than ever. The majority of other liquid cooled drives in the market is based on modifications to an air cooled drive.

Total lifetime costs

- Compact size, less material and labour required
- Space savings up to 70%
- Smaller enclosure footprint
- Efficiency >98%
- Heat losses to air < 0.1...0.15% of output power
- Electrical energy savings between air cooled and liquid cooled drives
- Power factor of 0.99 with Active Front-End
- Modularity
- Serviceability

VACON NXP LIQUID COOLED
CH63

VACON NXP LIQUID COOLED
CH64

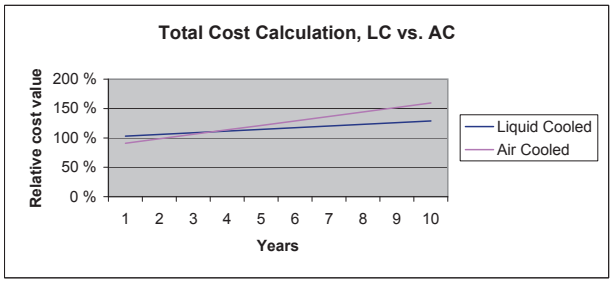
VACON NXP LIQUID COOLED
CH74

THE ADVANTAGES OF THE COOLING TECHNOLOGY

When comparing the cooling technology solutions, it is important to understand the effects on the infrastructure of the electrical room, and electrical room requirements. Additional comparison parameters are the geographical location, the customer segment and the customer process.

400 kW, 690 VAC liquid cooled drive is:

- 32 % of the volume of the air cooled drive
- 50 % of the width of the air cooled drive
- 70 % of the weight of the air cooled drive
- 20 dBA more silent than the air cooled drive



In warm climates it is extremely important to observe the amount of heat load transferred to the electrical room because it is in a direct relationship to the electrical energy consumption.

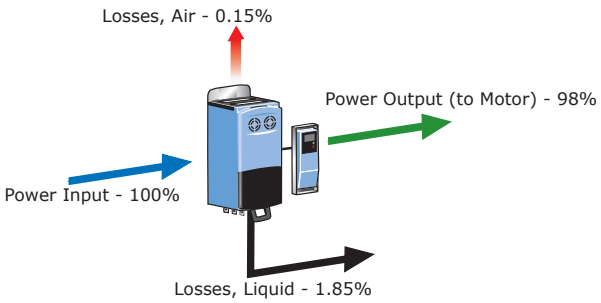
The type-tested switchgears standard EN 60439-1 specifies that the electrical room's 24-hour average temperature should be below +35°C and the maximum temporary temperature cannot exceed +40°C. Due to this, the cooling system in electrical rooms is typically based on air conditioning chillers, which are dimensioned by the maximum heat load, the inside temperature of the electrical room and the outdoor maximum temperature.

The normal electrical energy consumption of air conditioning is 25...33% of the cooling power. Therefore, high-power drives are creating huge energy consumption, based on the heat load produced.

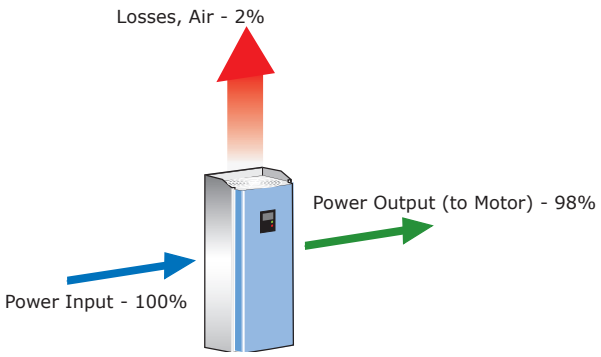
The initial investments in the liquid cooled AC drives technology are slightly more expensive than those in the air cooled AC drives technology because of the technology used, cooling piping arrangements and heat exchanger systems. It is significant to understand that a heat exchanger needs also be compared to ventilation and air condition systems with ventilation ducts, ventilation machine and ventilation automation system.

The non-evaluated features remarkably decrease the payback time of the liquid cooled drives. The payback time of a single 650-kW liquid cooled drive is 3 years. The payback time of >1 MW high power drives or drive groups reduces significantly and the initial investment difference can be compensated during the first operating year. The electrical energy cost trend supports a wider use of the liquid cooled drives technology, and the number of on-shore installations is growing rapidly.

Liquid Cooled Drive



Air Cooled Drive



Vacon NXP liquid cooled frequency converters – Mains voltage 400—500 VAC

Converter type 6-pulse	Converter type 12-pulse	Drive/Current			Electrical output power		Power loss	Chassis
		Thermal I_{TH} [A]	Rated continuous I_L [A]	Rated continuous I_H [A]	Optimum motor at I_{TH} (400 V) [kW]	Optimum motor at I_{TH} (500 V) [kW]	c/a/T*) [kW]	
0016_5		16	15	11	7,5	11	0.4/0.2/0.6	CH3
0022_5		22	20	15	11	15	0.5/0.2/0.7	CH3
0031_5		31	28	21	15	18,5	0.7/0.2/0.9	CH3
0038_5		38	35	25	18,5	22	0.8/0.2/1.0	CH3
0045_5		45	41	30	22	30	1.0/0.3/1.3	CH3
0061_5		61	55	41	30	37	1.3/0.3/1.5	CH3
0072_5		72	65	48	37	45	1.2/0.3/1.5	CH4
0087_5		87	79	58	45	55	1.5/0.3/1.8	CH4
0105_5		105	95	70	55	75	1.8/0.3/2.1	CH4
0140_5		140	127	93	75	90	2.3/0.3/2.6	CH4
0168_5		168	153	112	90	110	4.0/0.4/4.4	CH5
0205_5		205	186	137	110	132	5.0/0.5/5.5	CH5
0261_5		261	237	174	132	160	6.0/0.5/6.5	CH5
0300_5		300	273	200	160	200	4.5/0.5/5.0	CH61
0385_5		385	350	257	200	250	6.0/0.5/6.5	CH61
0460_5	0460_5	460	418	307	250	315	6.5/0.5/7.0	CH72
0520_5	0520_5	520	473	347	250	355	7.5/0.6/8.1	CH72
0590_5	0590_5	590	536	393	315	400	9.0/0.7/9.7	CH72
0650_5	0650_5	650	591	433	355	450	10.0/0.7/10.7	CH72
0730_5	0730_5	730	664	487	400	500	12.0/0.8/12.8	CH72
0820_5		820	745	547	450	560	12.5/0.8/13.3	CH63
0920_5		920	836	613	500	600	14.4/0.9/15.3	CH63
1030_5		1030	936	687	560	700	16.5/1.0/17.5	CH63
1150_5		1045	766	600	750	750	18.5/1.2/19.7	CH63
1370_5	1370_5	1370	1245	913	700	900	19.0/1.2/20.2	CH74
1640_5	1640_5	1640	1491	1093	900	1100	24.0/1.4/25.4	CH74
2060_5	2060_5	2060	1873	1373	1100	1400	32.5/1.8/34.3	CH74
2300_5		2300	2091	1533	1200	1500	36.3/2.0/38.3	CH74
2470_5	2470_5	2470	2245	1647	1300	1600	38.8/2.2/41.0	2xCH74
2950_5	2950_5	2950	2681	1967	1550	1950	46.3/2.6/48.9	2xCH74
3710_5	3710_5	3710	3372	2473	1950	2450	58.2/3.0/61.2	2xCH74
4140_5	4140_5	4140	3763	2760	2150	2700	65.0/3.6/68.6	2xCH74
2x2470_5	2x2470_5	4700	4300	3100	2450	3050	73.7/4.2/77.9	4xCH74
2x2950_5	2x2950_5	5600	5100	3700	2900	3600	88/5/93	4xCH74
2x3710_5	2x3710_5	7000	6400	4700	3600	4500	110.6/5.7/116.3	4xCH74
2x4140_5	2x4140_5	7900	7200	5300	4100	5150	123.5/6.9/130.4	4xCH74

Explanations of the currents

I_{TH} = Thermal maximum continuous RMS current. Dimensioning can be done according to this current if the process does not require any overloadability or the process does not include any torque ripple or margin for overloadability.

I_L = Low overloadability current. Allows +10% torque ripple. 10% exceeding can be continuous
I_H = High overloadability current. Allows +50% torque ripple. 50% exceeding can be continuous.
All values with cosφ = 0.83 and efficiency = 97%

*) c = power loss into coolant; a = power loss into air; **T = total power loss**; power losses of input chokes not included. All power losses obtained using max. supply voltage, I_{TH} and switching frequency of 3.6 kHz and closed loop control mode. All power losses are worst-case losses. If some other mains voltage is used, apply the formula P = $\sqrt{3}$ U_N x In x cosφ x eff% to calculate the output power of the Vacon NX liquid cooled drive.

The enclosure class for all Vacon NX liquid cooled frequency converters is IP00, suitable for wall-mounted in a cabinet.

If the motor is continuously (besides start and stop ramps) run at frequencies below 5 Hz, pay attention to the drive dimensioning for low frequencies, or choose drive according to I_H. It is recommended to check the rating with your distributor or Vacon. Drive overrating may also be necessary if the process requires a high starting torque.

Vacon NXP liquid cooled frequency converters – Mains voltage 525—690 VAC

Converter type 6-pulse	Converter type 12-pulse	Drive/Current			Electrical output power		Power loss c/a/T*) [kW]	Chassis
		Thermal I_{TH} [A]	Rated continuous I_L [A]	Rated continuous I_H [A]	Optimum motor at I_{TH} (525 VAC) [kW]	Optimum motor at I_{TH} (690 VAC) [kW]		
0170_6		170	155	113	110	160	5.5/0.2/5.7	CH61
0208_6		208	189	139	132	200	6.5/0.3/6.8	CH61
0261_6		261	237	174	160	250	6.5/0.3/6.8	CH61
0325_6	0325_6	325	295	217	200	300	7.5/0.4/7.9	CH72
0385_6	0385_6	385	350	257	250	355	9.0/0.5/9.5	CH72
0416_6	0416_6	416	378	277	250	355	9.4/0.5/9.9	CH72
0460_6	0460_6	460	418	307	300	400	10.0/0.5/10.5	CH72
0502_6	0502_6	502	456	335	355	450	12.0/0.6/12.6	CH72
0590_6		590	536	393	400	560	13.0/0.7/13.7	CH63
0650_6		650	591	433	450	600	16.0/0.8/16.8	CH63
0750_6		750	682	500	500	700	18.0/0.9/18.9	CH63
0820_6	0820_6	820	745	547	560	800	19.0/1.0/20.0	CH74
0920_6	0920_6	920	836	613	650	850	21.3/1.2/22.5	CH74
1030_6	1030_6	1030	936	687	700	1000	22.0/1.1/23.1	CH74
1180_6	1180_6	1180	1073	787	800	1100	25.0/1.3/26.3	CH74
1300_6	1300_6	1300	1182	867	900	1200	31.0/1.6/32.6	CH74
1500_6	1500_6	1500	1364	1000	1000	1400	38.0/1.9/39.9	CH74
1700_6	1700_6	1700	1545	1133	1150	1550	38.0/1.9/39.9	CH74
1850_6	1850_6	1850	1682	1233	1250	1650	39.6/2.0/41.6	2xCH74
2120_6	2120_6	2120	1927	1413	1450	1900	45.0/2.4/47.4	2xCH74
2340_6	2340_6	2340	2127	1560	1600	2100	55.8/2.9/58.7	2xCH74
2700_6	2700_6	2700	2455	1800	1850	2450	68.4/3.4/71.8	2xCH74
3100_6	3100_6	3100	2818	2066	2150	2800	68.4/3.4/71.8	2xCH74
2x1850_6	2x1850_6	3500	3200	2300	2400	3150	75,2/3,8/79	4xCH74
2x2120_6	2x2120_6	4000	3600	2700	2750	3600	85,5/4,6/90,1	4xCH74
2x2340_6	2x2340_6	4400	4000	2900	3050	3950	106/5,5/111,5	4xCH74
2x2700_6	2x2700_6	5100	4600	3400	3500	4600	130/6,5/136,5	4xCH74
2x3100_6	2x3100_6	5900	5400	3900	4050	5300	130/6,5/136,5	4xCH74

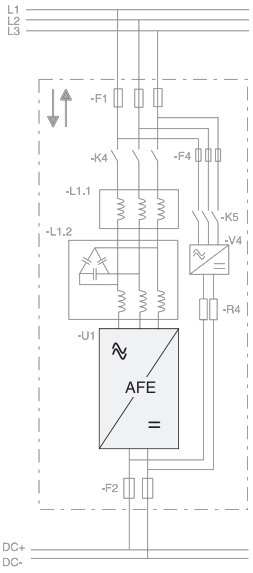
Vacon NXP liquid cooled dimensions: Drives consisting of one module

Chassis	Width (mm)	Height (mm)	Depth (mm)	Weight (kg)
CH3	160	431	246	30
CH4	193	493	257	35
CH5	246	553	264	40
CH61/62	246	658	372	55
CH63	505	923	375	120
CH64	746	923	375	180
CH72	246	1076	372	90
CH74	746	1175	385	280

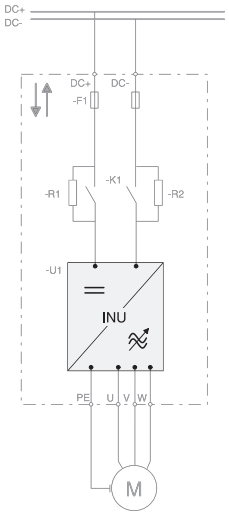
One-module drive dimensions (mounting base included)
Please note that AC chokes are not included.

Mains connection	Input voltage U_{in}	400...500 VAC; 525...690 VAC; (–10%...+10%) 465...800 VDC; 640...1100 VDC (–0%...+0%)
	Input frequency	45...66 Hz
Control characteristics	Control method	Frequency control U/f Open loop sensorless vector control Closed loop frequency control Closed loop vector control
	Switching frequency	NX_5: Up to and including NX_0061: 1...16 kHz; Factory default 10 kHz From NX_0072: 1...12 kHz; Factory default 3.6 kHz NX_6: 1...6 kHz; Factory default 1.5 kHz
Ambient conditions	Ambient operating temperature	–10°C (no frost)...+50°C (at I_{th})
	Installation temperature	0...+70C
	Storage temperature	–40°C...+70°C; no liquid in heatsink under 0ºC
	Relative humidity	5 to 96% RH, non-condensing, no dripping water
	Air quality	No corrosive gases
	- chemical vapours	IEC 60721-3-3, unit in operation, class 3C2
	- mechanical particles	IEC 60721-3-3, unit in operation, class 3S2 (no conductive dust allowed)
	Altitude	NX_5 (380...500 V): 3000 m; in case network is not corner grounded NX_6: 2000 m. For further requirements, please contact factory
	Vibration	5...150 Hz
	EN50178/EN60068-2-6	Displacement amplitude 0.25 mm (peak) at 3...31 Hz Max acceleration amplitude 1 G at 31...150 Hz
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	IP00/Open Frame standard in entire kW/HP range
EMC	Immunity	Fulfils all EMC immunity requirements
	Emissions	EMC level N, T (IT networks)
Safety		EN50178, IEC 60204-1, CE, UL, CUL, IEC 61800-5-1 (see unit nameplate for more detailed approvals)
Approvals	Type tested	UL, DNV, BV, SGS Fimko CE
	Factory acceptance tested (FAT)	Lloyd's Register, ABS, GL
	Approvals our partners have	Ex, SIRA
Liquid cooling	Allowed cooling agents	Drinking water Water-glycol mixture
	Temperature of cooling agent	0...35°C (I_{th})(input); 35...55ºC, please see manual for further details Temperature rise during circulation max. 5°C No condensation allowed
	System max. working pressure	6 bar/ 40 bar peak
	Pressure loss (at nominal flow)	Varies according to size, please see manual for further details

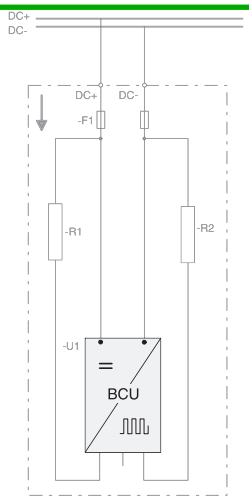
TYPICAL DEVICE CONFIGURATIONS



ACTIVE FRONT-END
(CH5, CH61, CH62, CH63, CH64)



INVERTER UNIT
(CH3, CH4, CH5, CH61, CH62, CH63, CH64)



BRAKE CHOPPER UNIT
(CH3, CH4, CH5, CH61, CH62)

NXA, Active Front-End

The Active Front-End (AFE) unit is bi-directional (regenerative) power converter (supply unit) for the front-end of a common DC bus drive line-up. An external LCL filter is used at the input. This unit is suitable in applications where a low level of mains harmonics and high power factor are required.

- LCL filter guarantees that harmonics are not an issue in any network
- Power factor is better than 0.99 which, together with low harmonics, means that supply chain transformers, generators, etc. can be sized very accurately without reserving margins for the reactive power. This can mean a saving of 10 % in supply chain investments
- Faster payback time, regenerative energy feeding back to the grid
- Power management system interface for backpower control, power limit

Fuses, LCL filters, pre-charging rectifiers and resistors need to be ordered and specified separately.

NXI, Inverter unit

The INU (Inverter unit) is a bidirectional DC-fed power inverter for the supply and control of AC motors. The INU is supplied from a common DC bus drive line-up. A charging circuit is needed in case a connection to a live DC bus is required. The DC-side charging circuit is external for inverter types.

Pre-charging resistors and switches or fuses are not included in an NXI delivery. They need to be specified and ordered separately.

NXB, Brake chopper unit

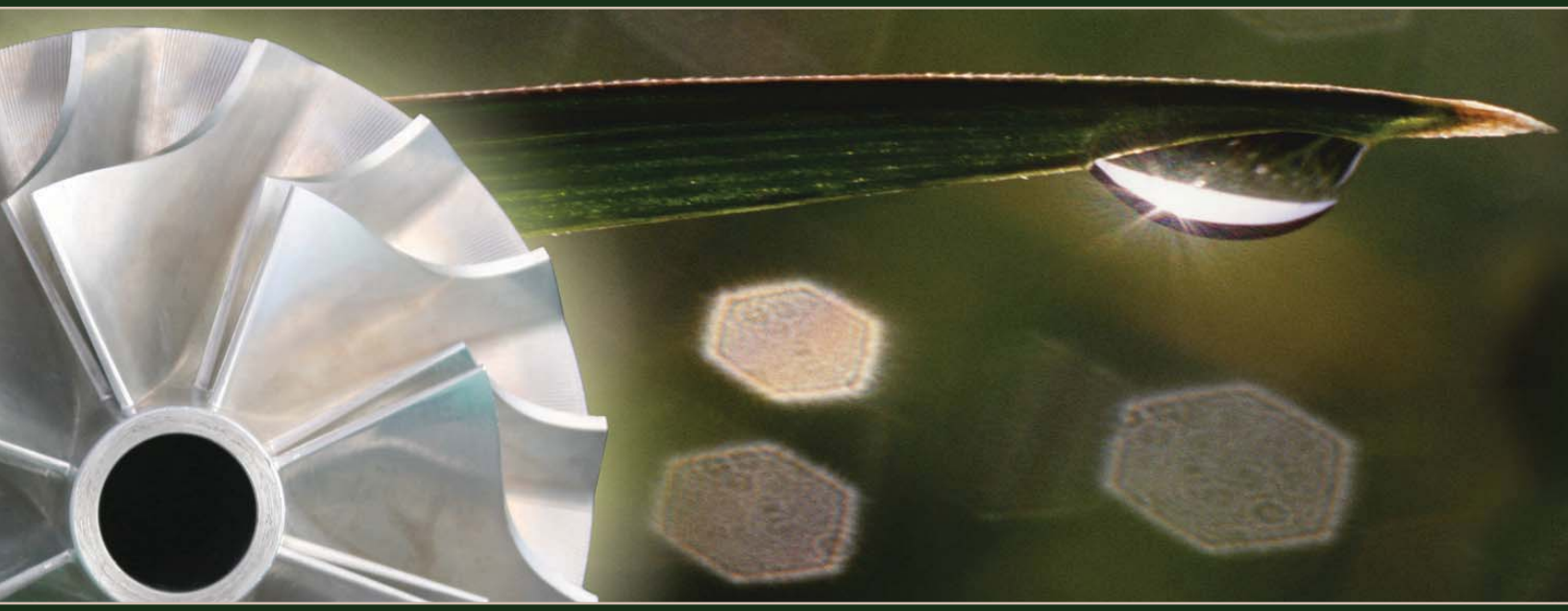
The Brake Chopper Unit (BCU) is unidirectional power converter for the supply of excessive energy from a common DC bus drive line-up or big single drive to resistors where the energy is dissipated as heat. External resistors are needed.

- Improves drive dynamic performance in a load regenerative operating point
- Protects common DC bus voltage level from overvoltage
- Saves AFE investments in some cases

Resistors or fuses are not included in an NXB delivery. They need to be specified and ordered separately.

Blower Brochure

HIGH SPEED TURBO BLOWERS



Innovation | Service | Experience

HIGH SPEED TURBO

HSi HIGH SPEED TURBO

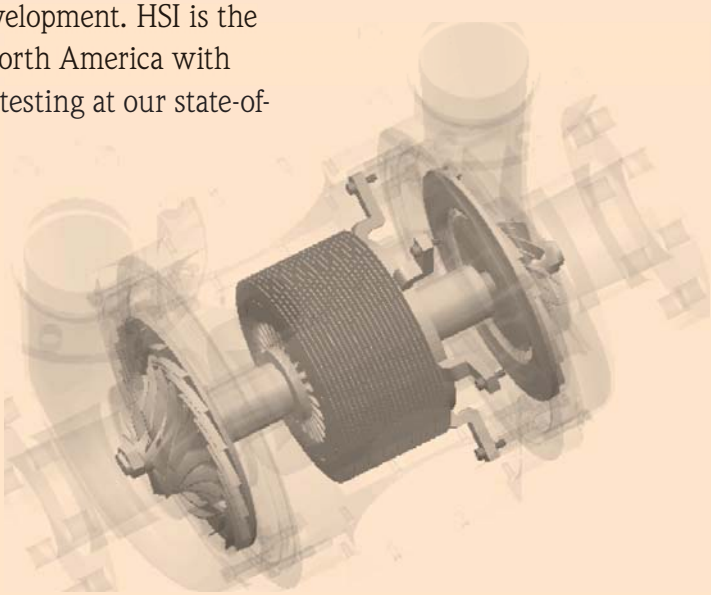
Introducing HSI High Speed Turbo Blowers and Exhausters

What if a blower could…

- Operate 20-40% more energy efficiently than conventional machines?
- Require NO lubrication?
- Require NO maintenance besides inlet filter changes?
- Achieve sound levels below 85 dBA and operate with virtually no vibration?
- Have a simple, yet rugged design?
- Be environmentally friendly?

What if you found this blower with the local service and support that you know and trust?

With 25 years of experience in the market, HSI is the industry leader in technology by providing tomorrow's innovations today with our high speed turbo product. The HT product line currently has over 45 performance configurations ranging from 5 hp to 300 hp (1 to 250kW) and more under development. HSI is the only air bearing turbo manufacturer in North America with design, engineering, manufacturing, and testing at our state-of-the-art facility in Houston, Texas USA.



These revolutionary blower designs incorporate air bearings supported on a single shaft with integrated variable frequency drive, control system and motor. These are all pre-packaged and pre-wired in a single enclosure for simple installation and application. Flow ranges from 10 to 10,000 SCFM (15 to 15,000 nm^3/hr) and pressures to 25 psi (1.7 bar) through the range of operation.

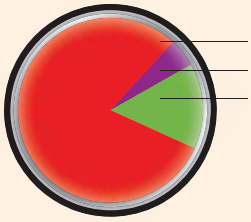
HSI HIGH SPEED TURBO

Shown above: State-of-the-Art blower test stand and customer viewing area

What is Your TRUE Cost of Ownership?

What does efficiency and payback really mean? "Wire to Air Efficiency" is the total cost of power to produce the performance you require. At HSI, we believe efficiency is only what a manufacturer can guarantee; and further what a manufacturer can verify with actual test results. Whether it be on our own ASME PTC-10 Compliant Performance Testing Facility or at your location, HSI is ready to show you real results.

A true total cost of ownership includes power consumption, maintenance, and initial capital costs.



Let us offer a 20 year life cycle analysis on your next project.

POWER SAVING

The HSI Turbo Blower is 20–40% more efficient than conventional blower technologies offering payback on investments in 2 to 3 years from energy savings alone.

LOW MAINTENANCE

NO lubrication, NO alignment and NO scheduled maintenance outside of routine inlet filter changes. This can save you time and money as compared to blower technologies requiring lubrication.

NOISE

Each standard package is fully enclosed and does not exceed 85 dBA per OSHA standards.

INSTALLATION

A compact blower design allows considerable space savings. No special foundation support required and the lightweight design offers easy access without the requirement of large overhead cranes.

CONTROL

Completely integrated controls are pre-engineered as a working system and can be upgraded to communicate with any known protocol for remote operation and monitoring.

INTEGRATION

With three different control modes as standard, this blower can seamlessly operate in parallel with other types of blowers.

COMPLETE PACKAGE

Compressor, motor, variable speed motor starter, pressure relief valve, expansion joint, and control cabinet built in one complete pre-engineered system. Just add electricity and piping.

SERVICE

Simple modular design offers complete replacement parts to be accessed without special tools or training. All in stock and readily available from our factory in Houston, Texas USA.

Impeller

Highly advanced computation fluid dynamic programming allows for performance design to truly offer an advancement in efficiency.

Each impeller vane configuration is matched with it's own specific volute to optimize aerodynamic efficiency. Matching the specific speed with the diameter of the wheel assures the best aerodynamic efficiency possible.

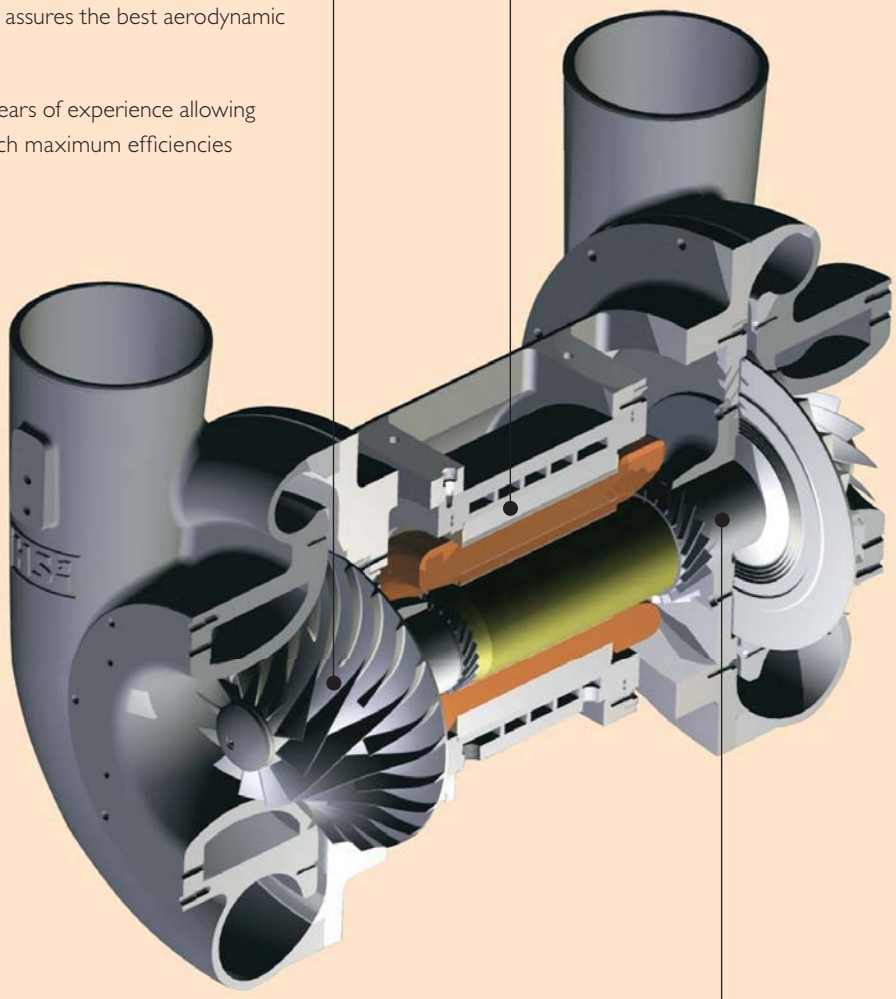
HSI's design team has more than 20 years of experience allowing for custom designed impellers to reach maximum efficiencies possible for any application.

Double suction symmetrical structure

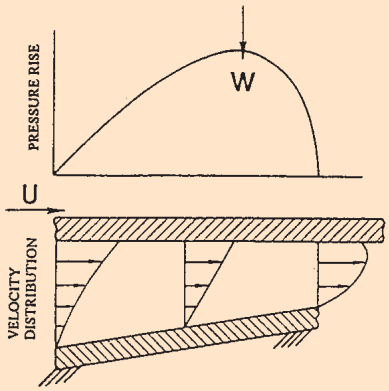
- Impellers at both ends of a common shaft counterbalance thrust load in the axial direction (axial load≈0)
- Superior stability and durability
- Improved efficiency over single impeller designs
- Reduction of local stress or twisting

Motor/Frame

- Highly efficient and reliable motor design
- Specifically designed for high speed service
- Designed for high heat environments
- Air or Liquid cooled



Principle of Air Bearing Technology



Bearings

Air Bearings

- Individually layered bearings are assembled in the housing to support the shaft
- As the shaft rotates at high speed, an air film is formed between the shaft and the bearings which achieves friction free floating without the use of lubricants
- No additional cooling required
- Suitable for high speed; bearing load capability increases with higher RPM.

Superior durability

- Little or no wear after 35,000 continuous on/off cycles
- Possible to operate under extreme environment (max. 250°C)
- Little to no vibration or noise

Enclosure and Control

Variable Frequency Drive

- Highly efficient design with minimal heat loss
- Specifically tuned to match high speed motor and provide the best efficiency over the entire speed range.
- Stable performance throughout the range of operation
- Lowest inrush current of any motor starter
- Unlimited starts and stops
- Liquid Cooled option for superior performance

Programmable Logic Controller (PLC)

- Integrated with VFD starter
- Complete system monitoring
- Simple touch screen HMI interface
- Protective cover
- Control modes include constant pressure mode, quantitative mode, and proportional mode

Enclosure

- UL/ULC/CSA certified electrical enclosure
- Self ventilating design
- Easy change inlet air filter
- Instant access to every component
- Compact low footprint

Blow Off Valve (BOV)

- Built in automated pressure relief valve for surge protection with enclosure mounted silencer.

Constant Pressure Mode

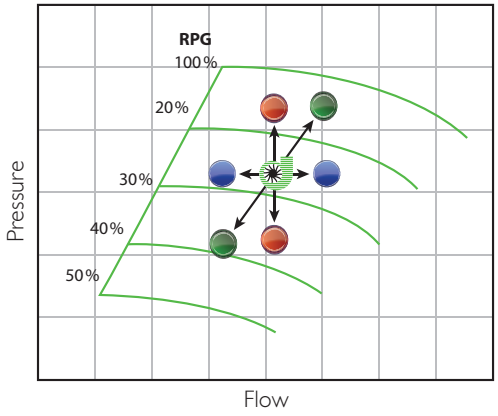
- Pressure: fixed
- Flow: variable

Quantitative Mode

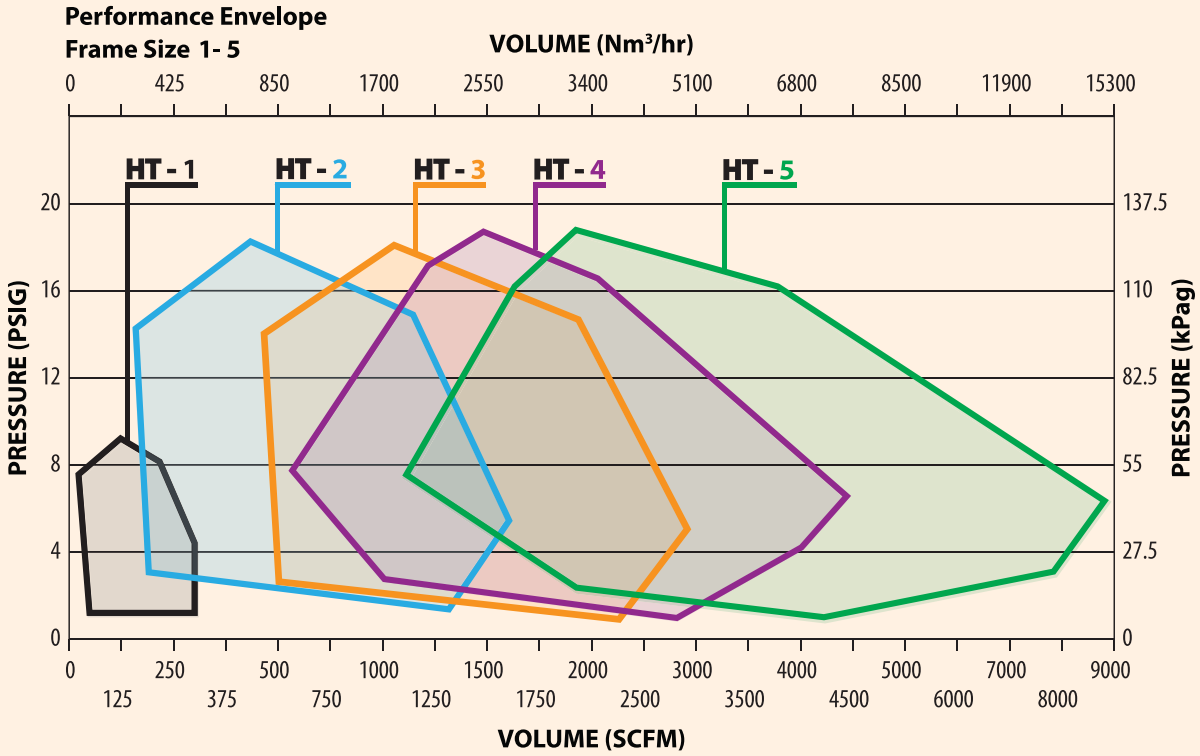
- Pressure: variable
- Flow: fixed

Proportional Mode

- Pressure: variable
- Flow: variable



HT Parallel Configuration



Consult HSI for Series Configurations to 25 PSIG/1.7 Bar

Blower Model	Impeller Configuration	HP Range	KW Range	Type of Motor
Frame 1	Single	5/10 HP	3/8 KW	Induction
Frame 2	Single/Dual	20/30/40/50 HP	15/22/30/37 KW	Induction / Permanent Magnet
Frame 3	Single/Dual	75/100/125 HP	56/75/93 KW	Induction / Permanent Magnet
Frame 4	Dual	125/150/200 HP	93/112/150 KW	Permanent Magnet
Frame 5	Dual	150/200/250/300 HP	112/150/186/225 KW	Permanent Magnet

Custom enclosures available including: Separate blower and control cabinets. Outdoor enclosure modifications.

Common Applications

Water and Wastewater

Basin aeration
Air scouring
Filter backwash systems
Grit chamber aeration
Lagoon aeration
Wastewater treatment
SBR
MBR

General Industrial

Pneumatic conveying
Blow off systems
Fermentation
Galvanization process
Printing systems
Pulp and paper industry
Carbon black
Steel plating
Black liquor recovery
Air knife drying

Power Industry

Flue gas
Desulphurization
Oxidation air
Coal gasification
Fluidized bed

Petroleum & Chemical

Sulphur recovery
Thermal oxidation

Specifications

TECHNICAL DATA

Configuration

Number of impellers	1 or 2 impellers (single, in series or in parallel)
Pressure range	2 To 25 PSIG (.13 to 1.7 bar)
Flow range	10 to 10,000 SCFM (15 to 15,000 nm^3/hr)
Outlet connection	Flanged ASA 125# / ANSI 150# drilling
Inlet filtration	Flanged inlet connection for external filter or Integral filter which is a 10 micron felted synthetic material that is washable
Pressure relief valve	Electric actuated pressure relief valve and integral silencer included in standard package. No external power supply required
Operating speed	8,000 RPM to 75,000 RPM (sub critical operation)
Casing pressure	50 PSIG maximum
Seals (air)	Self contained
Bearings	Air foil – Non contact, Non wearing, Dynamic fluid film – Utilizing air (leaf or journal type)
Lubrication	None required
Drive type	Self contained motor with impeller(s) coupled directly to the shaft
Rotor balance	ISO 1940 G 2.5. Individual impellers and rotating assembly dynamically balanced
Enclosure/electrical	NEMA 12 (standard), NEMA 4/3R and outdoor upgrades available
Electrical code	Electrical cabinet and all electrical components UL/ULC/CSA listed. HSI is a UL 508A certified panel shop
Motor voltage	380/440/480/575 volt, 50 or 60 Hz-3 phase input power. Internal control voltage transformer
Motor HP/KW rating	5 to 300 hp (1 to 250kW)
Motor	High efficiency permanent magnet or induction type motor
Motor starter	Inverter type – variable frequency drive
VFD type	High efficiency 6 pulse drive standard with operating range to 1250 hz operation (optional harmonic filters available)
Noise level	Under 85 dBA per OSHA standards
Control	Programmable logic controller with touch screen human machine interface (standard)
UV protective cover	Included to protect touch screen interface
Network connections	Ethernet, RS232, or DH485 as standard. Optional connections to communicate with any protocol available
Cooling system	Internally self cooled by inlet air or external cooling options available to capture heat to supplement HVAC or water heating.

MATERIALS OF CONSTRUCTION

Blower housing	Aluminum
Impellers	Aluminum
Air bearings	Teflon® coated Inconel®
Blower enclosure	16 gauge sheet metal with synthetic wool sound dampening material
Blower enclosure skid	Heavy duty steel I-beam construction with forklift access ports and top bounded lifting eyes
Enclosure finish	Powder coated with 2 coat epoxy paint standard

HSI HIGH SPEED TURBO

HIGH SPEED TURBO BLOWERS

7901 Hansen
Houston, Texas
77061
713-947-1623
1-800-725-2291
713-947-6409 Fax
www.hsiblowers.com
sales@hsiblowers.com

Additional Products

Multistage Centrifugal Blowers

Blower Control Systems

Aftermarket Services

E-SL-025, Rev. 03
2-02-11 photo

Powder Coat Specifications

Technical Information Sheet

ALESTA Powder Coatings

NUMBER: PFG678S9

NAME: Agricultural Green **Type:** TGIC-Polyester

Alesta Group Code:

POWDER PROPERTIES

ASTM D5965-96, C	Specific Gravity	1.31 ± 0.05
	Theoretical Coverage	147 ft^2/lb/mil
ASTM D3451-92, 13	Mass Loss During Cure	< 1%
	Recommended Shelf Life:	12 Months @ 75 °F

COATING PROPERTIES

ASTM D523-89	Gloss at 60 °	90+
DPC TM 10.219	PCI Powder Smoothness	7
ASTM D2454-95	Overbake Resistance, Time	100%
ASTM D3363-92a	Pencil Hardness	2H
ASTM D2794-93	Dir / Rev Impact, Gardner	60 / 20 in/lbs
ASTM D3359-97	Adhesion, Cross Hatch (minimu	5B Pass
ASTM D522-93a	Flexibility, Mandrel	1/8 in. dia., no fracture
ASTM B117-97	Salt Spray	1,000 hrs
UL DTOV2 Organic Coating	Steel Enclosures, Elect. Eq.	Recognized

APPLICATION

Electrostatic Spray, Cold
Substrate: 0.032 in. CRS
Pretreatment: Bonderite® 1000, Parcolene® 60

CURE SCHEDULE:
(Time at substrate temperature)
10 Minutes @ 400 °F

FILM THICKNESS: 2.0-3.0 Mils

This coating is designed with extended exterior durability. When compared under similar outdoor conditions to standard grade powder coatings of similar color, gloss, and specific gravity, it will retain original appearance for a longer period.

Prepared 5/16/2008

9800 Genard Rd. Houston, TX 77041-7624 1-800-247-3886 fax: 713-939-4027
4130 Lyman Ct. Hilliard, OH 43026-1213 1-800-667-9610 fax: 614-771-4139

POWDER COATED TOUGH ISO 9001

Technical Information Sheet

ALESTA Powder Coatings

NUMBER: RFH692R8

NAME: Mod Gray Texture

August 8, 2000

Type: Epoxy-Polyester Hybrid

Alesta Group Code:

POWDER PROPERTIES

ASTM D5965-96, C	Specific Gravity	1.65 ± 0.05
	Theoretical Coverage	117 ft^2/lb/mil
ASTM D3451-92, 13	Mass Loss During Cure	< 1%
	Recommended Shelf Life:	12 Months @ 75 °F

COATING PROPERTIES

ASTM D523-89	Gloss at 60°	Visual
DPC TM 10.219	PCI Powder Smoothness	n/a
ASTM D2454-95	Overbake Resistance, Time	100%
ASTM D3363-92a	Pencil Hardness	2H
ASTM D2794-93	Dir / Rev Impact, Gardner	160 / 160 in/lbs
ASTM D3359-97	Adhesion, Cross Hatch (minimu	5B Pass
ASTM D522-93a	Flexibility, Mandrel	1/8 in. dia., no fracture
ASTM B117-97	Salt Spray	1,000 hrs

APPLICATION

Electrostatic Spray, Cold
Substrate: 0.032 in. CRS
Pretreatment: Bonderite® 1000, Parcolene® 60

CURE SCHEDULE:
(Time at substrate temperature)
10 Minutes @ 400 °F

FILM THICKNESS: 2.5-3.5 Mils

Prepared 7/23/2008

9800 Genard Rd. Houston, TX 77041-7624 1-800-247-3886 fax: 713-939-4027
4130 Lyman Ct. Hilliard, OH 43026-1213 1-800-667-9610 fax: 614-771-4139

POWDER COATED TOUGH ISO 9001

SOLUCOAT OC

Here in one convenient package . . . is a liquid amorphous phosphate prepaint preparation specially formulated to save fuel and cut processing costs by treating mixed runs of metal at low temperatures.

SOLUCOAT OC does it easily.

This liquid, 3-stage spray applied material simultaneously cleans and conversion coats mixed production runs of steel, aluminum and galvanized steel. And SOLUCOAT OC performs with excellent results in the energy efficient temperature range of from 21° to 49°C (120° to 130°F) (do not operate over 170°F). Compared with the 60°C (140°F) temperature usually required in the prepaint phosphate treatment of metals, it's no wonder that using SOLUCOAT OC can lower your fuel bill substantially. Moreover, you also cut material costs, wastage and man-hours because you're cleaning and phosphating mixed runs of metal in one line - at one time.

EXCELLENT CLEANING AND COATING AT ENERGY-SAVING TEMPERATURES
SOLUCOAT OC combines powerful cleaning agents with soil-seeking detergents. Together, they quickly penetrate and easily remove normal fabricating soils - including most oils. In this way, the material provides the excellent cleaning so essential to the proper preparation of metal surfaces prior to painting with the new water-borne coatings. And because SOLUCOAT OC is a low-foaming formulation, it can be spray applied at low temperatures without a defoamant.

In the same application, the prepaint preparation develops a uniform, continuous conversion coating with a minimum weight of 30 - 50 mg/ft^2. This amorphous coating guards the treated metal surfaces against corrosion and improves the adhesion of any finish subsequently applied by electrocoating, powder coating, spray or dip. Most important, the material cleans and conditions mixed runs of metal at temperatures as low as 21°C (71°F).

SOLUCOAT OC meets or exceeds Federal and Military specifications as follows: TT-C-490B, Type II and MIL-C-46487, Type I and II (5 stages mandatory).

QUALITY THAT STANDS OUT
SOLUCOAT OC is ideal for the manufacturer who wants to develop a quality phosphate coating at a money- and energy-savings low temperature. The tight paint bond provided by this coating allows development of a finish that not only lasts longer but looks better. Thus, SOLUCOAT OC enhances the well deserved reputation of Working Solutions' entire line of phosphate treatment materials for developing longer-lasting, better looking finishes. These finishes make SOLUCOAT OC the preferred quality prepaint phosphating process.

OTHER BENEFITS OF SOLUCOAT OC

- Provides long solution lide with little or no sludging
- Furnishes solutions with good tolerances for hard water, high tolerance for soil build up
- Promotes working efficiency by keeping down heat and humidity in summer
- Is easily monitored and automatically metered through equipment available from Working Solutions.

APPLICATION OF SOLUCOAT OC

For normal cleaning / conditioning with the phosphating material, a smiple 3 – stage procedure is followed in the spray-washer or vat. The normal working temperature is 70 – 120 ^{0} F. The pH at working concentrations ranges from 4.0 to 5.0 with an optimum of 4.5.

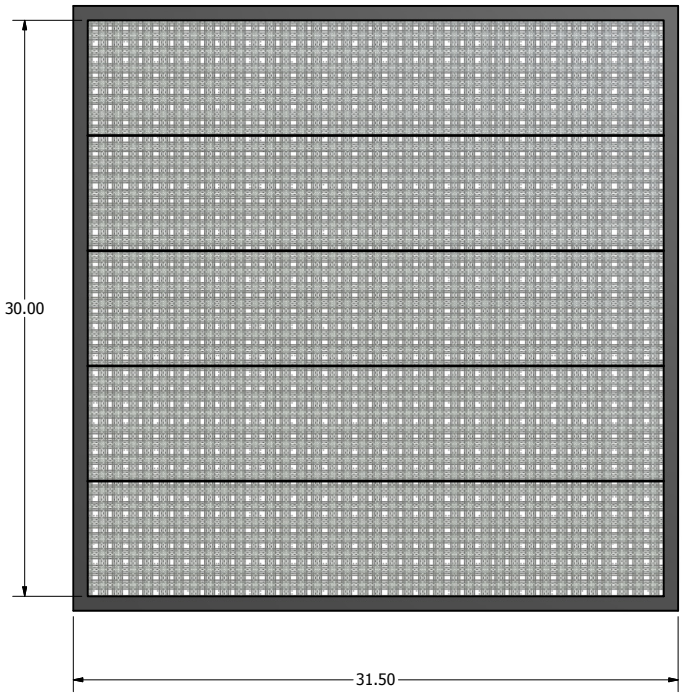
For increased corrosion resistance and paint adhesion a final seal such as the **Solucoat 5038** or **Solucoat NC Seal** should be added tot he final stage of your process.

EQUIPMENT NOTE
Stainless steel 316 / 304 holding tanks and heating coils are preferred but mild steel or black iron equipment may be used. As your Working Solutions Technical Sales Representative for specific recommendations.

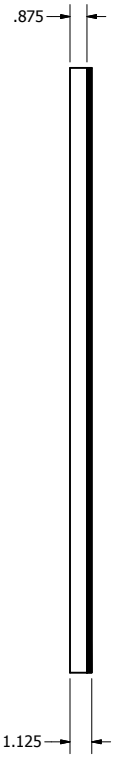
FOR FURTHER DETAILS CONSULT MATERIAL SAFETY DATA SHEET.

Air Filter

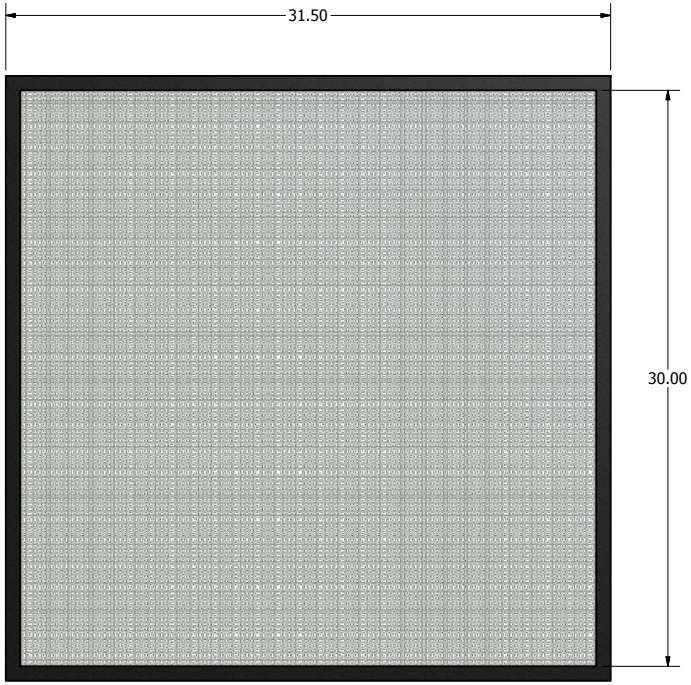
REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
0	INITIAL RELEASE PER ECR: 1376	6/16/2011	JH



FRONT VIEW (UP STREAM)



SIDE VIEW



REAR VIEW (DOWN STREAM)

SPECIFICATIONS:

1. ENDUSTRA PANAL FILTER ELEMENT
2. GALVANIZED STEEL FRAME
3. ENDURALAST HI-FLOW SYNTHETIC MEDIUM 98% EFFICIENT @ 10-MICRON (NOM)
4. POTTED ON ALL 4 SIDES
5. 6800SCFM @ 0.2" WG MAX INITIAL; NOT TO EXCEED 10" WG
6.FRONT AND BACK GALVANIZED FLATTENED EXPANDED METAL SCREENS
7. PLEAT SEPARATING GLUE BEADS ON THE UP SIDE
8. INCLUDES .75 WIDE X .25 THICK FULL-FACE NEOPRENE GASKET ON ONE SIDES

NOTE:

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

DIMENSION TOLERANCE (INCH):
.X ± .063, .XX ± .031
DIMENSION TOLERANCE (MILLIMETER):
.X ± 1.6, .XX ± .8
ANGLE:
X ± 1˚
REMOVE ALL BURRS AND SHARP EDGES
DIMENSIONING AND TOLERANCE
PER ANSI Y14.5M - 1994

THIRD ANGLE PROJECTION

MATERIAL:
SEE SPECIFICATIONS

DRAWN BY: JH	6/16/2011	
CHECKED BY: PSC	6/16/2011	
APPROVED BY: JG	6/16/2011	

HSI Blowers
7901 HANSEN, HOUSTON, TX 77061

TITLE
HSI FRAME 5 SERIES
1 IN THK. FILTER

SIZE	PART NO.	REV.
C	31500060131	0

ECR: 1376 | DO NOT SCALE DRAWING | SHEET: 1 OF 1

Blower Pressure Sensor

RUGGED SOLID STATE TRANSDUCERS
WITH AMPLIFIED OUTPUTS
STANDARD AND METRIC MODELS

EXCLUSIVE!

PX209/PXM209 Series

0-15 to 0-300 psi-Standard Units
0-1 to 0-20 bar-Metric Units
Gage, Absolute, and Compound Ranges

MADE IN USA · 3 YEAR WARRANTY · NIST · CE · OMEGADYNE · RoHS

Standard

- **Stainless Steel Fitting and Body**
- **5-Point NIST-Traceable Calibration Included**
- **Solid State Media Isolation (Suitable for Use with Many Industrial Liquids and Gases)**
- **Broad Temperature-Compensated Range of -20 to 80°C (-4 to 176°F) Yields High Stability with Changing Temperatures**
- **Electrical Isolation to 100 MΩ Ensures Long-Term Reliability**
- **Rugged High Shock and Vibration Design for Tough OEM Applications**
- **100,000 Hr MTBF Typical**

Based on proprietary sensor technology developed by OMEGA to meet the high reliability and accuracy demanded by aerospace applications, the PX209/PXM209 Series voltage and current output pressure transducer offers superior performance in non-corrosive applications, including: engine/powertrain testing, well monitoring, and ground and race water monitoring. The transducer uses a 4-active-arm bridge sensor with a micro-machined diffused silicon diaphragm and proprietary thin-film media, plus dielectric isolation barriers.

This same core sensing element technology, which includes multiple types of signal conditioning and the ability to survive extremes of shock and vibration, provides a modular building block for OMEGA's revolutionary family of pressure-sensing instruments.

SPECIFICATIONS

Voltage Output

Excitation: 24 Vdc @ 15 mA
5 Vdc Output: 7 to 35 Vdc
10 Vdc Output: 12 to 35 Vdc
Output: 0 to 5 Vdc or 0 to 10 Vdc, ±1.5% FSO, 3-wire
Zero Balance: 0 Vdc ±2% FSO

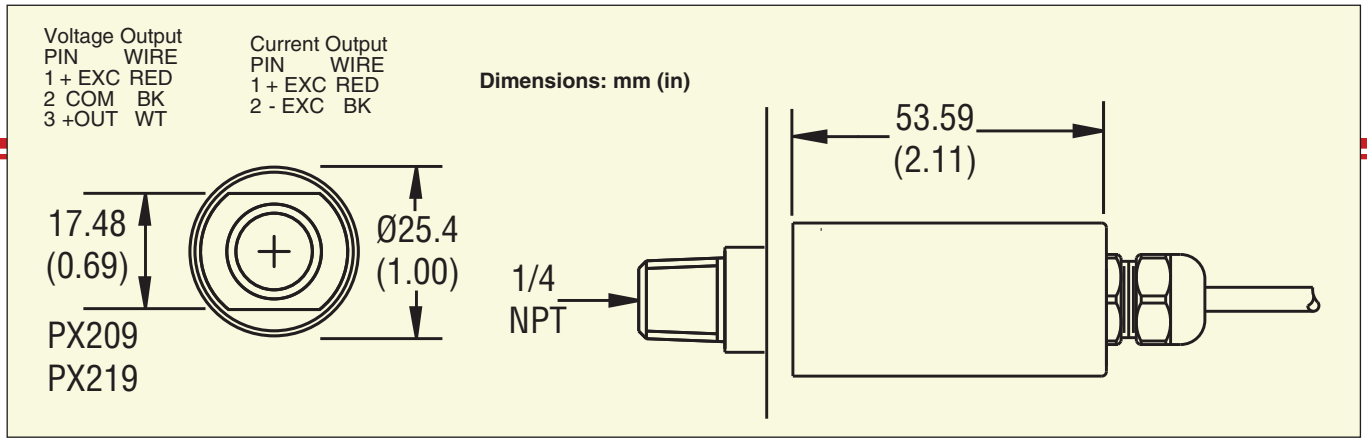
4 to 20 mA Output

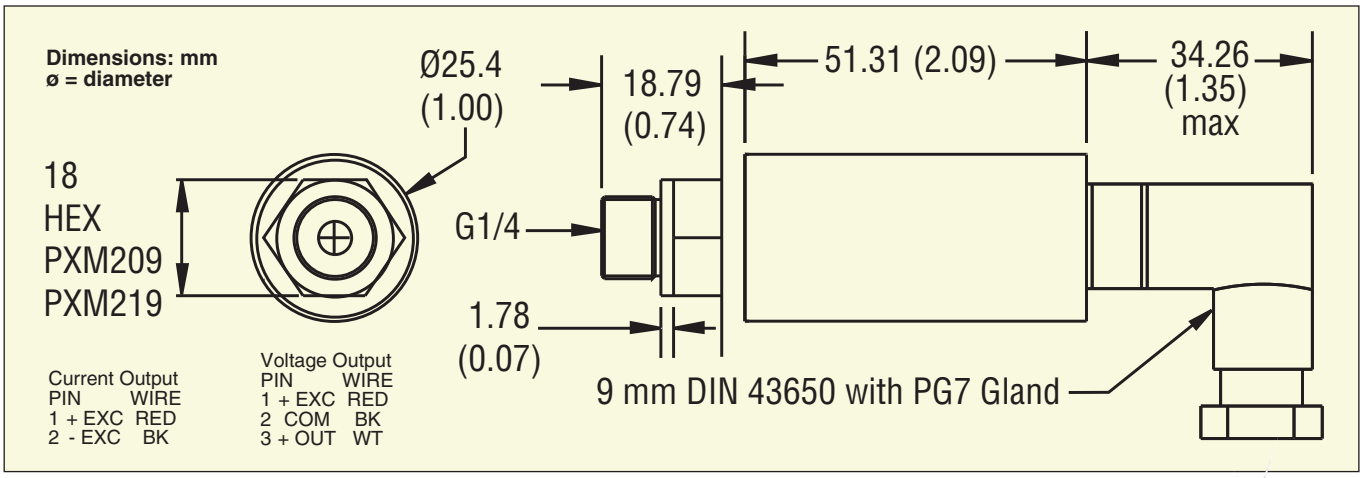
Excitation: 24 Vdc (7 to 35 Vdc) reverse polarity protected
Output: 4 to 20 mA (2-wire) ±1% FSO
Zero Balance: 4 mA ±2% FSO

Max Loop Resistance: 50 x (supply voltage - 10) Ω

Common Specifications

Accuracy: 0.25% FS (including linearity, hysteresis and repeatability)
Operating Temperature: -54 to 121°C (-65 to 250°F)
Compensated Temperature: -20 to 80°C (-4 to 176°F)
Thermal Effects: 0.04% FS/°C (0.02% FS/°F)
Proof Pressure: 150%
Burst Pressure: 300% range max
Response Time: 2 ms typical
Vibration Sensitivity: At 20 g peak sinusoidal vibration from 10 Hz to 2000 Hz (½" D.A.), the output shall not exceed 0.04% FS/g for 15 psi range to 0.005% FS/g for 100 psi and above
Natural Frequency: >35 kHz for 100 psi range
Gage Type: Diffused silicon strain gages
Wetted Parts: 316 SS, borosilicate glass, silicon nitride, epoxy
Pressure Port: See dimensional drawing on page B-91
Electrical Connections:
PX209/PXM209: 1 m (36") shielded 4-conductor cable
PX219/PXM219: DIN 43650 plug connector supplied
Weight: 128 g (4.5 oz)





MAKE IT WIRELESS!

ADD WIRELESS CAPABILITY TO YOUR PROCESS MEASUREMENT SYSTEM!

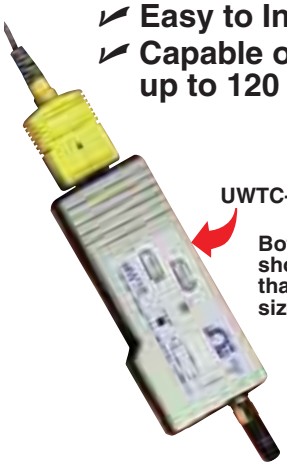
Wireless Connections From Your Sensor to Your Instrumentation:

- **Thermocouple, RTD, Infrared Temperature, Humidity, pH, as well as Process Voltage/Current**
- **Easy to Install and Use**
- **Capable of Distances up to 120 m (400')**

MADE IN USA

For Complete Details See Wireless Section W

WRS232-USB wireless transmitter, shown close to actual size.



UWTC-1

Both models shown smaller than actual size.

UWTC-REC2, available with 4 to 20 mA, 0 to 5 Vdc, 0 to 10 Vdc and Type K thermocouple output.

Laptop not included.

Wireless Communications From Your Instrument to a PC:

- **Convert the RS232 Signal on Your Meter, Controller or PLC**
- **Works with any PC with a USB Port**
- **Easy to Install with Seamless Operation**
- **Capable of Distances up to 120 m (400')**

STANDARD MODELS

AVAILABLE FOR FAST DELIVERY!

To Order *(Specify Model Number)*

psi	bar	CABLE STYLE		CONN. STYLE		COMPATIBLE METERS*
GAGE PRESSURE RANGES (psig) WITH 0 TO 5 Vdc OUTPUT						
0 to 15	0 to 1.0	**PX209-015G5V**		**PX219-015G5V**		DPi8, DP41-E, DP25B-E
0 to 30	0 to 2.1	**PX209-030G5V**		**PX219-030G5V**		DPi8, DP41-E, DP25B-E
0 to 60	0 to 4.1	**PX209-060G5V**		**PX219-060G5V**		DPi8, DP41-E, DP25B-E
0 to 100	0 to 6.9	**PX209-100G5V**		**PX219-100G5V**		DPi8, DP41-E, DP25B-E
0 to 200	0 to 13.8	**PX209-200G5V**		**PX219-200G5V**		DPi8, DP41-E, DP25B-E
0 to 300	0 to 20.7	**PX209-300G5V**		**PX219-300G5V**		DPi8, DP41-E, DP25B-E
ABSOLUTE PRESSURE RANGES (psia) WITH 0 TO 5 Vdc OUTPUT						
0 to 15	0 to 1.0	**PX209-015A5V**		**PX219-015A5V**		DPi8, DP41-E, DP25B-E
0 to 30	0 to 2.1	**PX209-030A5V**		**PX219-030A5V**		DPi8, DP41-E, DP25B-E
0 to 60	0 to 4.1	**PX209-060A5V**		**PX219-060A5V**		DPi8, DP41-E, DP25B-E
0 to 100	0 to 6.9	**PX209-100A5V**		**PX219-100A5V**		DPi8, DP41-E, DP25B-E
0 to 200	0 to 13.8	**PX209-200A5V**		**PX219-200A5V**		DPi8, DP41-E, DP25B-E
0 to 300	0 to 20.7	**PX209-300A5V**		**PX219-300A5V**		DPi8, DP41-E, DP25B-E
VACUUM AND COMPOUND RANGES WITH 0 TO 5 Vdc OUTPUT						
-14.7 to 0	-1 to 0	**PX209-30VAC5V**		**PX219-30VAC5V**		DPi8, DP41-E, DP25B-E
-14.7 to 15	-1 to 1.0	**PX209-30V15G5V**		**PX219-30V15G5V**		DPi8, DP41-E, DP25B-E
-14.7 to 45	-1 to 3.1	**PX209-30V45G5V**		**PX219-30V45G5V**		DPi8, DP41-E, DP25B-E
-14.7 to 85	-1 to 5.9	**PX209-30V85G5V**		**PX219-30V85G5V**		DPi8, DP41-E, DP25B-E
-14.7 to 135	-1 to 9.3	**PX209-30V135G5V**		**PX219-30V135G5V**		DPi8, DP41-E, DP25B-E

Comes complete with 5-point NIST calibration certificate. ******* *See section D for compatible meters.*

See pages B-149 and B-150 for PX209 units with 4 to 20 mA output.

***Note**: To order 0 to 10 Vdc output, replace "**5V**" suffix with "**10V**" (no extra charge).*

***Ordering Example: PX219-015A5V**, 0 to 5 Vdc output transducer for absolute pressure with a 0 to 15 psia range, **PS-4G** snubber for gasses and **TX4-100** shielded wire*

STANDARD ACCESSORIES

MODEL		DESCRIPTION
PS-4G		¼ NPT pressure snubber for gaseous media
PS-4E		¼ NPT pressure snubber for water and light oils
PS-4D		¼ NPT pressure snubber for dense liquids (motor oil)
TX4-100		30 m (100') of 4-conductor shielded wire

METRIC ACCESSORIES

MODEL		DESCRIPTION
PS-4G-MG		G¼ pressure snubber for gaseous media
PS-4E-MG		G¼ pressure snubber for water and light oils
PS-4D-MG		G¼ pressure snubber for dense liquids (motor oil)
TX4-100		30 m (100') of 4-conductor shielded wire

Order a snubber to protect your pressure transducer!

PS-4G, shown smaller than actual size.

METRIC MODELS

AVAILABLE FOR FAST DELIVERY!

To Order *(Specify PXM209 for Cable or PXM219 for DIN Connector)*

bar	psi	CABLE STYLE		CONN. STYLE		COMPATIBLE METERS*
GAGE PRESSURE RANGES (bar) WITH 0 to 10 Vdc OUTPUT						
0 to 1.0	0 to 15	**PXM209-001G10V**		**PXM219-001G10V**		DPi8, DP41-E, DP25B-E
0 to 1.6	0 to 23	**PXM209-1.60G10V**		**PXM219-1.60G10V**		DPi8, DP41-E, DP25B-E
0 to 2.5	0 to 36	**PXM209-2.50G10V**		**PXM219-2.50G10V**		DPi8, DP41-E, DP25B-E
0 to 4.0	0 to 58	**PXM209-004G10V**		**PXM219-004G10V**		DPi8, DP41-E, DP25B-E
0 to 6.0	0 to 87	**PXM209-006G10V**		**PXM219-006G10V**		DPi8, DP41-E, DP25B-E
0 to 10.0	0 to 145	**PXM209-010G10V**		**PXM219-010G10V**		DPi8, DP41-E, DP25B-E
0 to 16.0	0 to 232	**PXM209-016G10V**		**PXM219-016G10V**		DPi8, DP41-E, DP25B-E
0 to 20.0	0 to 290	**PXM209-020G10V**		**PXM219-020G10V**		DPi8, DP41-E, DP25B-E
ABSOLUTE PRESSURE RANGES (bar) WITH 0 to 10 Vdc OUTPUT						
0 to 1.0	0 to 15	**PXM209-001A10V**		**PXM219-001A10V**		DPi8, DP41-E, DP25B-E
0 to 1.6	0 to 23	**PXM209-1.60A10V**		**PXM219-1.60A10V**		DPi8, DP41-E, DP25B-E
0 to 2.5	0 to 36	**PXM209-2.50A10V**		**PXM219-2.50A10V**		DPi8, DP41-E, DP25B-E
0 to 4.0	0 to 58	**PXM209-004A10V**		**PXM219-004A10V**		DPi8, DP41-E, DP25B-E
0 to 6.0	0 to 87	**PXM209-006A10V**		**PXM219-006A10V**		DPi8, DP41-E, DP25B-E
0 to 10.0	0 to 145	**PXM209-010A10V**		**PXM219-010A10V**		DPi8, DP41-E, DP25B-E
0 to 16.0	0 to 232	**PXM209-016A10V**		**PXM219-016A10V**		DPi8, DP41-E, DP25B-E
0 to 20.0	0 to 290	**PXM209-020A10V**		**PXM219-020A10V**		DPi8, DP41-E, DP25B-E
VACUUM AND COMPOUND RANGES (bar) WITH 0 to 10 Vdc OUTPUT						
VAC to 0	VAC to 0	**PXM209-VAC000G10V**		**PXM219-VAC000G10V**		DPi8, DP41-E, DP25B-E
VAC to 1	VAC to 15	**PXM209-VAC001G10V**		**PXM219-VAC001G10V**		DPi8, DP41-E, DP25B-E
VAC to 3	VAC to 45	**PXM209-VAC003G10V**		**PXM219-VAC003G10V**		DPi8, DP41-E, DP25B-E
VAC to 6	VAC to 87	**PXM209-VAC006G10V**		**PXM219-VAC006G10V**		DPi8, DP41-E, DP25B-E
VAC to 9	VAC to 131	**PXM209-VAC009G10V**		**PXM219-VAC009G10V**		DPi8, DP41-E, DP25B-E

Comes complete with 5-point calibration. ******* *See section D for compatible meters.*

***Note:** The voltage output versions of the vacuum and compound sensors generate 0 Vdc at vacuum and 10 Vdc at full scale.*

***Ordering Example: PXM219-001A10V**, 0 to 10 Vdc output transducer for absolute pressure with a 0 to 1 bar range, **PS-4G-MG** snubber and **TX4-100** shielded wire*

STANDARD MODELS

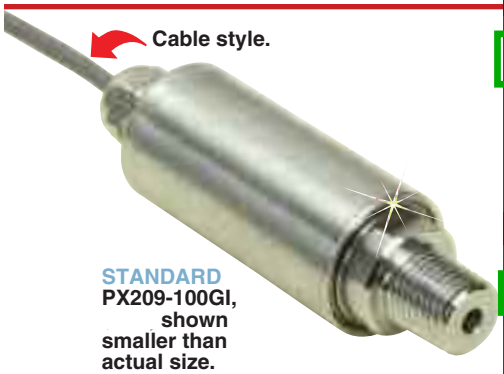
AVAILABLE FOR FAST DELIVERY!

To Order *(Specify PX209 for Cable or PX219 for DIN Connector)*

psi	bar	CABLE STYLE	CONN. STYLE	COMPATIBLE METERS*
GAGE PRESSURE RANGES (psig) WITH 4 TO 20 mA OUTPUT				
0 to 15	0 to 1.0	PX209-015GI	PX219-015GI	DPi8, DP41-E, DP25B-E
0 to 30	0 to 2.1	PX209-030GI	PX219-030GI	DPi8, DP41-E, DP25B-E
0 to 60	0 to 4.1	PX209-060GI	PX219-060GI	DPi8, DP41-E, DP25B-E
0 to 100	0 to 6.9	PX209-100GI	PX219-100GI	DPi8, DP41-E, DP25B-E
0 to 200	0 to 13.8	PX209-200GI	PX219-200GI	DPi8, DP41-E, DP25B-E
0 to 300	0 to 20.7	PX209-300GI	PX219-300GI	DPi8, DP41-E, DP25B-E
ABSOLUTE PRESSURE RANGES (psia) WITH 4 TO 20 mA OUTPUT				
0 to 15	0 to 1.0	PX209-015AI	PX219-015AI	DPi8, DP41-E, DP25B-E
0 to 30	0 to 2.1	PX209-030AI	PX219-030AI	DPi8, DP41-E, DP25B-E
0 to 60	0 to 4.1	PX209-060AI	PX219-060AI	DPi8, DP41-E, DP25B-E
0 to 100	0 to 6.9	PX209-100AI	PX219-100AI	DPi8, DP41-E, DP25B-E
0 to 200	0 to 13.8	PX209-200AI	PX219-200AI	DPi8, DP41-E, DP25B-E
0 to 300	0 to 20.7	PX209-300AI	PX219-300AI	DPi8, DP41-E, DP25B-E
VACUUM AND COMPOUND RANGES WITH 4 TO 20 mA OUTPUT				
-14.7 to 0	-1 to 0	PX209-30VACI	PX219-30VACI	DPi8, DP41-E, DP25B-E
-14.7 to 15	-1 to 1.0	PX209-30V15GI	PX219-30V15GI	DPi8, DP41-E, DP25B-E
-14.7 to 45	-1 to 3.1	PX209-30V45GI	PX219-30V45GI	DPi8, DP41-E, DP25B-E
-14.7 to 85	-1 to 5.9	PX209-30V85GI	PX219-30V85GI	DPi8, DP41-E, DP25B-E
-14.7 to 135	-1 to 9.3	PX209-30V135GI	PX219-30V135GI	DPi8, DP41-E, DP25B-E

Comes complete with 5-point NIST traceable calibration. ***** *See section D for compatible meters.*

***Ordering Example: PX219-015AI**, 4 to 20 mA output transducer for absolute pressure with a 0 to 15 psia range, **PS-4G** snubber and **TX4-100** shielded wire*



STANDARD
PX209-100GI, shown smaller than actual size.

Order a snubber to protect your pressure transducer!

PS-4G, shown actual size.

STANDARD ACCESSORIES

MODEL		DESCRIPTION
PS-4G		¼ NPT pressure snubber for gaseous media
PS-4E		¼ NPT pressure snubber for water and light oils
PS-4D		¼ NPT pressure snubber for dense liquids (motor oil)
TX4-100		30 m (100') of 4-conductor shielded wire

METRIC ACCESSORIES

MODEL		DESCRIPTION
PS-4G-MG		G¼ pressure snubber for gaseous media
PS-4E-MG		G¼ pressure snubber for water and light oils
PS-4D-MG		G¼ pressure snubber for dense liquids (motor oil)
TX4-100		30 m (100') of 4-conductor shielded wire

Recommended Reference Video: Pressure, Industrial Measurement Series, **VT-1005-DVD**
See Section Y For Additional Books.

METRIC MODELS

AVAILABLE FOR FAST DELIVERY!

To Order *(Specify PXM209 for Cable or PXM219 for DIN Connector)*

bar	CABLE STYLE	CONN. STYLE	COMPATIBLE METERS*
GAGE PRESSURE RANGES (bar) WITH 4 to 20 mA OUTPUT			
0 to 1.0	PXM209-001GI	PXM219-001GI	DPi8, DP41-E, DP25B-E
0 to 1.6	PXM209-1.60GI	PXM219-1.60GI	DPi8, DP41-E, DP25B-E
0 to 2.5	PXM209-2.50GI	PXM219-2.50GI	DPi8, DP41-E, DP25B-E
0 to 4.0	PXM209-004GI	PXM219-004GI	DPi8, DP41-E, DP25B-E
0 to 6.0	PXM209-006GI	PXM219-006GI	DPi8, DP41-E, DP25B-E
0 to 10.0	PXM209-010GI	PXM219-010GI	DPi8, DP41-E, DP25B-E
0 to 16.0	PXM209-016GI	PXM219-016GI	DPi8, DP41-E, DP25B-E
0 to 20.0	PXM209-020GI	PXM219-020GI	DPi8, DP41-E, DP25B-E
ABSOLUTE PRESSURE RANGES (bar) WITH 4 to 20 mA OUTPUT			
0 to 1.0	PXM209-001AI	PXM219-001AI	DPi8, DP41-E, DP25B-E
0 to 1.6	PXM209-1.60AI	PXM219-1.60AI	DPi8, DP41-E, DP25B-E
0 to 2.5	PXM209-2.50AI	PXM219-2.50AI	DPi8, DP41-E, DP25B-E
0 to 4.0	PXM209-004AI	PXM219-004AI	DPi8, DP41-E, DP25B-E
0 to 6.0	PXM209-006AI	PXM219-006AI	DPi8, DP41-E, DP25B-E
0 to 10.0	PXM209-010AI	PXM219-010AI	DPi8, DP41-E, DP25B-E
0 to 16.0	PXM209-016AI	PXM219-016AI	DPi8, DP41-E, DP25B-E
0 to 20.0	PXM209-020AI	PXM219-020AI	DPi8, DP41-E, DP25B-E
VACUUM AND COMPOUND RANGES (bar) WITH 4 to 20 mA OUTPUT			
VAC to 0	PXM209-VAC000GI	PXM219-VAC000GI	DPi8, DP41-E, DP25B-E
VAC to 1	PXM209-VAC001GI	PXM219-VAC001GI	DPi8, DP41-E, DP25B-E
VAC to 3	PXM209-VAC003GI	PXM219-VAC003GI	DPi8, DP41-E, DP25B-E
VAC to 6	PXM209-VAC006GI	PXM219-VAC006GI	DPi8, DP41-E, DP25B-E
VAC to 9	PXM209-VAC009GI	PXM219-VAC009GI	DPi8, DP41-E, DP25B-E

Comes complete with 5-point NIST traceable calibration. ***** *See section D for compatible meters.*

***Note:** The current output versions of the vacuum and compound sensors generate 4 mA at vacuum and 20 mA at full scale.*

***Ordering Example: PXM219-001AI,** 4 to 20 mA output transducer for absolute pressure with a 0 to 1 bar range, **PS-4G-MG** snubber and **TX4-100** shielded wire*

ECONOMICAL LOW-PRESSURE/ VACUUM SWITCHES

PSW-680 Series
Vacuum to 200 inH$_2$O

PSW-681, $95, shown actual size.

MADE IN USA 3 YEAR WARRANTY

- Compound Range Covers Vacuum and Pressure in One Unit
- Low Inch-of-Water Ranges
- Silver Switch Contacts Rated for 5 A @ 250 Vac
- 1 A, Gold-Plated Contacts for TTL or Dry Contacts

SPECIFICATIONS

Process Temp: -55 to 90°C (-67 to 194°F); a setpoint change of up to 2% of sensor capacity can be anticipated when switch is used either below -25°C (-13°F) or above 50°C (122°F)

Repeatability: ±0.8 inH$_2$O

Cycling: Not to exceed 20 cpm

Warranty: 3 years/1 million cycles

Proof Pressure/Vacuum: ±553.6 inH$_2$O (±20 psi)

Wetted Parts: Buna-N, 316 SS, zinc alloy with chromate finish, loctite #271 sealing compound

Dimensions: 58.4 D x 57.2 mm H (2.3 x 2.25")

Pressure Port: ⅛-27 MNPT

Electrical Connection: 300 mm (12") pigtail leads, 20 AWG, polyvinyl insulated

Weight: 221 g (7.8 oz)

Proof Pressure/Vacuum: 15 psi, -5.4 psi or 11 inHg vac

AVAILABLE FOR FAST DELIVERY!

To Order *(Specify Model Number)*

MODEL NO.		ADJUSTABLE RANGE DECREASING	ADJUSTABLE RANGE INCREASING	UNITS	MAX PRES*	SWITCH
Compound Range (Units = inH$_2$O)						
PSW-681		2.75 to 200 6.8 to 100	2.75 to 200 5.4 to 100	inH$_2$O pressure	±20 psi	1 A
PSW-685				inH$_2$O vacuum	±20 psi	5 A

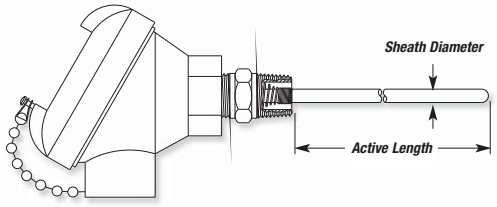
** Exceeding these values may cause a shift in the setpoint.*

RTD

RTD Assemblies with Terminal He ads and Spring-Loaded Mounting

RTD Assemblies

Spring-loaded assemblies are used to maintain positive contact between the sensor tip and the surface to be monitored, typically used with thermowell assemblies. Conax Buffalo supplies a number of styles of spring-loaded assemblies to meet application needs. Spring-loaded assemblies can be provided with all terminal heads. In addition, the T11SL model provides a spring-loaded assembly built into the T11 aluminum terminal head. This allows complete disassembly and removal of the sensor probe without dismantling the terminal head from the conduit or the vessel. For detailed information on these mounting styles, see pages 44-45.



Progressive Description Example: **RTD43W3-316SS25-T5AL(CSLW)-12.00"**

Sensor Element · W' Sensor Tolerance · '3' Sensor Lead Configuration · 0.250" 316 Stainless Steel Sheath · T5 Aluminum Termination · Mounting Style · Length

Specify Sensor Element

RTD43 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -250° C to +600° C
- -418° F to +1112° F

MRTDF43 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -50° C to +550° C
- -58° F to +1022° F

RTD44 Platinum
- 100Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -250° C to +800° C
- -418° F to +1472° F
- Inconel 600 sheath standard

RTD45 Platinum
- 100Ω @ 0° C
- α = 0.003916 Ω/Ω/°C
- -250° C to +600° C
- -418° F to +1112° F

RTD86 Platinum
- 200Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -250° C to +600° C
- -418° F to +1112° F

MRTDF430 Platinum
- 1000Ω @ 0° C
- α = 0.00385 Ω/Ω/°C
- -50° C to +550° C
- -58° F to +1022° F
- Available with 0.250" sheath diameter or larger

Note: For ASTM E1137 assemblies, use ordering prefix ARTD44W4-SS25 or ARTD44W4-INC25.

Specify Sensor Tolerance

W (Class B)
- Available for RTD43, 44 and 45, single and dual; and RTD86, MRTDF43 and MRTDF430, single only
- Tolerance at 0° C is ±0.3° C

V (1/3 Class B)
- Available for RTD43, 44 and 45 single only
- Tolerance at 0° C is ±0.1° C

S (Class A)
- Available for RTD43, 44 and 45 single only
- Tolerance at 0° C is ±0.15° C

X
- Available for ERTD41, single only; tolerance at 0° C is ±0.4° C
- Available for ERTD42, single; tolerance at 0° C is ±0.8° C
- Available for ERTD42, dual; tolerance at 0° C is ±1.4° C

ERTD41 Copper
- 10Ω (9.05Ω actual) @ 0° C
- α = 0.00426 Ω/Ω/°C
- -70° C to +150° C
- -94° F to +300° F
- Available with 0.250" sheath diameter or larger

ERTD42 Nickel
- 120Ω @ 0° C
- α = 0.00672 Ω/Ω/°C
- -40° C to +180° C
- -40° F to +350° F
- Available with 0.250" sheath diameter or larger

Specify Sensor Lead Configuration

2 — RED, WHITE — 2-WIRE SINGLE

3 — RED, RED, WHITE — 3-WIRE SINGLE

4 — RED, RED, WHITE, WHITE — 4-WIRE SINGLE

6 — RED, RED, WHITE, WHITE — 2-WIRE DUAL

7 — RED, RED, RED, RED, WHITE, WHITE — 3-WIRE DUAL

8 — RED, RED, RED, RED, WHITE, WHITE, WHITE, WHITE — 4-WIRE DUAL

Note: 0.125" and 0.187" diameter sheaths can contain up to 4 wires; 0.250" diameter sheaths can contain up to 8 wires.

Specify Sheath Material & Size

304 Stainless Steel

SS12
- 0.125" diameter

SS18
- 0.187" diameter

SS25
- 0.250" diameter

316 Stainless Steel

316SS12
- 0.125" diameter

316SS18
- 0.187" diameter

316SS25
- 0.250" diameter

Inconel 600

INC12
- 0.125" diameter
- Standard sheath material for RTD44

INC18
- 0.187" diameter
- Standard sheath material for RTD44

INC25
- 0.250" diameter
- Standard sheath material for RTD44

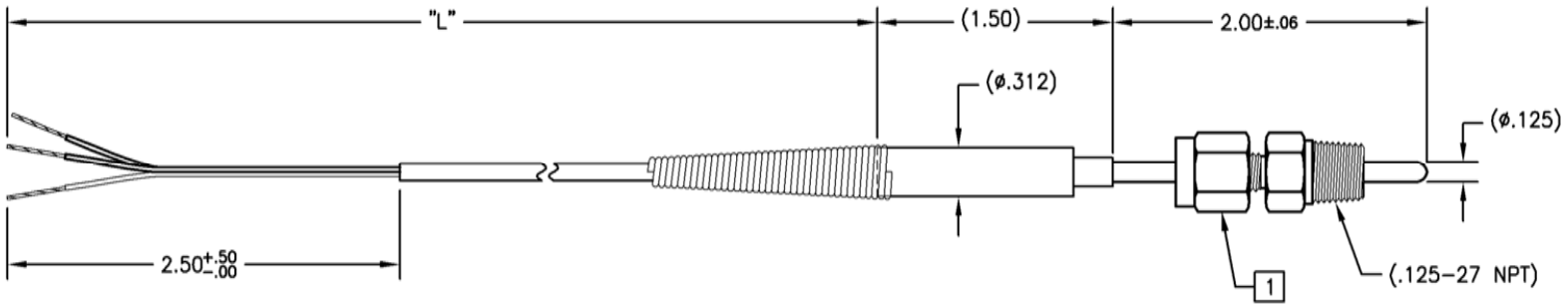
Note: For additional diameters and other sheath materials, see pages 23-24.

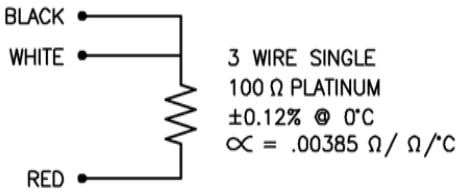
Conax Buffalo Technologies

For more information call: ***1-800-223-2389*** *•* *e-mail:* ***conaxbuf@conaxbuffalo.com*** *•* *visit our website:* ***www.conaxbuffalo.com***

"L" +2.00 −0.00
74.00
120.00
144.00

REVISIONS			
LETTER	DESCRIPTION		DATE
ORIG	PER E.O. QP−9016	SMK	11/20/08
A	PER E.O. QP−9863	PJZ	09/21/09
B	PER E.O. QP−11579	RTE	04/27/11
C	PER E.O. QP−12036	PJZ	09/15/11





RTD ELEMENT WIRE DIAGRAM

SEE SHEET 2 FOR BILL OF MATERIALS

−003	−002	−001	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION	MATERIAL	SP
QTY REQD							
X				10−1236−003	ERTD43W3−SS12−T3(144" SPEC)−2.00"		
	X			10−1236−002	ERTD43W3−SS12−T3(120" SPEC)−2.00"		
		X		10−1236−001	ERTD43W3−SS12−T3(74" SPEC)−2.00"		

PARTS LIST

(ITEM 13) TO BE SHIPPED LOOSE ON PROBE.

DIMENSIONS & TOLERANCES PER ANSI STD Y14.5M, 1982.
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

.XX ± .010
.XXX ± .005
ANGLES ± 1/2°
125 FINISH ALL OVER
FILLETS .005 − .040
RADIUS .005 − .015
ALL PARTS TO BE FREE OF BURRS.

GEOMETRIC SYMBOLS

FLATNESS	CONCENTRICITY
STRAIGHTNESS	RUNOUT
ROUNDNESS	PERPENDICULAR
PARALLELISM	TRUE POSITION

APPROVALS		DATE
DWN	SMK	11/20/08
CHKD	SMP	11/21/08
ENGR	SMK	11/21/08
REF:		

DO NOT SCALE DRAWING

Conax® TECHNOLOGIES 2300 BUFF

ERTD43W3−SS12−T3(XXX" S
FOR HSI

PROJECT No: 1CD5364

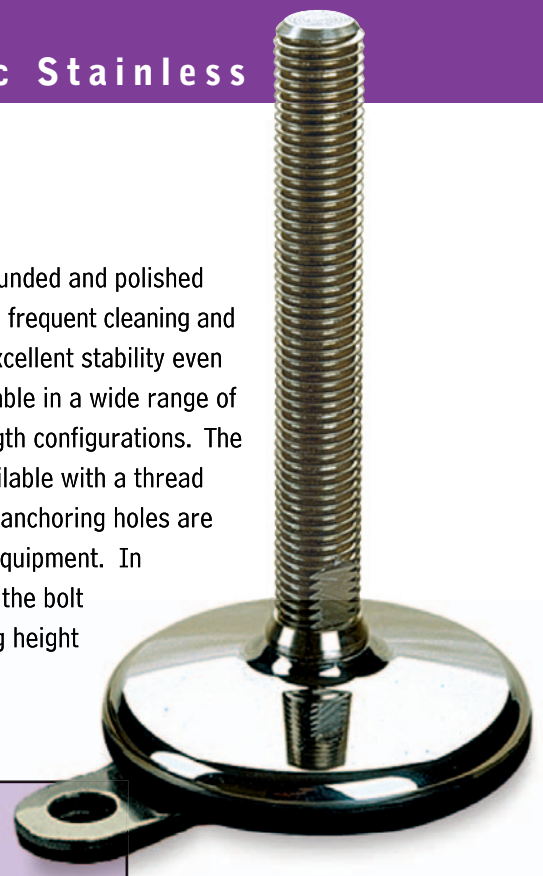
SIZE	CODE IDENT. NO.	
B	1CRL3	10−

SCALE 1=1 SHE

Leveling Mounts

Hygienic M-Series

The Sunnex Hygienic M-Series has a rounded and polished surface design for applications requiring frequent cleaning and wash-downs. The 5° swivel provides excellent stability even on inclined surfaces. Models are available in a wide range of load capacities, bolt diameters and length configurations. The Hygienic-M Series mounts are also available with a thread casing for added cleanliness. Optional anchoring holes are available to provide easy fastening of equipment. In addition, integrated adjustment flats in the bolt allow full adjustment without sacrificing height even in a blind hole design.



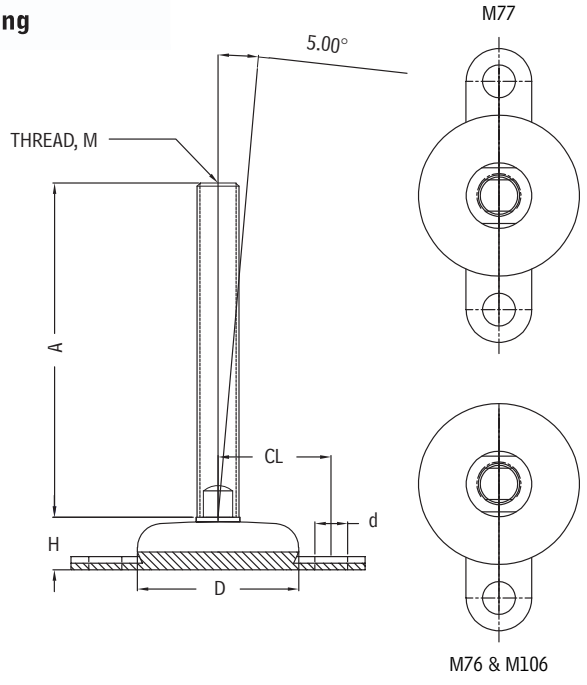
Model M-Anchoring

Applications

- Conveyors
- Material Handling Equipment
- Vibratory Feeders
- Shaker Bowls
- Automated Assembly Equipment
- Production Conveyors
- Packaging Filling Machines

Advantages

- Rubber meets FDA standard
- 177.2600 for food grade requirements
- Rubber permanently vulcanized to housing for hygienic seal
- Wide temperature range: –20° to 100° C
- 5° swivel for increased stability



Item	Load (lbs)	Base Dia. (D)	Thread (M)	Length (A)	Base H	Overall Ht	Hole (d)	Center (CL)
M76124	1770	2.95	1/2-12	4.0	0.87	4.87	0.63	2.05
M76584	1770	2.95	5/8-11	4.0	0.87	4.87	0.63	2.05
M76586	1770	2.95	5/8-11	6.0	0.87	6.87	0.63	2.05
M76346	1770	2.95	3/4-10	6.0	0.87	6.87	0.63	2.05
M77124	1770	2.95	1/2-12	4.0	0.87	4.87	0.63	2.05
M77584	1770	2.95	5/8-11	4.0	0.87	4.87	0.63	2.05
M77586	1770	2.95	5/8-11	6.0	0.87	6.87	0.63	2.05
M77346	1770	2.95	3/4-10	6.0	0.87	6.87	0.63	2.05
M106124	2220	3.94	1/2-12	4.0	1.26	5.26	0.63	2.64
M106584	2220	3.94	5/8-11	4.0	1.26	5.26	0.63	2.64
M106586	2220	3.94	5/8-11	6.0	1.26	7.26	0.63	2.64
M106346	2220	3.94	3/4-10	6.0	1.26	7.26	0.63	2.64

See our Online Specifications:
www.sunnexonline.com/mounts/hygienicHa.htm
www.sunnexonline.com/mounts/hygienicM.htm

Main Circuit Breaker

Tmax-Molded Case Circuit Breakers

T4 250A Frame

AC Circuit Breakers and Switches

DC Circuit Breakers and Switches

3 and 4 Pole

Motor Circuit Protectors

Higher Performances in Less Space

Field Installable Accessories and Trip Units

Dimensions 3P Fixed Version 8.07H x 4.13W x 4.07D

Compliance with Standards

UL 489
CSA C22.2 No.5.1
IEC 60947-2
Standards
EC directive:
– “Low Voltage Directives” (LVD) no. 73/23 EEC
– “Electromagnetic Compatibility Directive” (EMC) no.89/336 EEC

The ABB Quality System complies with the international ISO 9001 - 2000 Standard (model for quality assurance in design, development, construction, and installation and service) and with the equivalent European EN ISO 9001 and Italian UNI EN ISO 9001 Standards

Interrupting ratings (RMS sym. kAmps)		T4				
Continuous Current Rating		250A				
Number of Poles		3-4				
		N	**S**	**H**	**L**	**V**
AC						
240V		65	100	150	200	200
480V		25	35	65	100	150
600V		18	25	35	65	100
DC*						
500V	2 poles in series	25	35	50	65	100
600V	3 poles in series	16	25	35	50	65

*Thermo Magnetic Trip Only

Company Quality Systems and Environmental Systems

The new Tmax series has a hologram on the front, obtained using special anti-imitation techniques, which guarantees the quality and that the circuit breaker is an original ABB product.

Attention to protection of the environment and to health and safety in the work place is another priority commitment for ABB and, as confirmation of this, the company environmental management system has been certified by RINA in 1997, in conformity with the international ISO 14001 Standard. This certification has been integrated in 1999 with the Management System for Health and Safety in the workplace, according to OHSAS 18001 (British Standards), obtaining one of the first certification of integrated management System, QES (Quality, Environment, Safety) issued by RINA. ABB - the first industry in the electromechanical section in Italy to obtain this recognition - thanks to a revision of the production process with an eye to ecology has been able to reduce the consumption of raw materials and waste from processing by 20%. ABB's commitment to safeguarding the environment is also shown in a concrete way by the Life Cycle Assessments of its products carried out directly by the ABB Research and Development in collaboration with the ABB Research Center. Selection of materials, processes and packing materials is made optimizing the true environmental impact of the product, also foreseeing the possibility of its being recycled.

Mounting

Fixed
Plug-in
Drawout

Connections

Busbar connection or compression lugs
Pressure-type terminals for bare cables
Rear connections

Trip Unit

TMF thermo magnetic trip units, with fixed thermal and magnetic threshold (I3 = 10 x In);

TMD (up to 50 A) thermo magnetic trip units with adjustable thermal threshold (I1 = 0.7…1 x In) and fixed magnetic threshold (I3 = 10 x In).

TMA thermo magnetic trip units, with adjustable thermal threshold (I1 = 0.7…1 x In) and adjustable magnetic threshold (I3 = 5…10 x In).

PR221DS, PR222DS/P and PR222DS/PD-A electronic trip unit

Weight (lbs)	6.18

Auxiliary Devices for Indication and Control

- Auxiliary contacts - AUX
- Undervoltage release - UVR
- Shunt trip - SOR
- Terminal covers
- Front for lever operating mechanism - FLD
- Direct rotary handle - RHD
- Stored energy motor operator - MOE
- Key lock - KLF
- Early auxiliary contact - AUE
- Transmitted rotary handle - RHE
- Front terminal for copper cable - FC Cu
- Front extended terminal - EF
- Front terminal for copper-aluminum - FC CuAl
- Front extended spread terminal – ES
- Distribution lugs
- Rear orientated terminal - R
- Phase separators
- Residual current release (IEC Only)

Publication LV038
No. 1SXU 210 038 D0201
Printed in USA, November, 2005

ABB Inc.

1206 Hatton Road
Wichita Falls, TX 76302
For more information and
the location of your local
field office please go to
www.abb-control.com

T4
250A, 600V Δ
Electronic and thermal magnetic

T4

Dimensions 3P Fixed Version 8.07H x 4.13W x 4.07D
Weight 6.18 (lbs)

General
The T4 breaker is a 250 amp frame with either a microprocessor based over current protective trip system or a thermal magnetic trip unit.

Standards
The UL489/CSA 22.2 version of T4 also carries an IEC-947 rating.

Versions
To meet all application requirements, the T4 is available in the following versions:
- T = Thermal-magnetic
- B = Selectable & adjustable LI or LS
- C = Adjustable LSI
- E = Adjustable LSIG
- D = Molded Case Switch
- E5 = Electronic instantaneous only (MCP)

Trip functions
These trip functions are available:
- L = Long time
- S = Short time
- I = Instantaneous
- G = Ground fault

Performance levels
Each version is also available in different maximum fault interrupting levels:
- N = Normal
- S = Standard
- H = High - UL Current Limiting
- L = Extra high
- V = Very high - UL Current Limiting

Number of poles ③
The T4 is available in two, three and four pole versions. Estimate 4 pole pricing by adding 35% to the 3 pole price and contact your ABB sales person for details.

UL489 / CSA C22.2 Interrupting capacity (kA RMS)

Voltage	N	S	H	L	V
240VAC	65	100	150	200	200
480VAC	25	35	65	100	150
600VAC	18	25	35	65	100
500VDC ①	25	35	50	65	100
600VDC ②	16	25	35	50	65

① 2 poles in series.
② 3 poles in series.
③ 2 pole breakers available in N version only. 4 pole breakers available in N and H version only.

T4
250A, 600V Δ
Adjustable thermal magnetic①

20A - 250A Frame

Breaker	IC at 480VAC	Rating	Magnetic trip	2 pole, 600VAC/600VDC catalog number	List price	3 pole, 600VAC/600VDC catalog number	List price
T4N	25	20A	500	T4N020TW-2	**$ 1290**	T4N020TW	**$ 1517**
		30A	500	T4N030TW-2	**1290**	T4N030TW	**1517**
		40A	500	T4N040TW-2	**1290**	T4N040TW	**1517**
		50A	500	T4N050TW-2	**1290**	T4N050TW	**1517**
		80A	400-800	T4N080TW-2	**1315**	T4N080TW	**1547**
		100A	500-1000	T4N100TW-2	**1315**	T4N100TW	**1547**
		125A	625-1250	T4N125TW-2	**2019**	T4N125TW	**1667**
		150A	750-1500	T4N150TW-2	**2019**	T4N150TW	**1667**
		200A	1000-2000	T4N200TW-2	**2019**	T4N200TW	**1667**
		250A	1250-2500	T4N250TW-2	**2019**	T4N250TW	**1717**
T4S	35	20A	500	–	–	T4S020TW	**1887**
		30A	500	–	–	T4S030TW	**1887**
		40A	500	–	–	T4S040TW	**1887**
		50A	500	–	–	T4S050TW	**1887**
		80A	400-800	–	–	T4S080TW	**1927**
		100A	500-1000	–	–	T4S100TW	**1927**
		125A	625-1250	–	–	T4S125TW	**2067**
		150A	750-1500	–	–	T4S150TW	**2067**
		200A	1000-2000	–	–	T4S200TW	**2067**
		250A	1250-2500	–	–	T4S250TW	**2092**
T4H UL Current Limiting	65	20A	500	–	–	T4H020TW	**3617**
		30A	500	–	–	T4H030TW	**3617**
		40A	500	–	–	T4H040TW	**3617**
		50A	500	–	–	T4H050TW	**3617**
		80A	400-800	–	–	T4H080TW	**3657**
		100A	500-1000	–	–	T4H100TW	**3657**
		125A	625-1250	–	–	T4H125TW	**3767**
		150A	750-1500	–	–	T4H150TW	**3767**
		200A	1000-2000	–	–	T4H200TW	**3767**
		250A	1250-2500	–	–	T4H250TW	**3832**
T4L	100	20A	500	–	–	T4L020TW	**5915**
		30A	500	–	–	T4L030TW	**5915**
		40A	500	–	–	T4L040TW	**5915**
		50A	500	–	–	T4L050TW	**5915**
		80A	400-800	–	–	T4L080TW	**5965**
		100A	500-1000	–	–	T4L100TW	**5965**
		125A	625-1250	–	–	T4L125TW	**5995**
		150A	750-1500	–	–	T4L150TW	**5995**
		200A	1000-2000	–	–	T4L200TW	**5995**
		250A	1250-2500	–	–	T4L250TW	**6110**
T4V UL Current Limiting	150	20A	500	–	–	T4V020TW	**6780**
		30A	500	–	–	T4V030TW	**6780**
		40A	500	–	–	T4V040TW	**6780**
		50A	500	–	–	T4V050TW	**6780**
		80A	400-800	–	–	T4V080TW	**6817**
		100A	500-1000	–	–	T4V100TW	**6817**
		125A	625-1250	–	–	T4V125TW	**6847**
		150A	750-1500	–	–	T4V150TW	**6847**
		200A	1000-2000	–	–	T4V200TW	**6847**
		250A	1250-2500	–	–	T4V250TW	**6887**

① T4N020TW - Fixed Thermal, Fixed Magnetic
T4N030TW - T4N050TW Adjustable Thermal, Fixed Magnetic

T4
250A, 600V Δ 100% rated
Adjustable thermal magnetic①

30A - 250A Frame 100% rated

Breaker	IC at 480 VAC kA	Rating	Magnetic trip	3 pole, 600VAC/600VDC Catalog number	List price
T4N	25	20A	500	T4NQ020TW	**$ 1673**
		30A	500	T4NQ030TW	**1673**
		40A	500	T4NQ040TW	**1673**
		50A	500	T4NQ050TW	**1673**
		80A	400-800	T4NQ080TW	**1706**
		100A	500-1000	T4NQ100TW	**1706**
		125A	625-1250	T4NQ125TW	**1839**
		150A	750-1500	T4NQ150TW	**1839**
		200A	1000-2000	T4NQ200TW	**1839**
		250A	1250-2500	T4NQ250TW	**1894**
T4S	35	20A	500	T4SQ020TW	**2081**
		30A	500	T4SQ030TW	**2081**
		40A	500	T4SQ040TW	**2081**
		50A	500	T4SQ050TW	**2081**
		80A	400-800	T4SQ080TW	**2125**
		100A	500-1000	T4SQ100TW	**2125**
		125A	625-1250	T4SQ125TW	**2280**
		150A	750-1500	T4SQ150TW	**2280**
		200A	1000-2000	T4SQ200TW	**2280**
		250A	1250-2500	T4SQ250TW	**2307**
T4H UL Current Limiting	65	20A	500	T4HQ020TW	**3990**
		30A	500	T4HQ030TW	**3990**
		40A	500	T4HQ040TW	**3990**
		50A	500	T4HQ050TW	**3990**
		80A	400-800	T4HQ080TW	**4034**
		100A	500-1000	T4HQ100TW	**4034**
		125A	625-1250	T4HQ125TW	**4155**
		150A	750-1500	T4HQ150TW	**4155**
		200A	1000-2000	T4HQ200TW	**4155**
		250A	1250-2500	T4HQ250TW	**4227**
T4L	100	20A	500	T4LQ020TW	**6524**
		30A	500	T4LQ030TW	**6524**
		40A	500	T4LQ040TW	**6524**
		50A	500	T4LQ050TW	**6524**
		80A	400-800	T4LQ080TW	**6579**
		100A	500-1000	T4LQ100TW	**6579**
		125A	625-1250	T4LQ125TW	**6612**
		150A	750-1500	T4LQ150TW	**6612**
		200A	1000-2000	T4LQ200TW	**6612**
		250A	1250-2500	T4LQ250TW	**6739**
T4V UL Current Limiting	150	20A	500	T4VQ020TW	**7478**
		30A	500	T4VQ030TW	**7478**
		40A	500	T4VQ040TW	**7478**
		50A	500	T4VQ050TW	**7478**
		80A	400-800	T4VQ080TW	**7519**
		100A	500-1000	T4VQ100TW	**7519**
		125A	625-1250	T4VQ125TW	**7552**
		150A	750-1500	T4VQ150TW	**7552**
		200A	1000-2000	T4VQ200TW	**7552**
		250A	1250-2500	T4VQ250TW	**7569**

① T4 20A Fixed Thermal, Fixed Magnetic
T4 30A - T4 50A Adjustable Thermal, Fixed Magnetic

T4
250A, 600V Δ
Electronic (AC only)

100A Frame, electronic trip unit (AC only)

Breaker	IC at 480VAC kA	Trip Unit	2 pole, 600V catalog number	List price	3 pole, 600V catalog number	List price
T4N	25	PR221 LS/I	T4N100BW-2	**$ 1710**	T4N100BW	**$ 1903**
		PR222 LSI	T4N100CW-2	**2135**	T4N100CW	**2540**
		PR222 LSIG	T4N100EW-2	**2985**	T4N100EW	**3330**
T4S	35	PR221 LS/I	-	**-**	T4S100BW	**2370**
		PR222 LSI	-	**-**	T4S100CW	**3164**
		PR222 LSIG	-	**-**	T4S100EW	**4148**
T4H UL Current Limiting	65	PR221 LS/I	-	**-**	T4H100BW	**4498**
		PR222 LSI	-	**-**	T4H100CW	**4846**
		PR222 LSIG	-	**-**	T4H100EW	**5877**
T4L	100	PR221 LS/I	-	**-**	T4L100BW	**5954**
		PR222 LSI	-	**-**	T4L100CW	**6063**
		PR222 LSIG	-	**-**	T4L100EW	**7091**
T4V UL Current Limiting	150	PR221 LS/I	-	**-**	T4V100BW	**8555**
		PR222 LSI	-	**-**	T4V100CW	**9213**
		PR222 LSIG	-	**-**	T4V100EW	**9957**

150A Frame, electronic trip unit (AC only)

Breaker	IC at 480VAC kA	Trip Unit	2 pole, 600V catalog number	List price	3 pole, 600V catalog number	List price
T4N	25	PR221 LS/I	T4N150BW-2	**$ 2625**	T4N150BW	**$ 2050**
		PR222 LSI	T4N150CW-2	**3050**	T4N150CW	**2737**
		PR222 LSIG	T4N150EW-2	**3900**	T4N150EW	**3588**
T4S	35	PR221 LS/I	-	**-**	T4S150BW	**2542**
		PR222 LSI	-	**-**	T4S150CW	**3394**
		PR222 LSIG	-	**-**	T4S150EW	**4449**
T4H UL Current Limiting	65	PR221 LS/I	-	**-**	T4H150BW	**4633**
		PR222 LSI	-	**-**	T4H150CW	**5024**
		PR222 LSIG	-	**-**	T4H150EW	**6094**
T4L	100	PR221 LS/I	-	**-**	T4L150BW	**6174**
		PR222 LSI	-	**-**	T4L150CW	**6288**
		PR222 LSIG	-	**-**	T4L150EW	**7354**
T4V UL Current Limiting	150	PR221 LS/I	-	**-**	T4V150BW	**8872**
		PR222 LSI	-	**-**	T4V150CW	**9555**
		PR222 LSIG	-	**-**	T4V150EW	**10,326**

250A Frame, electronic trip unit (AC only)

Breaker	IC at 480VAC kA	Trip Unit	2 pole, 600V catalog number	List price	3 pole, 600V catalog number	List price
T4N	25	PR221 LS/I	T4N250BW-2	**$ 2625**	T4N250BW	**$ 2112**
		PR222 LSI	T4N250CW-2	**3050**	T4N250CW	**2819**
		PR222 LSIG	T4N250EW-2	**3900**	T4N250EW	**3696**
T4S	35	PR221 LS/I	-	**-**	T4S250BW	**2573**
		PR222 LSI	-	**-**	T4S150CW	**3435**
		PR222 LSIG	-	**-**	T4S250EW	**4503**
T4H UL Current Limiting	65	PR221 LS/I	-	**-**	T4H250BW	**4713**
		PR222 LSI	-	**-**	T4H250CW	**5127**
		PR222 LSIG	-	**-**	T4H250EW	**6219**
T4L	100	PR221 LS/I	-	**-**	T4L250BW	**6300**
		PR222 LSI	-	**-**	T4L250CW	**6416**
		PR222 LSIG	-	**-**	T4L250EW	**7504**
T4V UL Current Limiting	150	PR221 LS/I	-	**-**	T4V250BW	**9053**
		PR222 LSI	-	**-**	T4V250CW	**9750**
		PR222 LSIG	-	**-**	T4V250EW	**10,537**

T4
250A, 600V Δ, 100% Rated Electronic (AC only)

100A Frame - 100% rated, electronic trip unit (AC only)

Breaker	IC at 480VAC kA	Trip Unit	3 pole, 600V catalog number	List price
T4N	25	PR221 LS/I	T4NQ100BW	**$ 2124**
		PR222 LSI	T4NQ100CW	**2835**
		PR222 LSIG	T4NQ100EW	**3716**
T4S	35	PR221 LS/I	T4SQ100BW	**2645**
		PR222 LSI	T4SQ100CW	**3531**
		PR222 LSIG	T4SQ100EW	**4629**
T4H UL Current Limiting	65	PR221 LS/I	T4HQ100BW	**5020**
		PR222 LSI	T4HQ100CW	**5383**
		PR222 LSIG	T4HQ100EW	**6530**
T4L	100	PR221 LS/I	T4LQ100BW	**6616**
		PR222 LSI	T4LQ100CW	**6737**
		PR222 LSIG	T4LQ100EW	**7879**
T4V UL Current Limiting	150	PR221 LS/I	T4VQ100BW	**9506**
		PR222 LSI	T4VQ100CW	**10,237**
		PR222 LSIG	T4VQ100EW	**11,063**

150A Frame - 100% rated, electronic trip unit (AC only)

Breaker	IC at 480VAC kA	Trip Unit	3 pole, 600V catalog number	List price
T4N	25	PR221 LS/I	T4NQ150BW	**$ 2288**
		PR222 LSI	T4NQ150CW	**3055**
		PR222 LSIG	T4NQ150EW	**4004**
T4S	35	PR221 LS/I	T4SQ150BW	**2837**
		PR222 LSI	T4SQ150CW	**3788**
		PR222 LSIG	T4SQ150EW	**4965**
T4H UL Current Limiting	65	PR221 LS/I	T4HQ150BW	**5171**
		PR222 LSI	T4HQ150CW	**5582**
		PR222 LSIG	T4HQ150EW	**6771**
T4L	100	PR221 LS/I	T4LQ150BW	**6860**
		PR222 LSI	T4LQ150CW	**6987**
		PR222 LSIG	T4LQ150EW	**8171**
T4V UL Current Limiting	150	PR221 LS/I	T4VQ150BW	**9858**
		PR222 LSI	T4VQ150CW	**10,616**
		PR222 LSIG	T4VQ150EW	**11,473**

250A Frame - 100% rated, electronic trip unit (AC only)

Breaker	IC at 480VAC kA	Trip Unit	3 pole, 600V catalog number	List price
T4N	25	PR221 LS/I	T4NQ250BW	**$ 2357**
		PR222 LSI	T4NQ250CW	**3146**
		PR222 LSIG	T4NQ250EW	**4125**
T4S	35	PR221 LS/I	T4SQ250BW	**2872**
		PR222 LSI	T4SQ150CW	**3834**
		PR222 LSIG	T4SQ250EW	**5025**
T4H UL Current Limiting	65	PR221 LS/I	T4HQ250BW	**5260**
		PR222 LSI	T4HQ250CW	**5697**
		PR222 LSIG	T4HQ250EW	**6910**
T4L	100	PR221 LS/I	T4LQ250BW	**7000**
		PR222 LSI	T4LQ250CW	**7129**
		PR222 LSIG	T4LQ250EW	**8338**
T4V UL Current Limiting	150	PR221 LS/I	T4VQ250BW	**10,058**
		PR222 LSI	T4VQ250CW	**10,833**
		PR222 LSIG	T4VQ250EW	**11,708**

T4
250A, 600V Δ
Instantaneous only, MCP/Molded case switch

Instantaneous only MCPs

T4 - 250A Frame magnetic only (MCP - AC only)

Breaker	IC at 480VAC	Trip unit type	Rating	Adjustment range	3 pole, 600VAC Catalog number	List price
T4N	25kA	Instantaneous only	100A 150A 250A	100-1000 150-1500 250-2500	T4N100E5W T4N150E5W T4N250E5W	**$ 1808** **1948** **2006**
T4S	35kA	Instantaneous only	100A 150A 250A	100-1000 150-1500 250-2500	T4S100E5W T4S150E5W T4S250E5W	**2252** **2415** **2444**
T4H	65kA	Instantaneous only	100A 150A 250A	100-1000 150-1500 250-2500	T4H100E5W T4H150E5W T4H250E5W	**4273** **4401** **4477**
T4L	100kA	Instantaneous only	100A 150A 250A	100-1000 150-1500 250-2500	T4L100E5W T4L150E5W T4L250E5W	**5656** **5865** **5985**

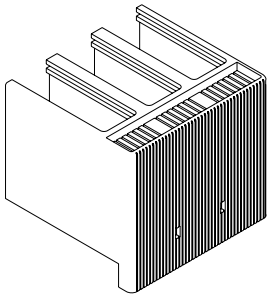
Molded case switch ①

Type	IC at 480VAC	Amps	Magnetic trip	3 pole 600V catalog number	List price
T4N-D	25kA	250	3000	T4N250DW	**$ 1354**
T4S-D	35kA	250	3000	T4S250DW	**1510**
T4H-D	65kA	250	3000	T4H250DW	**2154**
T4L-D	100kA	250	3000	T4L250DW	**3419**
T4V-D	150kA	250	3000	T4V250DW	**3842**

① When protected by a OCPD with appropriate ratings.

Accessories
Mechanical
T1 - T7


KT3100-3


KT1HTC-3



KT4LTC-3

Standard cable terminal

Frame	Wire Size	Catalog number (set of 2)	List Price	Catalog number (set of 3)	List Price	Catalog number (set of 4)	List Price
T1	14AWG-1/0	—	—	Integral	—	Integral	—
T2	14AWG-1/0	—	—	KT2100-3	$ 9	KT2100-4	$ 12
T3	14AWG - 1/0	—	—	KT3100-3	9	KT3100-4	12
	4AWG - 300kcmil	—	—	KT3225-3	18	KT3225-4	24
Ts3	14AWG-2AWG	KTS3060-2	$ 19	KTS3060-3	27	KTS3060-4	36
	14AWG-1/0	KTS3100-2	19	KTS3100-3	27	KTS3100-4	36
	2AWG-4/0	KTS3150-2	26	KTS3150-3	36	KTS3150-4	54
	4AWG-300kcmil	KTS3225-2	26	KTS3225-3	36	KTS3225-4	72
T4	14AWG-1/0	KT4100-2	18	KT4100-3	9	KT4100-4	12
	6AWG-350kcmil	KT4250-2	60	KT4250-3	30	KT4250-4	40
T5	250kcmil-500kcmil	KT5300-2	90	KT5300-3	45	KT5300-4	60
T5 ①	(2) 3/0-250kcmil	KT5400-2	90	KT5400-3	45	KT5400-4	60
T5 ②	(2) 3/0-500kcmil	—	—	KT5600-3	225	—	—
T6	(2) 250-500kcmil	—	—	KT6600-3	270	KT6600-4	360
T6 ①	(3) 2/0-400kcmil	—	—	KT6800-3	350	KT6800-4	470
T7 ①	(4) 4/0-500kcmil	—	—	KT7X1200-3	560	KT7X1200-4	747

Standard cable lug kits with power control taps

Frame	Wire Size	Catalog number (set of 2)	List Price	Catalog number (set of 3)	List Price	Catalog number (set of 4)	List Price
T3	14AWG - 1/0	—	—	KT3100-3C	$ 16	KT3100-4C	$ 19
	4AWG - 300kcmil	—	—	KT3225-3C	18	KT3225-4C	31
Ts3	14AWG-1/0	KTS3100-2C	$ 34	KTS3100-3C	48	KTS3100-4C	57
	2AWG-4/0	KTS3150-2C	34	KTS3150-3C	48	KTS3150-4C	57
	4AWG-300kcmil	KTS3225-2C	53	KTS3225-3C	75	KTS3225-4C	93
T4	14AWG-1/0	KT4100-2C	30	KT4100-3C	15	KT4100-4C	15
	6AWG-350kcmil	KT4250-2C	72	KT4250-3C	36	KT4250-4C	48
T5	250kcmil-500kcmil	KT5300-2C	102	KT5300-3C	51	KT5300-4C	68
T5 ①	(2) 3/0-250kcmil	KT5400-2C	102	KT5400-3C	51	KT5400-4C	68
T6	(2) 250-500 kcmil	—	—	KT6600-3C	310	KT6600-4C	414
T6 ②)	(3) 2/0-400kcmil	—	—	KT6800-3C	403	KT6800-4C	541

Terminal covers for fixed breakers - Low profile-kit includes two pieces

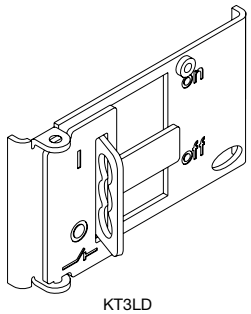
Frame	Catalog number (3 pole)	List Price	Catalog number (4 pole)	List Price
T1	KT1LTC-3	$ 35	KT1LTC-4	$ 47
T2	KT2LTC-3	40	KT2LTC-4	54
T3	KT3LTC-3	50	KT3LTC-4	68
Ts3	KTS3LC-3	50	KTS3LC-4	68
T4	KT4LTC-3	55	KT4LTC-4	74
T5	KT5LTC-3	60	KT5LTC-4	81
T6	KT6LTC-3	66	KT6LTC-4	88
T7 ③	KT7LTC-3	70	KT7LTC-4	93

Terminal covers for fixed breakers - High profile-kit includes two pieces

Frame	Catalog number (3 pole)	List Price	Catalog number (4 pole)	List price
T1	KT1HTC-3	$ 37	KT1HTC-4	$ 50
T2	KT2HTC-3	43	KT2HTC-4	58
T3	KT3HTC-3	53	KT3HTC-4	72
Ts3	KTS3HTC-3	53	KTS3HTC-4	72
T4	KT4HTC-3	58	KT4HTC-4	78
T5	KT5HTC-3	63	KT5HTC-4	85
T6	KT6HTC-3	66	KT6HTC-4	88
T7	KT7XHTC-3	77	KT7XHTC-4	104

① Comes standard with high profile terminal covers.
② Uses front extended spreaded terminals-refer to technical catalog.
③ Fixed breaker only.

Accessories
Mechanical, T1 - T7
Locking devices and handle operators



KT3LD

Padlock locking device

Frame	Style	Locking Position	Breaker Mounting	Catalog number	List Price
T1,T2,T3	PLL	OPEN/CLOSED OPEN	Fixed	KT3LD KT3LDO	**$ 35**
Ts3	FLD	OPEN	Fixed, Plug-In Draw-0ut	KTS3FLD KTS3LDW	**50** **55**
T4-T5	FLD	OPEN	Fixed, Plug-In Draw-out	KT5FLD KT5FLDW	**40** **55**
T6	FLD	OPEN	Fixed, Plug-In Draw-out	KT6FLD KT6FLDW	**40** **55**
T7	PLL	OPEN	Fixed, Drawout	KT7LD	**55**

Keylocks-Rotary handle mechanism

Frame	Style	Locking Position	Keys	Catalog number	List Price
T1,T2,T3	RHL	OPEN/CLOSED	Different	KT3RHL3	**$ 94**
Ts3	-	OPEN	Different	KTS3KL-2	**58**
T4-T5	KLF-D	OPEN	Different	KT5KLFD	**58**
T6	KLF-D	OPEN	Different	KT6KLFD	**79**
T7	KLF-D	OPEN	Different	KT7KLFD	**79**


KT5RH

Direct mount rotary operator handle

Frame	Breaker Mounting	Catalog number	List Price
T1,T2,T3	Fixed, Plug-In	KT3RH	**$ 146**
Ts3	Fixed, Plug-In	KTS3RH	**146**
Ts3	Draw-out	KTS3RHW	**146**
T5	Fixed, Plug-In	KT5RH	**275**
T5	Draw-0ut	KT5RHW	**275**
T6	Fixed, Plug-In	KT6RH	**310**
T6	Draw-out	KT6RHW	**310**
T7	Fixed, Plug-In	KT7RH	**348**
T7	Draw-out	KT7RHW	**348**

OHB65J6

Variable depth handle operators

Frame	NEMA rating	Mechanism catalog number	List Price	Shaft catalog number	List Price	Handle catalog number	List Price
T1-T3	1,3R,12	-	**-**	-	**-**	OHB65J6 ① OHY65J6 ①	**$ 80**
	4, 4X	KT3VD-M	**$ 72**	OXP6X430 (16.9)	**$ 28**	OHB80L6 ① OHY80L6 ①	**130**
	1	-	**-**	KT3VD-S (11.8)	**35**	KT3VD-H	**87**
Ts3	1,3R,12	-	**-**	OXP10X148 (5.8")	**24**	OHB95J10 ① OHY95J10	**80**
	4,4X	KTS3VD-M	**72**	OXP10X225 (8.9")	**26**	OHB95L10 ① OHY95L10	**120**
	-	-	**-**	OXP10X500 (19.7")	**32**	-	**-**
	1	-	**-**	KTS3VD-S12 (11.8) KTS3VD-S20 (20")	**24** **28**	KTS3VD-H	**87**
T4-T5	1,3R,12	-	**-**	OXP10X148 (5.8")	**24**	OHB95J10 ① OHY95J10	**80**
	4,4X	KT5VD-M	**65**	OXP10X225 (8.9")	**26**	OHB95L10 ① OHY95L10	**120**
	-	-	**-**	OXP10X500 (19.7")	**32**	-	**-**
	-	-	**-**	-	**-**	-	**-**
	1	-	**-**	KT5VD-S (19.7")	**36**	KT5VD-H	**87**
T6	1,3R,12	-	**-**	OXP10X148 (5.8")	**24**	OHB125J10 ① OHY125J10	**90**
	4,4X	KT6VD-M	**90**	OXP10X225 (8.9")	**26**	OHB125L10 ① OHY125L10	**130**
	-	-	**-**	OXP10X500 (19.7")	**32**	-	**-**
	1	-	**-**	KT5VD-S (19.7)	**36**	KT6VD-H	**87**
T7	1,3R,12	-	**-**	OXP10X148 (5.8")	**24**	OHB175J10 ① OHY175J10	**100**
	-	KT7VD-M	**95**	OXP10X225 (8.9")	**26**	OHB175L10 ① OHY175L10	**140**
	-	-	**-**	OXP10X500 (19.7")	**32**	-	**-**
	1	-	**-**	KT7VD-S (19.7")	**100**	KT7VD-H	**100**

OHB125J10

① Discount schedule

Accessories
T1 - T7

KT3MIF2

DIN rail adapters

Item	Catalog Number	List Price
T1/T2 (mounts on 35 mm DIN rail 15mm high)	KT2DIN	**$ 33**
T3 (mounts on 35mm DIN rail 15mm high)	KT3DIN	**41**
Ts3 (mounts on 75 mm DIN rail)	KTS3DMB	**41**

Mechanical interlocks

T1-T3	Catalog Number	List Price
Sliding bar interlock-front mounted (2 Breakers)	KT3MIF2	**$ 625**
Sliding bar interlock-front mounted (3 Breakers)	KT3MIF3	**844**
T3		
Rear Interlock-horizontal	KT3MI-H	**700**
Rear Interlock-vertical	KT3MI-V	**798**
TS3		
Horizontal	KTS3MI-H	**700**
Vertical	KTS3MI-V	**798**
T4-T5 ①		
Interlock frame		
Mechanical Interlock frame-horizontal	KT5MIR-HB	**490**
Mechanical Interlock frame-vertical	KT5MIR-VB	**588**
Plate type		
A T4 (F-P-W) T4 (F-P-W)	KT5MIR-PA	
B T4 (F-P-W) T5 400 (F-P-W) OR T5 600 (F)	KT5MIR-PB	
C T4 (F-P-W) T5 600 (P-W)	KT5MIR-PC	**210**
D T5 (F-P-W) T5 400 (F-P-W) OR 630 (F)	KT5MIR-PD	
E T4 (F-P-W) T5 600 (P-W)	KT5MIR-PE	
F T4 (F-P-W) T5 600 (P-W)	KT5MIR-PF	
T6		
Horizontal	KT6MI-H	**620**
Vertical	KT6MI-V	**620**
T7 ②		
Cable T7-X1	KT7XMLC	**195**
Mech. interlock plate-fixed	KT7XMLPW	**310**
Mech. interlock plate-draw-out	KT7XMLPF	**610**

① T4-T5 Complete assembly consists of one interlock frame and one plate.
② T7 Complete assembly consists of one cable and two plates.

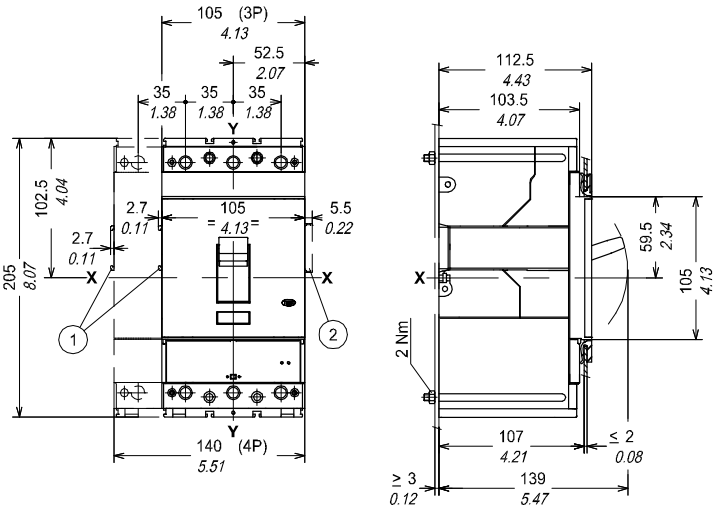
Approximate dimensions
T4

Fixed circuit breaker

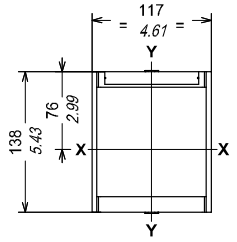
Caption

(1) Overall dimensions with cabled accessories mounted (SOR-C, UVR-C, RC221-222)

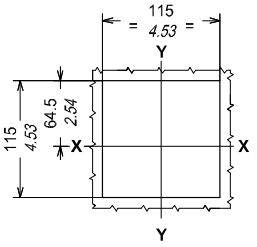
(2) Overall dimensions with cabled auxiliary contacts mounted (only 3Q 1SY)



Flange for compartment door

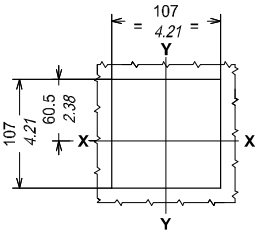


Drilling templates of the compartment door



3-4 POLES

With flange

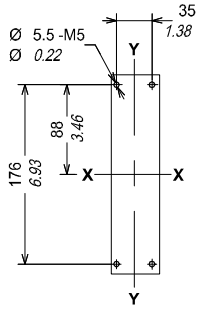


3-4 POLES

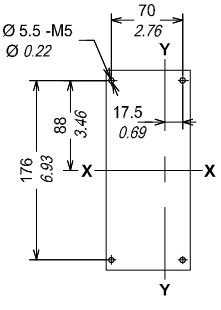
Without flange

Drilling templates for support sheet

For front terminals

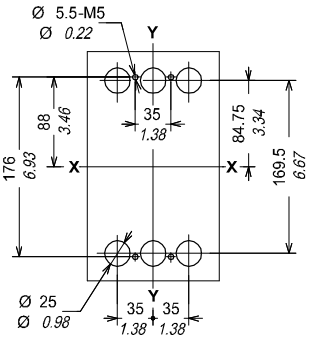


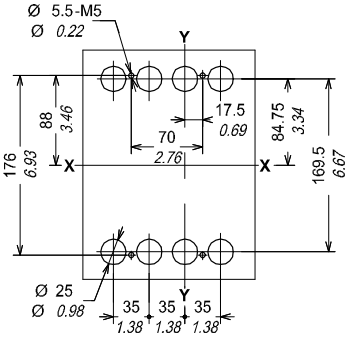
3 POLES



4 POLES

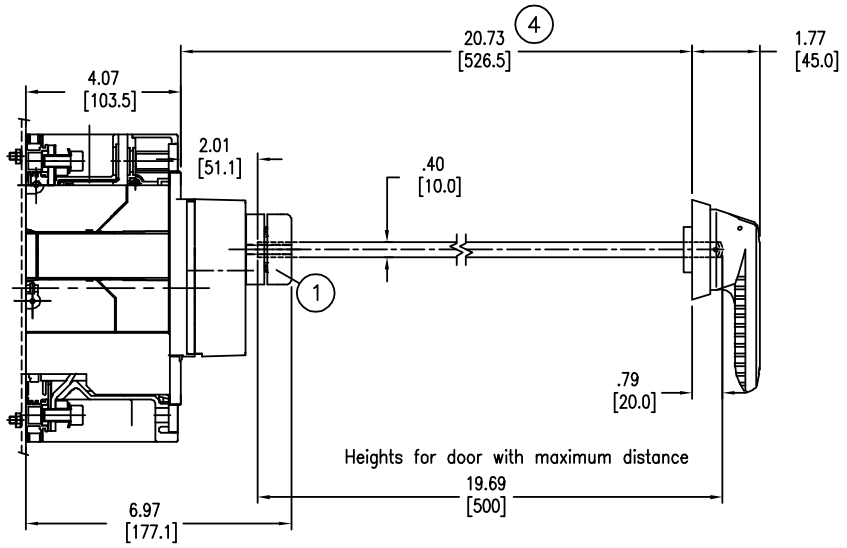
For rear terminals

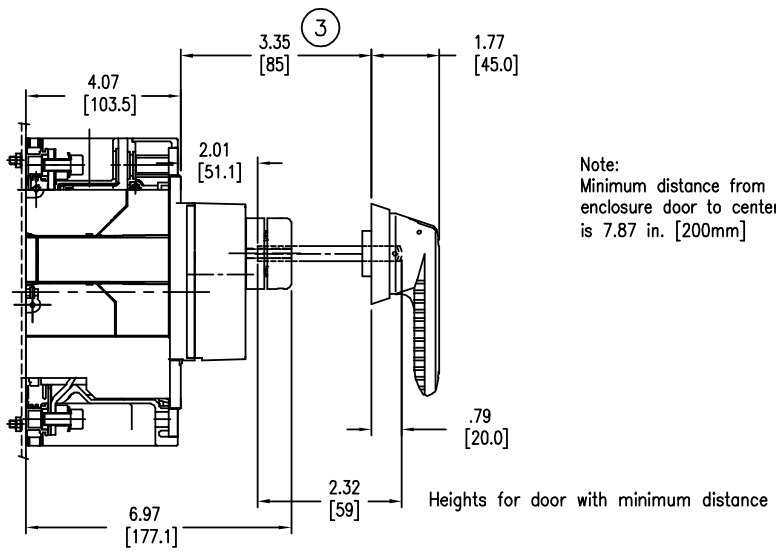




Approximate dimensions
Variable depth mechanism with OHB handle
T4 - T5

Pistol handle operating mechanism on the compartment door



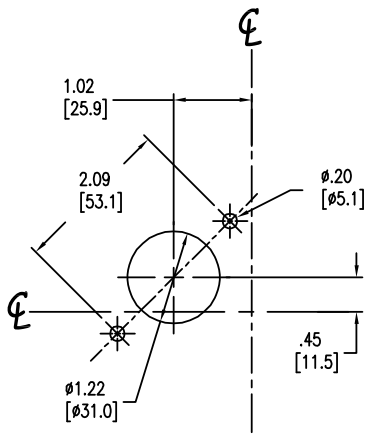


Caption

1. Transmission unit
2. Pistol handle operating mechanism on the compartment door
3. Minimum distance from the front door with accessory
4. Maximum distance from the front door with accessory

Note:
Minimum distance from hinge of enclosure door to center of shaft is 7.87 in. [200mm]

Drilling template of the compartment door



Harmonic Filter

HG7™ HarmonicGuard® Series
Drive-Applied Filter
Performance and Protection for Drives

Reliable Harmonic Filtration Technology with the HarmonicGuard® Series Drive-Applied Filter

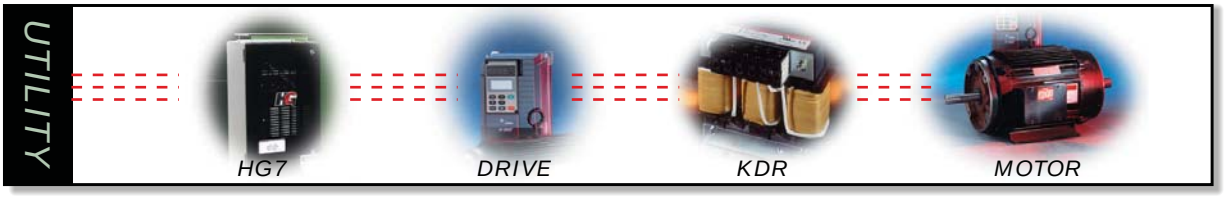
As power utilities continue to be pushed to the limits of supply capability, rising energy costs and decreasing power quality will continue to be an issue for consumers. Users continually search for ways to not only reduce energy costs, but also ensure their processes will continue to operate no matter the quality of the incoming power. To accomplish this, more and more variable frequency drives, UPS systems, and other non-linear loads, are being installed. For over a decade, TCI has been building harmonic mitigation filters. From waste water treatment facilities, commercial buildings, and factory floors to harsh mountain environments, reliable TCI filters have been installed to the satisfaction of thousands of customers. The next generation of the HarmonicGuard® Series filter has arrived. TCI's considerable experience with harmonic mitigation technology has led to the development of the HG7; a filter design based on proven technology with significantly improved performance.

Manufacturer's Warranty

HG7 HarmonicGuard Series Drive-Applied Filters are warranted against Manufacturer's defect for three years from the date of original shipment. For complete warranty details, please refer to TCI's Limited Warranty Policy.

Drawings/Specifications

Autocad compatible *.dxf drawings and Acrobat Reader compatible *.pdf drawings of all HG7 HarmonicGuard Series Drive-Applied Filters are available at www.transcoil.com or by contacting TCI at (800) 824-8282. The Installation, Operation, and Maintenance Manual is also available for download.



Typical Problems, Superior Solutions with HG7 Filters

Non-linear Loads and the Impure Sine Wave

Non-linear loads are products that draw non-sinusoidal current from the distribution line. This non-sinusoidal current is derived from waveforms that combine the fundamental frequency with integral multiples of that frequency. The resulting harmonic distortion is a basic result of the operation of non-linear loads. When these types of loads are a significant portion of an electrical system, harmonic distortion may begin to cause problems throughout the entire system. These problems range from poor power factor, transformer and distribution equipment overheating, random breaker tripping, or even sensitive equipment failure. Since harmonics affect the overall power distribution system, the power utility may even levy heavy fines when a facility is affecting the utility's ability to efficiently supply power to all of its customers. As a result, in the search for more efficient power use, other costly issues have been created.

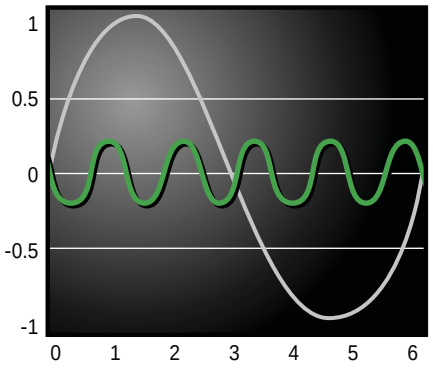
Superior HG7 Performance

The HG7 not only limits current distortion to less than 7% TDD, it also improves true power factor. Multiple package options will allow TCI customers to choose the right filter configuration for the application. Since every power system is different, harmonic mitigation requirements will differ, and even IEEE limits change based on the system loading characteristics. The HG7 product returns the power of choice to the customer, allowing for different configurations to achieve different performance and monitoring results. It is TCI's intention to provide the maximum value to our customers by offering the package and performance necessary for the application.

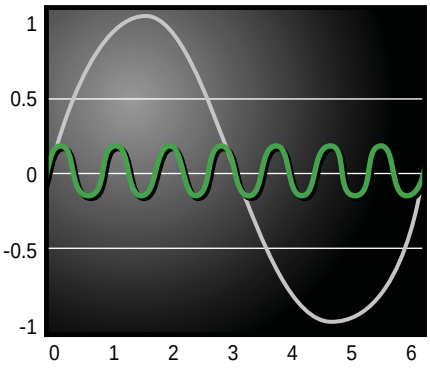
True Power Factor Correction

"Real" or True power is used to perform real work. Inductive loads require Real and Reactive power. Utilities provide Apparent power. Apparent power is a geometric combination of Real and Reactive (or imaginary) power. Reactive power performs no work. However, the flow of reactive current, a component of reactive power, does consume energy as it passes through resistive elements of the power system. Thus, reducing overall system efficiency. This reactive power is used to generate magnetic fields within motors, transformers, and other magnetic devices. Reactive power, combined with harmonic currents, contribute to poor power factor in electrical systems. The capacitors inherent in the HG7 design supply the necessary reactive power so the utility doesn't have to. The reduction in harmonic currents further improves the ratio of active power to apparent power. This overall improvement to true power factor assists in the efficient operation of facilities and the avoidance of possible fines due to poor power factor.

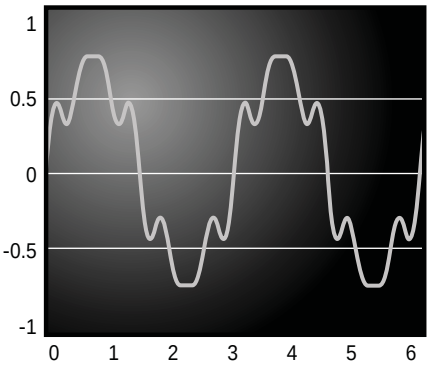
Sample 5^{th} Harmonic



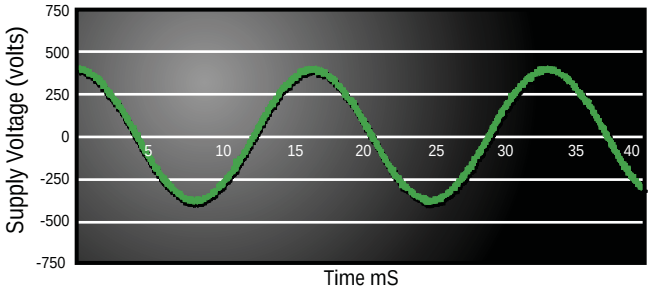
Sample 7^{th} Harmonic

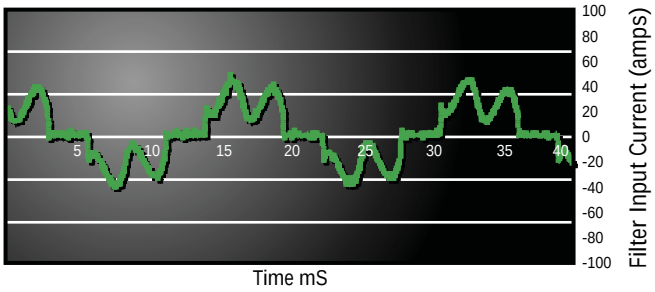


Fundamental Plus 5^{th} and 7^{th}

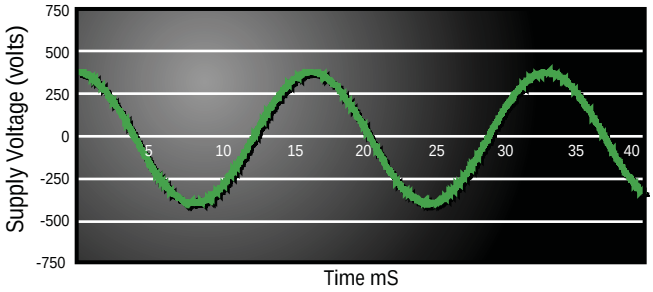


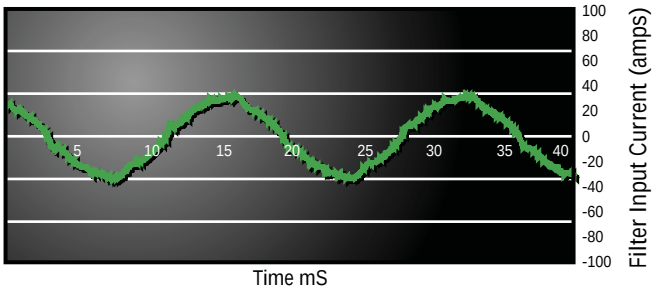
No Filter





HG7 Filter





IEEE-519 1992 Harmonic Distortion Limits

In 1981, "Recommended Practices and Requirements for Harmonic Control in Electric Power Systems" was published. This document was the first attempt at establishing acceptable standards for distortion, both voltage and current, within the distribution system. Unfortunately, the original document did not address the users' responsibility for contributing to the overall system distortion levels. Re-published in 1992, IEEE 519 set forth distortion limits for power users. These limits defined the maximum current and voltage distortion percentages allowable at the point of common coupling, commonly referred to as the PCC, under full load. These limits are on a sliding scale based on system loading parameters. Table 10-3 of IEEE Std 519-1992 "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems" can be found below.

Table 10-3

Current Distortion Limits for General Distribution Systems (120V through 69,000V)
Maximum Harmonic Current Distortion in Percent of I L
Individual Harmonic Order (Odd Harmonics)

ISC/IL	<11	11≤ h <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

Even harmonics are limited to 25% of the odd harmonic limits above. Current distortions that result in a dc offset, e.g., half-wave converters, are not allowed.
*All power generation equipment is limited to these values of current distortion, regardless of actual ISC/IL.
where
ISC = maximum short-circuit current at PCC.
IL = maximum demand load current (fundamental frequency component) at PCC.

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HG7 480V AC Filters

PART NUMBER OPEN STYLE	HP	k-Var	WATTS LOSS	OPEN WEIGHT	PART NUMBER ENCLOSED	ENCLOSED DIMENSIONS (in.) HEIGHT	WIDTH	DEPTH	ENCLOSED WEIGHT	FIELD TERMINAL PHASE SIZE
HG8AW00ST	7.5	3	200	40	HG8AW01ST	19.75	17.50	12.14	66	#4 - #18
HG10AW00ST	10	3	200	40	HG10AW01ST	19.75	17.50	12.14	66	#4 - #18
HG15AW00ST	15	5	275	50	HG15AW01ST	19.75	17.50	12.14	75	#4 - #18
HG20AW00ST	20	6	300	60	HG20AW01ST	19.75	17.50	12.14	85	#4 - #18
HG25AW00ST	25	8	325	65	HG25AW01ST	19.75	17.50	12.14	90	#4 - #18
HG30AW00ST	30	10	375	80	HG30AW01ST	31.38	17.50	12.14	130	#4 - #18
HG40AW00ST	40	12	625	120	HG40AW01ST	31.38	17.50	12.14	170	#4 - #18
HG50AW00ST	50	15	650	130	HG50AW01ST	31.38	17.50	12.14	180	#4 - #18
HG60AW00ST	60	20	825	135	HG60AW01ST	31.38	17.50	12.14	90	#2 - #22
HG75AW00ST	75	25	950	140	HG75AW01ST	31.38	17.50	12.14	195	#2/0 - #6
HG100AW00ST	100	30	975	185	HG100AW01ST	31.38	17.50	12.14	235	#2/0 - #6
HG125AW00ST	125	40	1150	220	HG125AW01ST	56.00	17.56	16.15	308	250MCM - #6
HG150AW00ST	150	45	1450	260	HG150AW01ST	56.00	17.56	16.15	350	250MCM - #6
HG200AW00ST	200	60	1775	350	HG200AW01ST	70.00	20.00	20.00	500	Two 250MCM - 1/0
HG250AW00ST	250	75	2050	355	HG250AW01ST	70.00	20.00	20.00	505	Two 250MCM - 1/0
HG300AW00ST	300	90	2500	450	HG300AW01ST	70.00	20.00	20.00	600	Two 350MCM - #4
HG350AW00ST	350	105	2725	500	HG350AW01ST	70.00	20.00	20.00	650	Two 350MCM - #4
HG400AW00ST	400	120	3100	680	HG400AW01ST	60.00	52.00	24.00	985	Two 350MCM - #4
HG450AW00ST	450	150	3350	685	HG450AW01ST	60.00	52.00	24.00	990	Two 600MCM - #2
HG500AW00ST	500	150	3500	715	HG500AW01ST	60.00	52.00	24.00	1020	Two 600MCM - #2
HG600AW00ST	600	180	3500	950	HG600AW01ST	60.00	52.00	24.00	1235	Three 600MCM - #2
HG700AW00ST	700	210	3600	1170	HG700AW01ST	60.00	52.00	24.00	1450	Three 600MCM - #2
HG800AW00ST	800	240	3900	1175	HG800AW01ST	60.00	52.00	24.00	1460	Three 600MCM - #2
HG900AW00ST	900	270	4200	1195	HG900AW01ST	60.00	52.00	24.00	1480	Three 800MCM - 350MCM

HG7 600V AC Filters

PART NUMBER OPEN STYLE	HP	k-Var	WATTS LOSS	OPEN WEIGHT	PART NUMBER ENCLOSED	ENCLOSED DIMENSIONS (in.) HEIGHT	WIDTH	DEPTH	ENCLOSED WEIGHT	FIELD TERMINAL PHASE SIZE
HG15CW00ST	15	5	300	40	HG15CW01ST	19.75	17.50	12.14	40	#4 - #18
HG30CW00ST	30	10	425	80	HG30CW01ST	31.38	17.50	12.14	130	#4 - #18
HG40CW00ST	40	12	675	120	HG40CW01ST	31.38	17.50	12.14	170	#4 - #18
HG50CW00ST	50	15	700	130	HG50CW01ST	31.38	17.50	12.14	180	#4 - #18
HG60CW00ST	60	20	900	135	HG60CW01ST	31.38	17.50	12.14	190	#4 - #18
HG75CW00ST	75	25	1000	140	HG75CW01ST	31.38	17.50	12.14	195	2/0 - #6
HG100CW00ST	100	30	1050	185	HG100CW01ST	31.38	17.50	12.14	235	2/0 - #6
HG125CW00ST	125	40	1200	220	HG125CW01ST	56.00	17.56	16.15	308	2/0 - #6
HG150CW00ST	150	45	1500	260	HG150CW01ST	56.00	17.56	16.15	350	250MCM - #6
HG200CW00ST	200	60	1850	350	HG200CW01ST	70.00	20.00	20.00	500	250MCM - #6
HG250CW00ST	250	75	2000	355	HG250CW01ST	70.00	20.00	20.00	505	Two 250MCM - 1/0
HG300CW00ST	300	90	2500	520	HG300CW01ST	70.00	20.00	20.00	675	Two 250MCM - 1/0
HG350CW00ST	350	105	2800	500	HG350CW01ST	70.00	20.00	20.00	725	Two 350MCM - #4
HG400CW00ST	400	120	2700	600	HG400CW01ST	60.00	52.00	24.00	990	Two 350MCM - #4
HG450CW00ST	450	150	3050	725	HG450CW01ST	60.00	52.00	24.00	1200	Two 350MCM - #4
HG500CW00ST	500	150	3000	930	HG500CW01ST	60.00	52.00	24.00	1300	Two 350MCM - #4
HG600CW00ST	600	180	3200	950	HG600CW01ST	60.00	52.00	24.00	1400	Two 600MCM - #2
HG700CW00ST	700	210	3600	1065	HG700CW01ST	60.00	52.00	24.00	1500	Two 600MCM - #2
HG800CW00ST	800	240	3900	1240	HG800CW01ST	60.00	52.00	24.00	1600	Three 600MCM - #2
HG900CW00ST	900	270	3800	1325	HG900CW01ST	60.00	52.00	24.00	1750	Three 600MCM - #2

HG7 240V AC Filters

PART NUMBER OPEN STYLE	HP	k-Var	WATTS LOSS	OPEN WEIGHT	PART NUMBER ENCLOSED	ENCLOSED DIMENSIONS (in.) HEIGHT	WIDTH	DEPTH	ENCLOSED WEIGHT	FIELD TERMINAL PHASE SIZE
HG8BW00ST	7.5	3	200	50	HG8BW01ST	19.75	17.50	12.14	75	#4 - #18
HG10BW00ST	10	3	225	55	HG10BW01ST	19.75	17.50	12.14	80	#4 - #18
HG15BW00ST	15	5	300	60	HG15BW01ST	19.75	17.50	12.14	85	#4 - #18
HG20BW00ST	20	6	350	80	HG20BW01ST	30.75	17.50	12.14	130	#4 - #18
HG25BW00ST	25	8	375	90	HG25BW01ST	30.75	17.50	12.14	140	2/0 - #6
HG30BW00ST	30	10	450	100	HG30BW01ST	30.75	17.50	12.14	150	2/0 - #6
HG40BW00ST	40	15	675	120	HG40BW01ST	30.75	17.50	12.14	170	2/0 - #6
HG50BW00ST	50	15	700	130	HG50BW01ST	30.75	17.50	12.14	180	250MCM - #6
HG60BW00ST	60	20	800	150	HG60BW01ST	30.75	17.50	12.14	200	250MCM - #6
HG75BW00ST	75	25	900	180	HG75BW01ST	56.00	17.56	16.15	265	Two 250MCM - 1/0
HG100BW00ST	100	30	1100	195	HG100BW01ST	56.00	17.56	16.15	285	Two 250MCM - 1/0

Typical Applications

- Printers
- Extruders
- Machining
- Pulp & Paper
- Waste Water Treatment
- Down Hole Pumping
- HVAC
- Uninterruptible Power Supplies
- AC Variable Frequency Drives
- 6-pulse rectifiers
- Fans
- Other Mission Critical Applications

Package Options

The HG7 has been designed with the customer in mind. From the Standard Package to the Power Monitor Package, TCI has the right solution for the application.

Standard Package

The Standard Package includes everything necessary for an application to meet IEEE 519 standards. From the highest quality harmonic grade capacitors on the market to the extraordinary reactors, this filter will meet the majority of application requirements found today. This cost effective product is available as either an open panel version or in a UL Type 1 enclosure. The open panel is perfect for inclusion in a MCC section or easy installation into industry standard enclosures. The UL Type 1 enclosed units maintain the same vertical profile as the open panel design. This design is perfect for applications where floor space is at a premium.

Sample Part Number: HG100AW00ST

Power Monitor Package Option

The Power Monitor package includes contactors and filter monitoring equipment. For units rated at 60 horsepower and below, the XM package utilizes indicator lights for filter operation and fuse failure. From 75 HP through 350 HP, the XM package uses the HG2™ Protection Monitor/Harmonic-Power Factor meter. The HG2™ Monitor Board displays operating information such as ITHD, VTHD, total filter amps, true power factor, and a series of fault and protection codes including over-current, over-voltage, and phase imbalance. It is also a programmable safety monitor, capable of bringing the filter off-line in a fault condition, or when the drive goes into a fault condition. For those applications that require the removal of capacitance for the start-up of stand-by generators, the contactors can remove the harmonic duty capacitors. Above 400 HP, the XM package includes a monitor board which has indicator lights to advise the mode of operation and when a fault should occur.

Sample Part Number: HG100AW00XM

Component Package Option

This package includes all of the major components that are found in the Standard Package. Ideal for integration into drive sections or other end-products, this option is ideal for the experienced drive integrator. This option does not include panels, enclosures, heating or cooling devices, wire, or lugs. It is also important to note that the inclusions of the Power Monitor package are also not available as a component set.

Sample Part Number: HG100AW00CP

Part Numbering System

HG xxxx x xxx xx xx

Series

Horse Power

Voltage Rating

A=480v, B=240v, C=600v

Enclosure

W00=open, W01=UL Type 1

Package Option

ST=Standard Option Package,

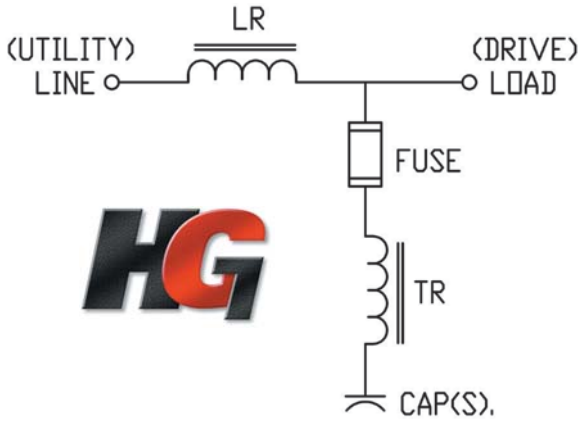
XM=Power Monitor Package

CP=Component Product Package

Custom

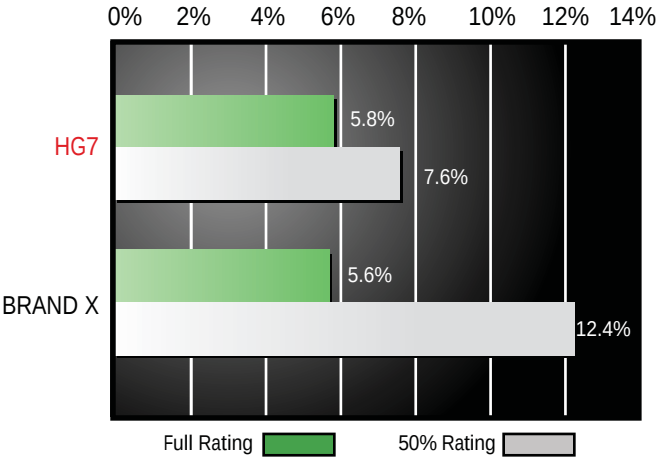
Custom Design based on standard options

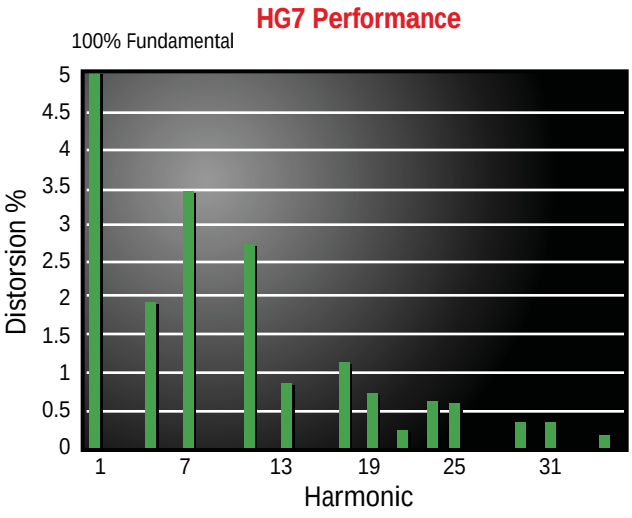
Standard Configuration One Line Diagram



Technological Highlights

With over a decade of experience in the manufacture and application of harmonic mitigation filters, TCI can provide the right filter for the job. With so many mitigation techniques available, from multi-pulse configurations to active harmonic cancellation filters, choosing the right form of harmonic reduction can be a difficult task. The HG7 is not only guaranteed to perform, its performance matches all but the most expensive mitigation technologies currently available on the market. The HG7 is easy to install and is shipped with all necessary components including an Installation, Operation, and Maintenance manual. Each unit contains high quality capacitors certified for harmonic rich environments. It is also important to note that critical applications will continue to operate even if the HG7 shuts down.



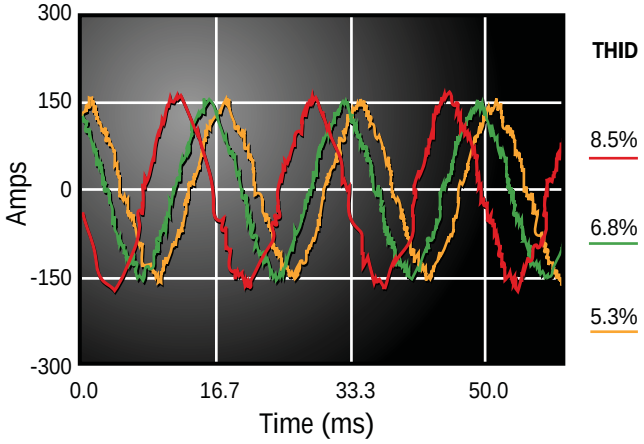


Superior Filter Performance

In general, the HG7 performs as well as, if not better than, any filter technology currently available on the market today. Harmonic distortion at the input terminals is typically between 5 and 7% TDD. With the HG7, voltage drop on the dc bus of a variable frequency drive is less than 2%. Since the filter uses TCI's reactor technology, nuisance tripping is eliminated and drive uptime is dramatically increased. While attenuating harmonic distortion, the filter also dramatically improves true power factor.

Distortion Comparison

Performance of the HG7 Harmonic Filter has been compared to other offerings currently available on the market. As noted in the waveforms displayed to the right, the differences in performance are subtle and hard to detect in a visual inspection. Between the 5% and 9% distortion range, performance may be less of a concern than other factors, including price, delivery, or support. In this particular example, the HG7 performs at the mid-point but carries a price tag that is less than the 8.5% filter. Although the differences between 20% distortion and 5% distortion are clear, determining the overall value between 8.5% and 5.3% distortion may be extremely difficult in each unique application.



Independent Third Party Testing

In independent third party tests, the HG7 filter performed extremely well. Test one applied a 75 HP HG7 to a 75 HP variable frequency drive connected to a 75 HP NEMA Design A motor at full load. The specified drive came with a bypass option. The concern was the operation of the bypass circuit as it relates to the voltage drop from the filter and the ability to pull in the 120 volt coils on the bypass contactors. Extensive testing showed that the voltage drop across the 480/120 Volt control power transformer was approximately 10%, well within the coil's dropout rating. The results show that the HG7 can be used with a standard drive/bypass configuration without any special system modifications.

In a second test, a 10 HP filter was applied to a 10 HP drive at 460 volts. In this particular application, 100% of the system was non-linear load. Under full load conditions, operating on an extremely stiff source, TDD was equivalent to 8%.

Total Demand Distortion (TDD) Guarantee

Properly applied and sized for the application, TCI guarantees that the HG7 will deliver typical results of 5 – 6 % TDD, but no more than 8%, at the filter input terminals. If a properly selected, installed, and loaded HG7 filter fails to meet the guaranteed performance levels, TCI will provide the necessary components or replacement filter at no additional charge. TCI does not take responsibility for additional installation or removal costs, to include, but not limited to, replacement of third party equipment.

Minimum System Requirements:

In order to achieve the performance levels as stated in this guarantee, the electrical system must adhere to the following:

Line Voltages must be balanced to within ±1%; Voltage at the filter input terminals is 100% (±5%) of filter rating; Source Impedance is at least 3%; Filter loading is 100% (±5%) of filter rating; Load is at least 10% of source rating. TCI cannot guarantee individual results when harmonic distortion exists on the system prior to HG7 installation. TCI does not take responsibility for incorrect installation of the component package option.

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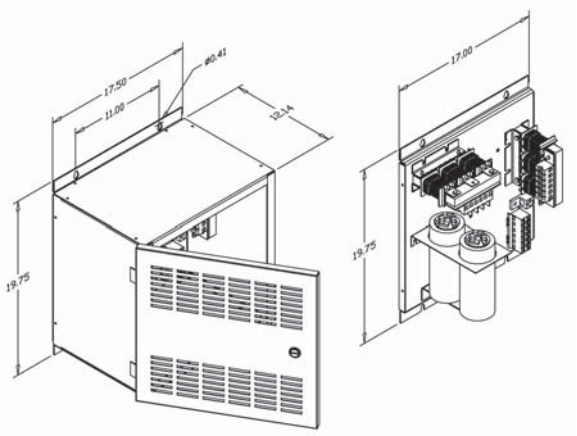
ENCLOSURES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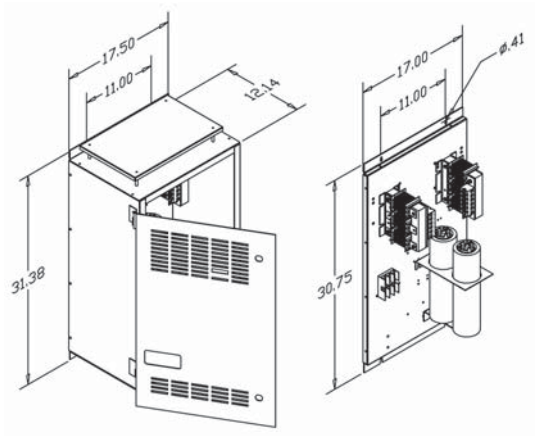
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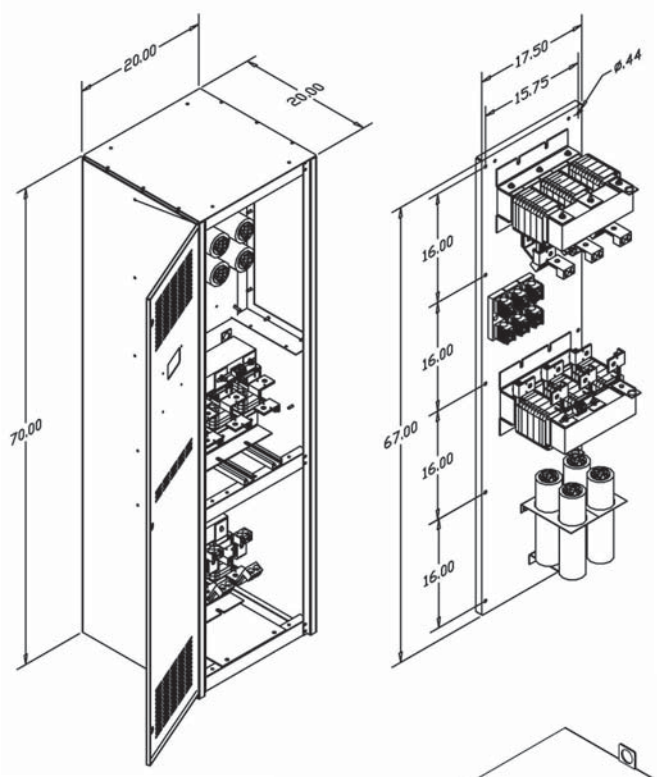
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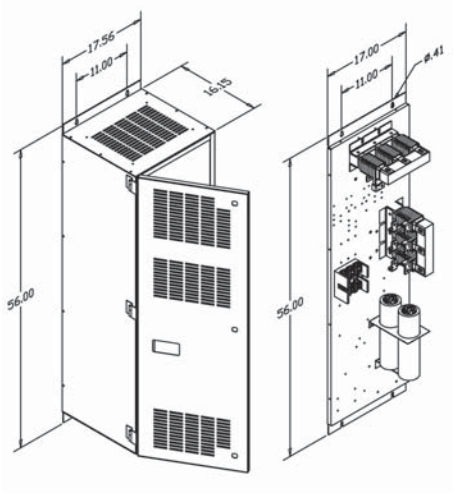
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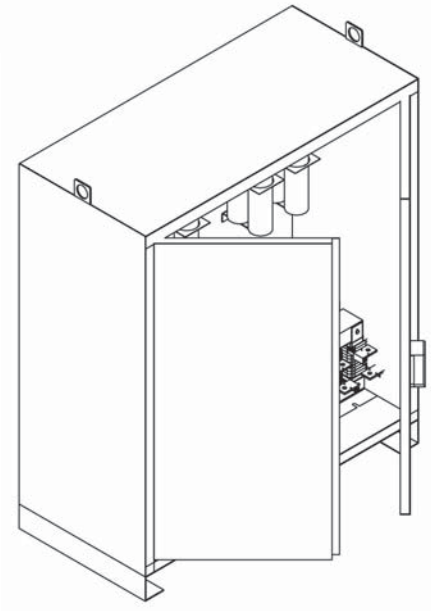

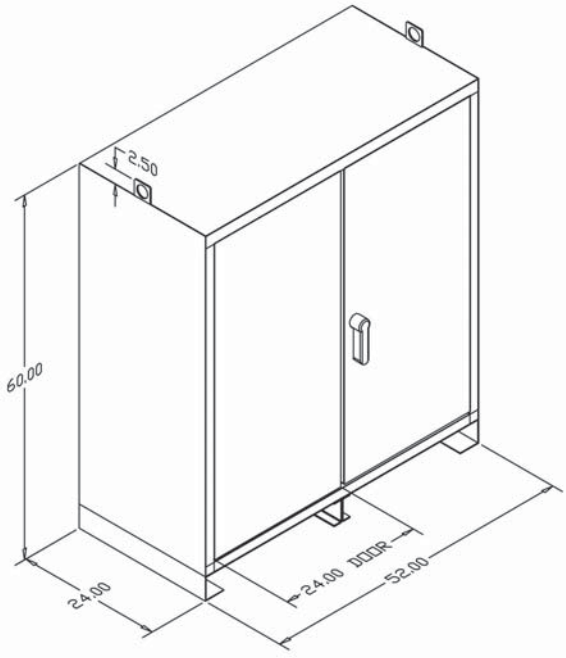
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SPECS

HG7 Product Specifications

- Available in 240V, 480V, and 600V designs
- UL-Listed (Industrial Control Panel)
- 3 Year Warranty
- Available in Standard 7.5 through 900 HP (100 HP Max at 240V)
- Open Panel and UL Type 1 Enclosed options available
- Convenient Component Package available
- Robust Power Monitor Package available
- High Quality Harmonic Grade Capacitors

TCI

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REV.05-16-05
Publication No. 25220

Section 2.1 - Heat Exchanger

- Specifications
- Pump
- Fan Motor
- Fan Blade

Specifications

Heat Exchanger System (Internal)

DESCRIPTION

The internal heat exchanger system is a closed loop cooling system that extracts heat from the blower motor and variable frequency drive and sends the heat through the compression cycle. An integrally mounted pump pushes a liquid glycol solution through the heat exchanger, motor, VFD, and returns back to an internal reservoir. The glycol loop is a closed loop system composed of 30-40% propylene glycol and 60-70% distilled water.

Coolant:

Coolant should be a mixture of distilled water and propylene glycol rated for use in brass/copper/aluminum radiators. The recommended mixture range is 60% to 80% of water. Higher concentrations of glycol can be used for colder climates.
(Customer is responsible for supplying coolant)

PRIMARY COMPONENTS

1. 480v Pump – powered from the blower power system
2. Reservoir (Stainless Steel)
3. Radiator
4. Interconnecting Copper Piping

MAINTENANCE:

1. Check fluid levels periodically to ensure the system is full.
2. Change liquid glycol solution as necessary when discoloration is noted. See IO&M Manual.
3. Visually inspect all parts to ensure there are no leaks

NOTE: The included pump does not require specific routine maintenance.

Appendix E Heat Exchanger Manual

This section explains each subcomponent of the Heat Exchanger inside the Blower unit (Figure 7).

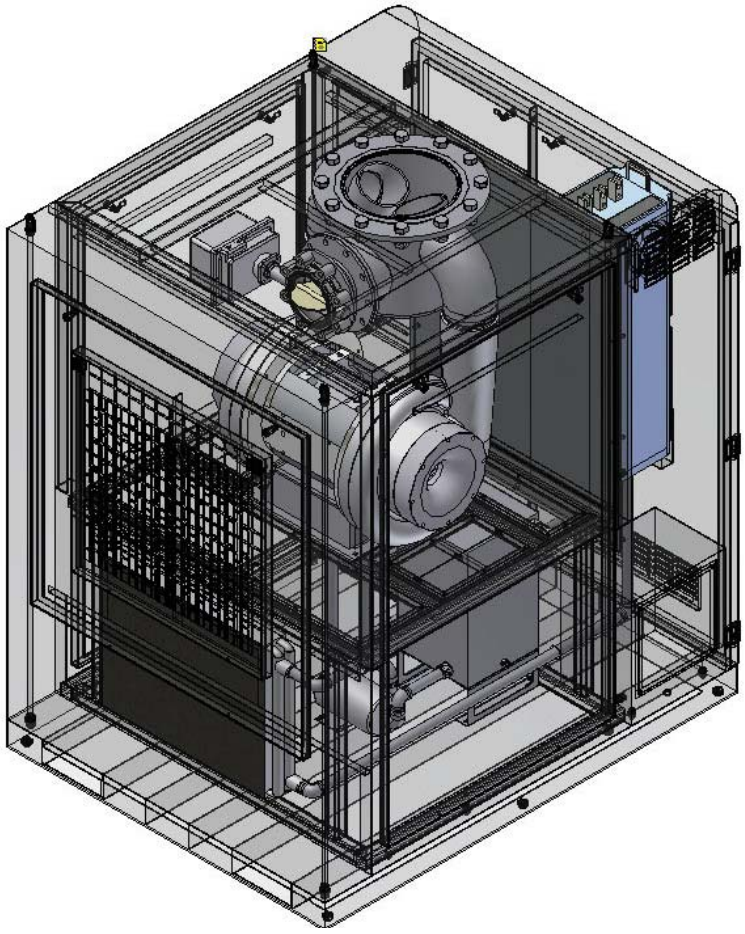


Figure 7: Internal Heat Exchanger.

E.1 Parts List

Figure 8: Heat Exchanger Components.

Item No.	Part No.	Description
1	HSI#31500060412	Pump
2	HSI#31500060416	Reservoir Tank
3	M3-FG	Radiator

E.2 Coolant

Cooling liquid is a mixture of distilled water and propylene glycol rated for use in brass/copper/aluminum radiators. The ratio depends on the application / location of the unit. The recommended mixture is 80% of water. 20% Propylene Glycol.

Volume of glycol and water required:

	Propylene Glycol	Distilled Water
Volume Required for Heat Exchanger	1 U.S. Gallons	4 U.S. Gallons

Total approximate volume of heat exchanger, blower, and piping may vary due to the length of piping between the heat exchanger and blower.

Prior to startup, have glycol and distilled water on site. HSI field technicians will fill the reservoir during startup as the unit must be operational to activate pumps and fill all lines.

Note:	**Reservoir will not accept total volume until the pump is activated during startup of the blower.**

E.3 Installation & Connections

The internal heat exchanger is an integral part of the blower cabinet. All the subcomponents of the heat exchanger are pre-designed, installed, and connected by the manufacturer as part of the blower package. No further installation is required onsite.

Step	Action
1	Fill up the reservoir tank with the coolant.
2	Turn on the heat exchanger from the HMI main screen (see Section 5.12).
3	Refill the reservoir tank, if needed.

E.4 Maintenance and Troubleshooting

WARNING:	**When performing any maintenance and/or troubleshooting tasks, make sure all electrical power is turned off.** **Before servicing the heat exchanger, unplug the unit from the electrical outlet or, if permanently wired, make sure the circuit breaker is in the OFF position.**

- Remove any dirt or debris that may collect in the bottom of the reservoir tank.
- On a monthly basis, check color and level of the cooling fluid. Refill and replace if significant color change is noticed

Pump

ITT

Commercial Water

Goulds Pumps

3642 Close-Coupled Centrifugal Pumps

GOULDS PUMPS

Goulds Pumps is a brand of ITT Corporation.

www.goulds.com

Engineered for life

FEATURES

- **Compact Design:** Close coupled, space saving design provides easy installation. Flexible couplings and bedplates not required.
- **Mounting:** Can be mounted in vertical or horizontal position.
- **Construction:** Available in bronze fitted (BF), all iron (AI), or all bronze (AB). Bronze fitted means bronze impeller.
- **Impeller:** Enclosed design for high efficiencies. Threaded directly on motor shaft. Stainless steel locknut on three phase models requires no clearance adjustments. Balanced for smooth operation.
- **Casing:** Volute type, cast iron or brass construction. Back pullout design. Discharge can be rotated in eight positions. Vertical discharge standard. Tapped openings provided for priming, venting and draining.
- **Mechanical Seal:** Standard carbon/ ceramic faces, BUNA elastomers, 300 series stainless steel components. Option seals available.
- **Motor:** Close-coupled design. Ball bearings carry all radial/axial thrust loads. Designed for continuous operation. All ratings are within working limits of the motor.

ITT

GOULDS PUMPS
Commercial Water

APPLICATIONS

Specifically designed for the following uses:
- Water circulation
- Booster service
- Liquid transfer
- Spraying systems
- Jockey pump service
- General purpose pumping

SPECIFICATIONS

Pump
- Capacities: to 110 GPM
- Heads: to 118 feet
- Pipe connections:

Model	Suction	Discharge
1 x 1¼ - 5	1¼" NPT	1" NPT
1¼ x 1½ - 5	1½" NPT	1¼" NPT

- Maximum working pressure: 125 PSI
- Temperature: standard seal, 212° F (100° C) maximum or 250° F (121° C) with optional high temperature seal.
- Rotation: right hand i.e.; clockwise when viewed from motor end.

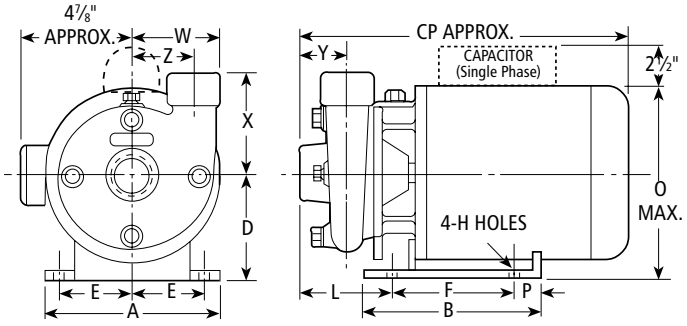
Motor
- NEMA standard
- Open drip proof, TEFC, or (explosion proof three phase only) enclosures.
- 60 Hz, 3500 RPM
- Stainless steel shaft
- Single phase: ½-2 HP ODP or TEFC. Built-in overload with automatic reset.
- Three phase: ⅓-2 HP: ODP, 208-230/460 V
  ½-2 HP: TEFC, 208-230/460 V
  ½-2 HP: expl. proof, 230/460 V
- Overload protection must be provided in starter unit. Starter and heaters (3) must be ordered separately.

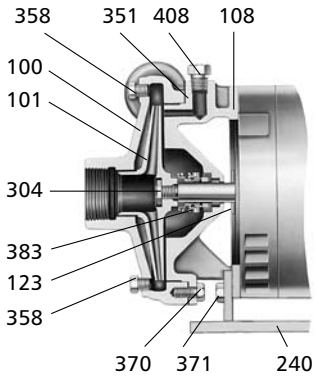
Goulds Pumps is ISO 9001 Registered.

DIMENSIONS AND WEIGHTS

Pump	A	B	D	E	F	H	L	O	P	W	X	Y	Z	CP	Motor Frame	Wt. (lbs.)
1x1¼-5	6¾	5⅞	4⅛	2 15/16	5	13/32	3⅝	7	7/16	4	4⅛	2 3/16	3 1/16	13½	48	55
														15½	56	67
1¼x1½-5							3⅞	7⅜			4	2¼	2 15/16	15¾	56	68

(All dimensions are in inches and weights in lbs. Do not use for construction purposes.)





COMPONENTS

Item No.	Description	Material Code		
		Bronze Fitted	All Iron	All Bronze
100	Casing	1001	1001	1101
101	Impeller	1101	1001	1101
108	Adapter	1001	1001	1101
123	Water deflector	Rubber or Micarta®		
240	Motor Support	Steel		
	Rubber Channel	Rubber		
304	Impeller nut*	Stainless steel		
351	Gasket-casing	Composite		
358	Pipe plug ¼" vent and drain	Brass	Steel	Brass
370	Hex head cap screw adapter to case	Zinc-Plated Steel		
371	Hex head cap screw adapter to motor	Zinc-Plated Steel		
408	Prime plug – priming ¼" NPT	Brass	Steel	Brass
383	Mechanical Seal			

Order Suffix	10K10	Std.	Service	Rotary	Stationary	Elastomers	Metal Parts
			General	Carbon	Ceramic	BUNA	300 Series SS
N	10K6	Opt.	Heavy Duty		Ni-Resist		
O	10K18		Hi Temp.		Sil-Carbide	EPR	
V	10K55		Chem. Duty		Ceramic	Viton	

* Impeller nut furnished on three phase units only.

MATERIALS OF CONSTRUCTION

Material Code	Engineering Standard
1001	Cast iron ASTM A48 CL 20
1101	Bronze ASTM B584, C87500 Lead-Free

MOTOR FRAME

Motor Frame	Single Phase		Three Phase	
	ODP	TEFC	ODP	TEFC/EXPL
48	⅓	—	—	—
56	½ – 2	½– 2	⅓ – 2	½ – 2

ITT

Commercial Water

GOULDS PUMPS

B3642 February, 2008

Engineered for life

Fan Motor

MARATHON ELECTRIC

Motor, 3-Ph, 1, 1725, 208-230/460, Eff 79.2

General Purpose Motor, Continuous Duty, 3-Phase, Totally Enclosed Fan-Cooled, 1 HP, RPM 1725, 208-230/460 Volts, NEMA/IEC Frame 56C, Service Factor 1.25, 60 Hz, Nominal Efficiency 79.2, C-Face Mounting, Ball Bearings, Thermal Protection None, FLA 3.6-3.8/1.9, Rotation CW/CCW, Insulation Class B, Ambient 40 C, Shaft Diameter 5/8 In, Shaft Length 1 7/8 In, Base None

Grainger Item #	3N689
Price (ea.)	**$268.00**
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Mfr. Model #	5K49MN4104
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Sell Qty. (Will-Call)	1
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Tech Specs | Additional Information | Compliance & Restrictions | MSDS | Required Accessories | Optional Accessories | Alternate Products | Repair Parts

Item	General Purpose Motor
Motor Type	3-Phase
HP	1
Nameplate RPM	1725
Voltage	208-230/460
NEMA Frame	56C
Enclosure	Totally Enclosed Fan-Cooled
Mounting	Face
Hz	60
Full Load Amps	3.7-3.6/1.9
Service Factor	1.25
Nominal Efficiency	79.2
Bearings	Ball
Thermal Protection	None
Rotation	CW/CCW
Insulation Class	B
Ambient (C)	40
Overall Length (In.)	11-7/16
Shaft Dia. (In.)	5/8
Shaft Length (In.)	1-7/8
Frame Material	Steel
Base	None
Efficiency Group	General Purpose Motor
NEMA Design	B
Phase	3
Mfr. Stock No.	K256
RPM Range	1400-1800

View Catalog Page View Printable Page

The "Usually Ships" reflects when an item is generally expected to ship from Grainger based on its stocking location. Real-time availability information will be shown during the checkout process and on the e-mail order confirmation (for U.S. and Puerto Rico - US customers only). Please allow additional delivery time for international orders.

We Also Carry

Motor, 3-Ph, 3/4, 1725, 208-230/460, Eff 78.9
Grainger Item #: 3N688
Price (ea.): $255.00

Motor, 3-Ph, 1.5, 1725, 208-230/460, Eff 81.7
Grainger Item #: 3N690
Price (ea.): $287.25

Sheave, Variable Pitch
Grainger Item #: 3X276
Price (ea.): $42.50

Fan Speed Control, 6 A
Grainger Item #: 1DGV2
Price (ea.): $40.40

Toggle Switch, Heavy Duty, DPST, On/Off
Grainger Item #: 1XWR1
Price (ea.): $9.61

Brand: MARATHON ELECTRIC	Brand: MARATHON ELECTRIC	Brand: APPROVED VENDOR	Brand: DAYTON	Brand: IDEAL
Qty.	Qty.	Qty.	Qty.	Qty.
Add to Order	Add to Order	Add to Order	Add to Order	Add to Order
Add to Personal List	Add to Personal List	Add to Personal List	Add to Personal List	Add to Personal List

Return To Top

CONTINUED

For assistance with motor selection, see pages 3 to 7.

HP	Nameplate RPM	NEMA Frame	Voltage	Full Load Amps	Service Factor	Nom. Efficiency	Frame Material	Insulation Class	Overall Length (in.)	Item No.		$ Each
Totally Enclosed Fan-Cooled, Face-Mount (Cont.)												
2	3480	145TC	208-230/460	5.5-5.2/2.6	1.15	84.0	Steel	F	13⅞	4THY3	✓	393.25
	3455	56C	208-230/460	5.8-5.6/2.8	1.15	82.5	Steel	F	12⅞	4THY2	✓	333.25
	1745	145TC	208-230/460	6.0-6.0/3.0	1.15	84.0	Steel	F	13⅞	4THY5	✓	413.25
	1725	56C	208-230/460	6.1-5.9/3.0	1.15	81.5	Steel	F	13 13⁄16	4THY4	✓	404.00
3	3485	145TC	208-230/460	8.1-7.5/3.8	1.15	85.5	Steel	F	13⅞	4THY6	✓	448.00
	1740	145TC	208-230/460	8.8-7.9/4.0	1.15	87.5	Steel	F	14⅝	11W363	✓	388.75
	1730	56C	208-230/460	8.8-8.3/4.2	1.15	85.5	Steel	F	13 13⁄16	4THY7	✓	400.50
Totally Enclosed Fan-Cooled, Face/Base-Mount												
¼	3460	56C	208-230/460	0.8-0.8/0.4	1.15	72.0	Steel	F	10 9⁄16	11W364	✓	206.00
	1720	56C	208-230/460	1.0-1.0/0.5	1.15	68.0	Steel	F	10 9⁄16	11W365	✓	210.00
	1140	56C	208-230/460	1.3-1.3/0.7	1.15	65.0	Steel	F	10 9⁄16	11W366	✓	206.75
⅓	3460	56C	208-230/460	1.2-1.1/0.6	1.15	71.5	Steel	F	10 9⁄16	11W367	✓	202.25
	1725	56C	208-230/460	1.2-1.2/0.6	1.15	72.5	Steel	F	10 9⁄16	4THY8	✓	245.75
	1140	56C	208-230/460	1.5-1.5/0.7	1.15	68.0	Steel	F	12⅛	11W368	✓	215.25
½	3445	56C	208-230/460	1.7-1.6/0.8	1.15	73.0	Steel	F	10 9⁄16	4THY9	✓	264.75
	1710	56C	208-230/460	1.8-1.7/0.9	1.15	74.0	Steel	F	10 9⁄16	4THZ1	✓	290.50
	1140	56C	208-230/460	2.3-2.3/1.2	1.15	70.5	Steel	F	12⅛	4THZ2	✓	288.50
¾	3420	56C	208-230/460	2.5-2.4/1.2	1.15	76.5	Steel	F	10 9⁄16	4THZ3	✓	277.25
	1720	56C	208-230/460	2.5-2.4/1.2	1.15	79.5	Steel	F	12⅛	4THZ4	✓	307.00
	1135	56C	208-230/460	3.0-3.0/1.5	1.15	74.0	Steel	F	12 13⁄16	4THZ5	✓	376.00
1	3420	56C	208-230/460	3.2-3.1/1.6	1.15	77.0	Steel	F	12⅛	4THZ6	✓	284.00
	1750	143TC	208-230/460	3.0-2.9/1.5	1.15	82.5	Steel	F	13⅞	4THZ8	✓	391.75
	1710	56C	208-230/460	3.3-3.2/1.6	1.15	78.5	Steel	F	12⅛	4THZ7	✓	320.00
	1150	145TC	208-230/460	3.6-3.5/1.8	1.15	82.5	Steel	F	13⅞	4TJA2	✓	432.75
	1145	56C	208-230/460	3.7-3.7/1.9	1.15	78.5	Steel	F	12 13⁄16	4TJA1	✓	390.00
1½	3510	143TC	208-230/460	4.2-4.0/2.0	1.15	85.5	Steel	F	13⅞	4TJA4	✓	386.75
	3480	56C	208-230/460	4.5-4.3/2.2	1.15	81.0	Steel	F	12 13⁄16	4TJA3	✓	303.50
	1740	145TC	208-230/460	4.3-4.1/2.1	1.15	86.5	Steel	F	13⅞	4TJA6	✓	413.25
	1725	56C	208-230/460	4.7-4.6/2.3	1.15	81.5	Steel	F	12 13⁄16	4TJA5	✓	337.75
	1170	182TC	208-230/460	6.90-6.32/3.16	1.15	87.5	Steel	F	16 9⁄16	11W369	✓	609.00
	1140	56HC	208-230/460	5.3-5.2/2.6	1.15	79.0	Steel	F	12 13⁄16	11W370	✓	311.00
2	3505	145TC	208-230/460	5.4-5.1/2.6	1.15	86.5	Steel	F	13⅞	4TJA8	✓	415.25
	3455	56C	208-230/460	5.8-5.6/2.8	1.15	82.5	Steel	F	12 13⁄16	4TJA7	✓	332.00
	1740	145TC	208-230/460	5.8-5.6/2.8	1.15	86.5	Steel	F	13⅞	11W371	✓	406.75
	1725	56HC	208-230/460	6.1-5.9/3.0	1.15	81.5	Steel	F	12 13⁄16	11W372	✓	324.00
3	3480	145TC	208-230/460	8.1-7.3/3.7	1.15	86.5	Steel	F	13⅞	4TJA9	✓	540.50
	1755	182TC	208-230/460	10.2-9.50/4.75	1.15	89.5	Steel	F	16 9⁄16	11W373	✓	575.50
	1730	56HC	208-230/460	8.8-8.3/4.2	1.15	85.5	Steel	F	13 13⁄16	11W374	✓	344.75

3-Phase Face- and Face/Base-Mount Motors

- Bearings: ball
- Thermal protection: none
- Max. ambient: 40°C
- Rotation: CW/CCW
- Warranty: 1 yr.

Use in pumps, speed reducers, machine tools, and other shaft-end-mounted industrial equipment applications. Open dripproof enclosures are for use in clean, dry, nonhazardous applications. Totally enclosed fan-cooled enclosures are for use in dusty or dirty applications. UL Recognized and CSA Certified.

marathon electric

Open Dripproof, No Base

Totally Enclosed Fan-Cooled, No Base

HP	Nameplate RPM	NEMA Frame	Voltage	Full Load Amps	Service Factor	Nom. Efficiency	Frame Material	Insulation Class	Overall Length (in.)	Foot-notes	Mfr. Model	Item No.		$ Each
Open Dripproof, Face-Mount														
¼	1725	56C	208-230/460	1.1-1.2/0.60	1.0	67.4	Steel	B	9½	—	5K49DN4132	5N112	✓	287.25
½	3450	56C	208-230/460	2.0-2.0/1.0	1.60	69.8	Steel	B	10 5⁄16	—	5K36JN57	6MA11	✓	235.75
1	1725	56C	208-230/460	3.6-3.8/1.9	1.15	79.2	Steel	B	10¾	—	5K46MN4126	3N685	✓	294.75
	1140	145TC	208-230/460	3.7-3.6/1.8	1.15	80.0	Steel	B	12⅝	—	5KE49UN8406A	4TD51	✓	457.75
1½	1725	56C	208-230/460	5.8-5.6/2.8	1.15	79.8	Steel	B	11⅜	—	5K49PN4120	5N131	✓	332.00
2	3450	145TC	208-230/460	5.6-5.2/2.6	1.15	84.0	Steel	B	11⅝	—	5KE49RN8420A	4TD54	✓	439.25
	1725	56C	208-230/460	6.6-6.4/3.2	1.15	83.8	Steel	B	13 13⁄16	—	5K49ZN4611	6LY97	✓	370.50
	1725	145TC	208-230/460	6.4-6.0/3.0	1.15	84.0	Steel	B	12⅝	—	5KE49UN8428	6LY99	✓	383.00
3	3450	145TC	208-230/460	8.4-7.6/3.8	1.15	84.0	Steel	B	12⅝	—	5KE49UN8394A	4TD56	✓	479.50
Open Dripproof, Face/Base-Mount														
½	1725	56C	208-230/460	2.3-2.2/1.1	1.25	74.7	Steel	B	10	—	5K42HN4032	5N974	✓	264.50
1	1725	56HC	208-230/460	3.6-3.8/1.9	1.15	79.2	Steel	B	10¾	—	5K46MN4623	6MA12	✓	361.50
1½	3450	56C	208-230/460	5.2-5.0/2.5	1.15	80.0	Steel	B	10 7⁄16	—	5K46HN2546	6MA13	✓	455.75
	1725	56HC	208-230/460	5.0-5.2/2.6	1.15	82.1	Steel	F	11 15⁄16	—	5K49RN4617	6MA10	✓	408.25
2	3450	56C	208-230/460	6.6-6.0/3.0	1.15	80.5	Steel	B	11⅜	—	5K49NN2046	6N045	✓	355.75
	1725	56HC	208-230/460	6.2-5.8/2.9	1.15	83.6	Steel	B	13⅞	—	5K49ZN4616	6MA14	✓	409.75
Totally Enclosed Nonventilated, Face-Mount														
¼	1725	56C	208-230/460	1.1-1.2/0.60	1.35	67.4	Steel	B	9½	44	5K49DN4130	5N114	✓	239.00
Totally Enclosed Fan-Cooled, Face-Mount														
⅓	3450	56C	208-230/460	1.5-1.8/0.90	1.0	61.0	Steel	B	10 9⁄16	—	5K33FN41	6WE78	✓	176.75
	1725	56C	208-230/460	1.5-1.6/0.80	1.0	68.8	Steel	B	10 9⁄16	—	5K33JNA943B	3N686	✓	240.25
½	1725	56C	208-230/460	2.1-2.2/1.1	1.25	76.1	Steel	B	10 15⁄16	4	5K35MNB114A	3N687	✓	273.75
¾	1725	56C	208-230/460	2.8-2.8/1.4	1.25	78.9	Steel	B	11⅜	—	5K36PNB116	3N688	✓	294.75
1	3450/2850	56C	208-230/460	3.6-3.6/1.8	1.0	77.0	Steel	B	11⅜	3	5K36MN4152	6NB71	✓	334.50
	1725	56C	208-230/460	3.7-3.6/1.9	1.25	79.2	Steel	B	11 7⁄16	—	5K49MN4104	3N689	✓	309.75
1½	3450/2850	56C	208-230/460	4.8-4.6/2.3	1.15	80.0	Steel	B	11 13⁄16	3	5K49JN2534	6NB72	✓	355.50
	1725	56C	208-230/460	4.7-4.4/2.2	1.0	81.7	Steel	B	12 7⁄16	—	5K49SN4117	3N690	✓	332.00
	1725	145TC	208-230/460	4.5-4.4/2.2	1.15	84.0	Steel	B	13¼	—	5KE49TN8374A	6NB79	✓	369.75
2	3450/2850	56C	208-230/460	6.0-6.0/3.0	1.15	77.0	Steel	B	12 5⁄16	3	5K46MN2533	6NB70	✓	410.75
	1725	56C	208-230/460	6.2-5.8/2.9	1.15	83.6	Steel	B	14¼	—	5K49ZN4253	6WE77	✓	440.00
3	1725	56C	208-230/460	8.2/4.1	1.0	84.7	Steel	F	14⅞	—	5K49QN4609	6NB78	✓	523.50
Totally Enclosed Fan-Cooled, Face/Base-Mount														
⅓	1725	56C	208-230/460	1.5-1.6/0.80	1.35	69.2	Steel	B	11	—	5K42FN4035	6N055	✓	268.50
½	3450	56C	208-230/460	2.2-2.5/1.3	1.25	65.5	Steel	B	11	—	5K42FN2048	6N056	✓	258.25
	1725	56C	208-230/460	2.3-2.2/1.1	1.25	74.7	Steel	B	11	—	5K42HN4034	6N057	✓	295.75
¾	3450	56C	208-230/460	2.6-2.6/1.3	1.25	73.2	Steel	B	11 7⁄16	—	5K36MN342	5N126	✓	272.00
	1725	56C	208-230/460	3.3-3.0/1.5	1.25	74.3	Steel	B	11 7⁄16	—	5K49KN4124	5N115	✓	306.00
1	3450	56C	208-230/460	3.2-3.0/1.5	1.25	78.5	Steel	B	12 7⁄16	—	5K38RN106A	5N127	✓	312.75
	1725	56C	208-230/460	3.6-3.8/1.9	1.25	79.2	Steel	B	11 7⁄16	—	5K49MN4110	5N116	✓	325.00
1½	3450	56C	208-230/460	5.0-4.8/2.4	1.15	77.3	Steel	B	11 13⁄16	—	5K49KN2047	6N061	✓	353.00
	1725	56C	208-230/460	4.7-4.4/2.2	1.25	81.7	Steel	B	12 7⁄16	—	5K49SN4119	5N117	✓	350.50
2	3450	56C	208-230/460	5.8-5.4/2.7	1.15	83.0	Steel	B	13	—	5K49SN2185	5N128	✓	375.25

Footnotes: 3—Has 50 Hz operation on rated voltage or 190/380V at rated HP and ⅚ of 60 Hz rpm at 1.0 SF. 4—Has 50 Hz operation on 190/380V at ⅚ of rated HP and 60 Hz rpm at 1.25 SF. 44—Totally enclosed nonventilated.

Fan Blade

REVCOR Propeller, 24 In Dia, 16 Deg Pitch

Replacement Propeller, Hubless, Propeller Dia 24 In, CFM @ 0.000-In. SP 4765, @ 0.300-In. SP 4237, Min HP 1/2, Max RPM 1140, Pitch 16 Deg, Clockwise Rotation, Number of Blades 4, Propeller Material Aluminum, For Use With Air Conditioning Condensers, Heat Pumps, Heat Exchangers and Unit Heaters, Requires Interchangeable Hex Hub 2A563 or 2A564 or 2A699

Grainger Item #	2RCC3
Price (ea.)	**$70.30**
Brand	REVCOR
Mfr. Model #	T2404-16 R
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	6.46
Usually Ships**	Today
Catalog Page No.	4228
Country of Origin (Country of Origin is subject to change.)	USA

Enlarge Image

Qty. _____

Add to Order | Add to Personal List | Compare Alternates

Price shown may not reflect your price. Sign in or register.

Tech Specs | Additional Information | Compliance & Restrictions | MSDS | Required Accessories | Optional Accessories | Alternate Products | Repair Parts

Item	Replacement Propeller, Hubless
Propeller Dia. (In.)	24
CFM @ 0.000-In. SP	4765
CFM @ 0.300-In. SP	4237
Min. HP	1/2
Max. RPM	1140
Pitch (Deg.)	16
Rotation	CW
Number of Blades	4
Propeller Material	Aluminum
Spiders	Galvalume
For Use With	Air Conditioning Condensers, Heat Pumps, Heat Exchangers and Unit Heaters
Requires	Interchangeable Hex Hub 2A563 or 2A564 or 2A699

View Catalog Page View Printable Page

The "Usually Ships" reflects when an item is generally expected to ship from Grainger based on its stocking location. Real-time availability information will be shown during the checkout process and on the e-mail order confirmation (for U.S. and Puerto Rico - US customers only). Please allow additional delivery time for international orders.

Return To Top

Accessories

Required

>More...

Hex Hub, 3/8 In

Grainger Item #: 2A563
Price (ea.): $8.90
Brand: DAYTON

Qty. _____

Add to Order

Section 2.2 – Control Panel Specifications

- PLC Ladder Logic
- I/O List
- Touch Screen Panel
- Power Supplies
- MicroLogix 1100 PLC
- I/O Modules
- Fuses
- Transformer
- EMI Filter
- HMI Operation

PLC Ladder Logic

LCP Software/PLC Programming

The Local Control Panel (LCP) programming is HSI proprietary ladder logic and an integral part of the blower. The PLC ladder logic is not required by the user and contains sensitive information. If an issue arrives, then the user should consult HSI or one of its authorized agents for assistance. HSI is responsible to resolve any issues that occur with the Local Control Panel, but the ladder logic programming will not be distributed, as it is proprietary information.

I/O List

HSI HSTB I/O List

PLC Address	Description	Notes
Discrete Bit Reads by the Remote Ethernet Device		
B14:0/0	Blower Surge Alarm	1=Alarm; 0=Ok
B14:0/1	Blower Surge Shutdown Alarm	1=Alarm; 0=Ok
B14:0/2	Blower Max Flow Alarm	1=Alarm; 0=Ok
B14:0/3	Blower Max Flow Shutdown Alarm	1=Alarm; 0=Ok
B14:0/4	High Motor Temperature Alarm	1=Alarm; 0=Ok
B14:0/5	High Motor Temperature Shutdown Alarm	1=Alarm; 0=Ok
B14:0/6	High Inlet Air Temperature Alarm	1=Alarm; 0=Ok
B14:0/7	High Inlet Air Temperature Shutdown Alarm	1=Alarm; 0=Ok
B14:0/8	High Outlet Air Temperature Alarm	1=Alarm; 0=Ok
B14:0/9	High Outlet Air Temperature Shutdown Alarm	1=Alarm; 0=Ok
B14:0/10	No Motor Feedback Alarm (No Run Signal)	1=Alarm; 0=Ok
B14:0/11	VFD Fault Alarm	1=Alarm; 0=Ok
B14:0/12	Inlet Filter Pressure Switch Alarm	1=Alarm; 0=Ok
B14:0/13	WAS: Enclosure High Temperature Switch Alarm	1=Alarm; 0=Ok
B14:0/14	Inlet Pressure Transmitter Failure	1=Alarm; 0=Ok
B14:0/15	Outlet Pressure Transmitter Failure	1=Alarm; 0=Ok
B14:1/0	VFD Speed Signal Failure	1=Alarm; 0=Ok
B14:1/1	VFD KW Signal Failure	1=Alarm; 0=Ok
B14:1/2	Motor Winding Phase 1 High Temp Alarm	1=Alarm; 0=Ok
B14:1/3	Motor Winding Phase 1 High Temp Shutdown Alarm	1=Alarm; 0=Ok
B14:1/4	Motor Winding Phase 2 High Temp Alarm	1=Alarm; 0=Ok
B14:1/5	Motor Winding Phase 2 High Temp Shutdown Alarm	1=Alarm; 0=Ok
B14:1/6	Blower Max Power Alarm	1=Alarm; 0=Ok
B14:1/7	Blower Max Power Shutdown Alarm	1=Alarm; 0=Ok
B14:1/8	Not Used	
B14:1/9	Not Used	
B14:1/10	Not Used	
B14:1/11	Not Used	
B14:1/12	Blower Permissive Enabled	This bit will be true, anytime the HOA is in Remote, all shutdown conditions have been reset, and the Blower Minimum Off time has expired. Upon a Blower start, this bit will go to 0. 1=Enabled: 0=Not Enabled
B14:1/13	Blower HOA in Remote	1=Remote: 0=Not in Remote
B14:1/14	Blower Run Status	1 = On; 0 = Off
B14:1/15	VFD Control Status	1 = Auto; 0 = Manual
B14:2/0	Communication Check Bit to Ethernet Device	Local Blower Panel always writes a 1 to this bit at all times. This can be used by Remote PLC to check communication.
B14:2/1	PID Loop Setpoint Source Selection	1 = Remote; 0 = Local
B14:2/2	E-Stop Status	1 = E-Stop Alarm; 0=Ok
B14:2/3	Blower at Max Air Output (Max Speed, or Flow, or Pressure, Overload Clamp, etc.)	1 = At Max Air Output; 0 = Not at Max
B14:2/4	Blower at Min Air Output (Min Speed, or Flow, or Pressure, Surge Clamp, etc.)	1 = At Min Air Output; 0 = Not at Min
B14:2/5	Not Used	
B14:2/6	Normal Power Status	1 = Normal Power ON; 0 = Normal Power OFF
B14:2/7	UPS Status	1 = Normal; 0 = Fail
B14:2/8	Blower Failure Signal	0 = Normal; 1 = Fail
B14:2/9	Minimum Off Timer Done (Blower is enabled to Start)	1 = Timer Done; 0 = Timer is Counting
B14:2/10	High Startup Pressure Shutdown Alarm	1=Alarm; 0=Ok
B14:2/11	Low Startup Pressure Shutdown Alarm	1=Alarm; 0=Ok
B14:2/12	Start Sequence Complete	1=Start Sequence Complete; 0=In Start Sequence, When the starting blower is finished with its start sequence this bit is sent to the Master Panel such that the Master Panel can inform all other blowers to go back to normal running mode by de-energizing B15:0/2
B14:2/13	Not Used	
B14:2/14	Not Used	
B14:2/15	Not Used	

HSI HSTB I/O List

PLC Address	Description	Notes
Discrete Bit Writes by the Remote Ethernet Device		
B15:0/0	Remote Start/Stop by Ethernet Device	1 = Run; 0 = Stop
B15:0/1	Communication Check Bit by Ethernet Device	Remote PLC to write a 1 to this bit at all times. The Local Blower Panel will reset it to 0 upon it being set to 1. If it remains 0 for more than 60 seconds, we will alarm at local HMI.
B15:0/2	Send Blower to Safe Line	1 = Go to Safe Line; 0 = Run Normal; When the Master calls for another blower to start, the Master should tell this running blower to go to its Startup Line or 'Safe Point' by energizing B15:0/2
Floating Point Reads by the Remote Ethernet Device		
F16:0	Calculated Flow	SCFM
F16:1	Outlet Pressure	psig
F16:2	Inlet Pressure	psia
F16:3	Outlet Temperature	Deg F
F16:4	Inlet Temperature	Deg F
F16:5	Motor Temperature	Deg F
F16:6	Signal to VFD	Hz
F16:7	Actual Speed from VFD	%
F16:8	Signal from the VFD	Hz
F16:9	RPM	rpm
F16:10	Horsepower	HP
F16:11	Input KW	KW
F16:12	Dissolved Oxygen	ppm
F16:13	Runtime Hours	hours
F16:14	Operating Mode	1 = Pressure, 2 = Flow, 3 = DO, 4 = Remote Speed
F16:15	Not Used	
F16:16	Not Used	
F16:17	Not Used	
F16:18	Not Used	
F16:19	Not Used	
F16:20	Not Used	
Floating Point Writes by the Remote Ethernet Device		
F17:0	Remote Setpoint to PID Loop or Remote Speed Signal from Plant SCADA	Remote Setpoint should be sent as actual value. Remote Speed Signal should be sent in Hz x 10 (420 Hz signal should be sent as 4200)
F17:1	Dissolved Oxygen Signal from Plant SCADA	

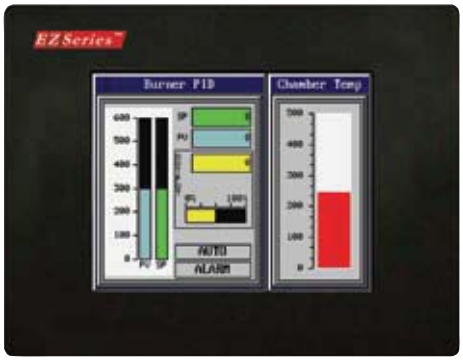
Touch Screen Panel

EZSeries 6" TFT Color Panels

6" Color EZSeries (5.7" TFT)

EZSeries 6" panels have a 5.7" diagonal touch screen with 320x240 pixel resolution. This model is a new addition to EZSeries line with a TFT LCD (liquid crystal display).

NOTE: EZSeries CE Touchpanels have built-in Ethernet yet are still available with additional Universal Ethernet option if the application needs multiple processors



EZSeries Touchpanel feature:

- 5.7" diagonal color TFT LCD
- Low-profile slim bezel design
- 128 colors
- NEMA 4, 4X
- 320x240 pixel resolution
- 512K RAM expandable to 1.5MB
- 512K, 1MB or 2MB option flash card for memory backup
- 400 nits brightness
- 75,000 hour expected bulb half-life
- 192 touch cells (16x12)
- 1/4" gasket and four DIN mounting clips for NEMA 4, 4X
- 2.3" (59.0mm) installed depth
- Has all EZSeries objects
- Has all 4,000 Library symbols
- Programmed with EZSeries programming software

See the different communication interface options available in the chart to the right

EZSeries CE Touchpanel

Part Number	Description
EZC-T6C-E	6" Color TFT, Enhanced CE 4.2 PP, Nema 4, 4X
EZC-T6C-ED	6" Color TFT, Enhanced CE 4.2 PP, DeviceNet, Nema 4, 4X
EZC-T6C-EH	6" Color TFT, Enhanced CE 4.2 PP, DH+, Nema 4, 4X
EZC-T6C-EM	6" Color TFT, Enhanced CE 4.2 PP, MB+, Nema 4, 4X
EZC-T6C-EP	6" Color TFT, Enhanced CE 4.2 PP, Profibus, Nema 4, 4X
EZC-T6C-EC	6" Color TFT, Enhanced CE 4.2 PP, CCLink, Nema 4, 4X
EZC-T6C-EU	6" Color TFT, Enhanced CE 4.2 PP, Universal Ethernet, Nema 4, 4X

Enhanced CE Touchpanels with Windows CE Professional Plus offer:

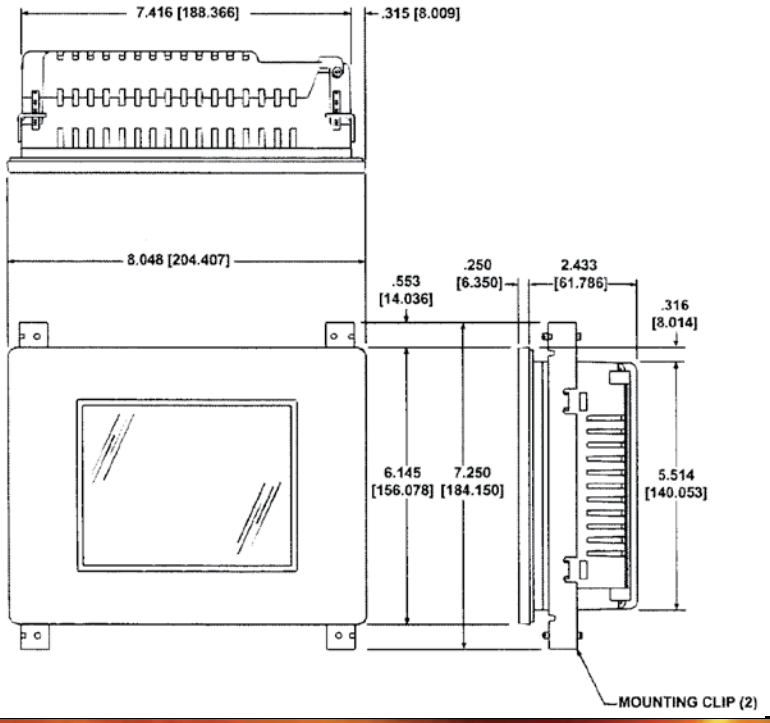
- File viewers such as Acrobat, Excel, Word, PowerPoint, Image and Internet Explorer for Windows CE
- Built-in Ethernet protocols, Ethernet IP, EZ IP, SRTP, Modbus TCP/IP and Koyo ECOM

EZSeries Dedicated OS

Model Number	Interface
EZ-T6C-ES	EZPLC driver only
EZ-T6C-FS	All serial drivers and accepts Ethernet and network cards
EZ-T6C-FSD	DeviceNet
EZ-T6C-FSE	AB Ethernet I/P
EZ-T6C-FSH	DH+, Remote I/O
EZ-T6C-FSM	Modicon MODBUS Plus
EZ-T6C-FSP	Profibus
EZ-T6C-FST	MODBUS TCP/IP
EZ-T6C-FSC	CCLink
EZ-T6C-FSU	Universal Ethernet drivers - DF1, I/P, Modbus TCP/IP, SRTP
EZ-T6C-RMC	RMC card installed

EZSeries CE Touchpanel feature:

- 5.7" diagonal color TFT LCD
- Low-profile slim bezel design
- 18 bit colors
- NEMA 4, 4X
- 320x240 pixel resolution
- 400 nits brightness
- 75,000 hour expected bulb half-life
- Analog resistive touch screen
- Alchemy 333 MHz Processor
- 32MB Flash, 64MB RAM and 2 MB for HMI
- 1/4" gasket and four DIN mounting clips
- 2.43" installed depth
- Has all EZSeries Touchpanel
- Has all 4,000 Library symbols
- Programmed with EZSeries Programming software



EZTouch Cables and Wiring

Power connector

A block style connector is used to connect an external 24VDC power supply. You can use our own FA-24PS 24VDC power supply as your source.

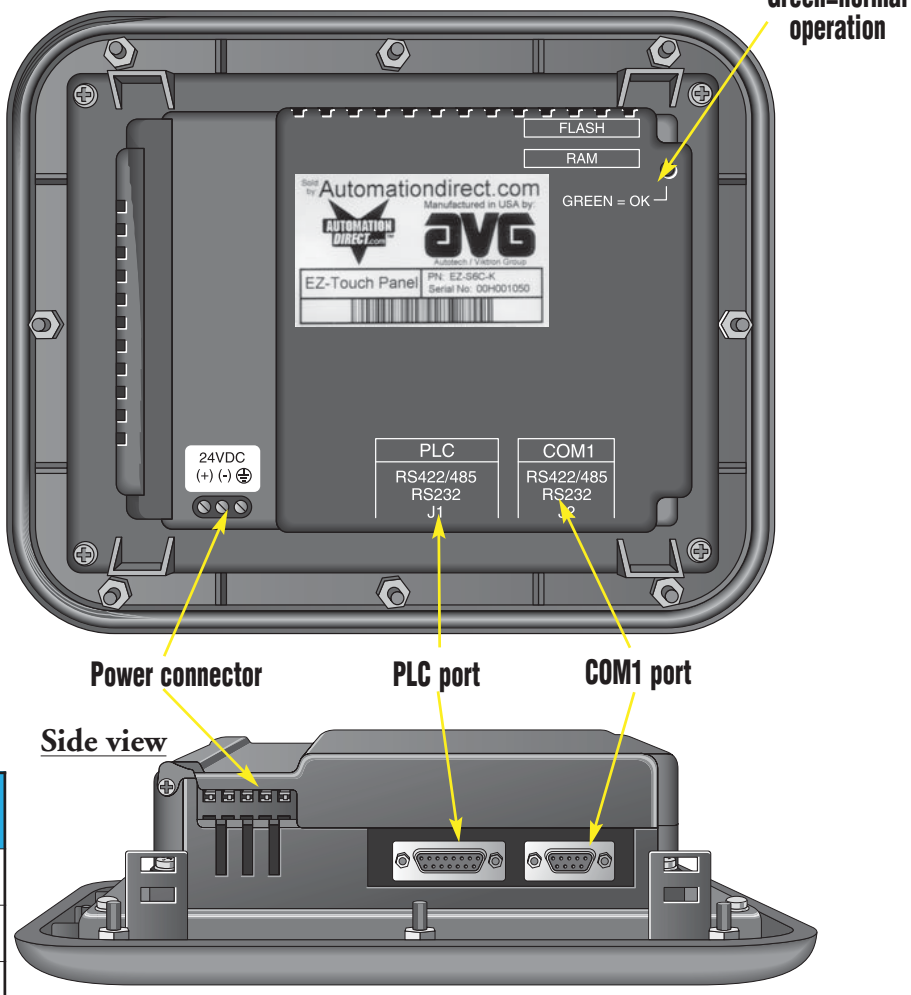
Power Connector		
Pin #	**Connection**	
+	+V	24VDC (20-30VDC)
-	-V	
⏚	Chassis Ground	

PLC port

The PLC port is a RS-232C, RS-422A or RS-485A female 15-pin D-sub connector. See the table below for the appropriate cable for your application.

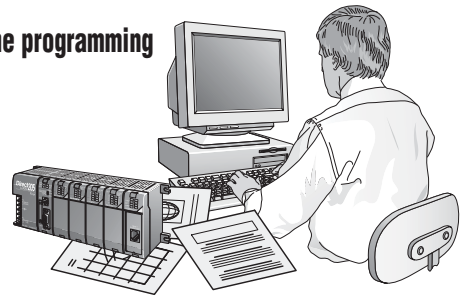
COM 1 port

RS-232C, RS-422A, or RS-485A female 9-pin D-sub connector is used to connect to the programming computer or PLC.



Cable Part Number	Cable Description	Price
EZ-2CBL	*DirectLOGIC* PLC RJ-12	$19.00
EZ-2CBL-1	*DirectLOGIC* VGA 15-pin (D2-250)	$19.00
EZ-3CBL	*DirectLOGIC* PLC RJ-11	$19.00
EZ-4CBL-1	*DirectLOGIC* DL405 PLC 15-pin D-sub port	$19.00
EZ-4CBL-2	*DirectLOGIC* PLC 25-pin D-sub port	$19.00
EZ-MLOGIX-CBL	Allen-Bradley MicroLogix	$19.00
EZ-SLC-232-CBL	Allen-Bradley SLC 5-03/04/05DF1 port	$19.00
EZPLC5-232-CBL	Allen-Bradley PLC-5 DF1 port	$19.00
EZ-DH485-CBL	Allen-Bradley SLC 500 DH485	$19.00
EZ-90-30-CBL	GE 90/30 and 90/70 15 pin D-sub	$19.00
EZ-MITSU-CBL	MITSUBISHI FX24 25-pin	$19.00
EZ-MITSU-CBL-1	MITSUBISHI FX24 8-pin mini-DIN	$19.00
EZ-S7MPI-CBL	Siemens S7 MPI adapter 9-pin D-sub	$19.00
EZTOUCH-PGMCBL	Programming cable	$19.00

Setup for online programming



PLC Connector	
Pin Number	**Connection**
1	Chassis GND
2	PLC TXD (RS-232)
3	PLC RXD (RS-232)
4	+5V
5	Logic GND
6	LE
7	PLC CTS (RS-232)
8	PLC RTS (RS-232)
9	RXD+ (RS-422)
10	RXD- (RS-422)
11	TXD+ (RS-422)
12	TXD- (RS-422)
13	Terminating resistor
14	NC
15	NC

COM 1 Connector	
Pin Number	**Connection**
1	TXD- (RS-422)
2	TXD (RS-232)
3	RXD (RS-232)
4	RXD- (RS-422)
5	Logic GND
6	TXD+ (RS-422)
7	CTS (RS-232)
8	RTS (RS-232)
9	RXD+ (RS-422)

Power Supplies

POWER SUPPLY

DELTA ELECTRONICS, INC.
www.delta.com.tw/industrialautomation

ASIA

Delta Electronics, Inc.
Taoyuan1
31-1, Xingbang Road, Guishan Industrial Zone,
Taoyuan County 33370, Taiwan, R.O.C.
TEL: 886-3-362-6301 / FAX: 886-3-362-7267

Delta Electronics (Jiang Su) Ltd.
Wujiang Plant3
1688 Jiangxing East Road,
Wujiang Economy Development Zone,
Wujiang City, Jiang Su Province,
People's Republic of China (Post code: 215200)
TEL: 86-512-6340-3008 / FAX: 86-769-6340-7290

Delta Electronics (Japan), Inc.
Tokyo Office
Delta Shibadaimon Building, 2-1-14 Shibadaimon,
Minato-Ku, Tokyo, 105-0012, Japan
TEL: 81-3-5733-1111 / FAX: 81-3-5733-1211

Delta Electronics (Korea), Inc.
234-9, Duck Soo BD 7F, Nonhyun-dong, Kangnam-Gu,
Seoul, Korea (Post code : 135-010)
TEL: 82-2-515-5305 / FAX: 82-2-515-5302

Delta Electronics (Singapore) Pte. Ltd.
8 Kaki Bukit Road 2, #04-18 Ruby Warehouse Complex,
Singapore 417841
TEL: 65-6747-5155 / FAX: 65-6744-9228

AMERICA

Delta Products Corporation (USA)
Raleigh Office
P.O. Box 12173,5101 Davis Drive,
Research Triangle Park, NC 27709, U.S.A.
TEL: 1-919-767-3813 / FAX: 1-919-767-3969

EUROPE

Deltronics (The Netherlands) B.V.
Eindhoven Office
De Witbogt 15, 5652 AG Eindhoven, The Netherlands
TEL: 31-40-2592850 / FAX: 31-40-2592851

*We reserve the right to change the information in this catalogue without prior notice

20081104 Power Suppy-E

Item # 4

DELTA ELECTRONICS, INC.

POWER SUPPLY

DIN Rail series

Source : Power Electronics Industry News March 2008
No. 1
2007 Global Sales of Power Supplies

www.delta.com.tw/industrialautomation

Features

- Easy wiring
- Overload protection
- Thermal protection
- Expected life time: 10 years
- RoHS compliant
- Power boost 150% for 3 seconds
- Compact design for easy handling
- Overvoltage protection
- Redundancy: Yes (with external oring diode)
- Warranty: 3 years

Introduction

The new DVP series & CliQ series power supplies are the latest offering from Delta Electronics, the world's largest power supply manufacturer. The product offers a nominal output voltage of 24V, a wide temperature range from -20℃ to +75℃ and a minimum holdup time of 20ms. The state-of-the-art design is made to withstand harsh industrial environments. The rugged, ultra-compact case material is shock and vibration resistant according to IEC 60068-2. The power supply provides overvoltage, overload and thermal protection. The wide input voltage ranges from 85 to 264VAC (1 phase) and 320 ~ 575VAC (3 phase), and the multiple output terminals are for fast wiring and easy installation.

Currently DIN Rail DC24V and 1 phase/3 phase 11 models are available:

Model	Spec
DVP-PS01/02	24W/48W,DC24V, 1 phase (White plastic case)
DRP024V060W1AZ	60W, DC24V, 1 phase (Black plastic case)
DRP024V060W1AA	60W, DC24V, 1 phase (Aluminum case)
DRP024V120W1AA	120W, DC24V, 1 phase (Aluminum case)
DRP024V240W1AA	240W, DC24V, 1 phase (Aluminum case)
DRP024V480W1AA	480W, DC24V, 1 phase (Aluminum case)
DRP024V060W3AA	60W, DC24V, 3 phase (Aluminum case)
DRP024V120W3AA	120W, DC24V, 3 phase (Aluminum case)
DRP024V240W3AA	240W, DC24V, 3 phase (Aluminum case)
DRP024V480W3AA	480W, DC24V, 3 phase (Aluminum case)

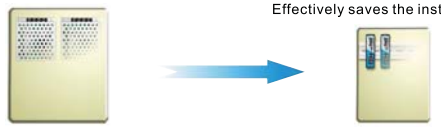
Easy Wiring

Adopting standard M3/M4 terminals and standard DIN rail installation, which simplify the wiring and save space.

Traditional iron-case power supply

DVP & CliQ DIN Rail power supply

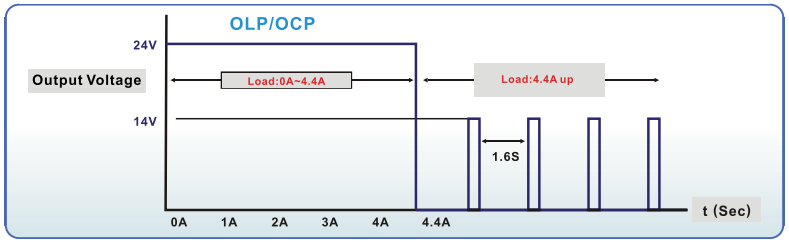
Effectively saves the installation space



Enhanced Security Level

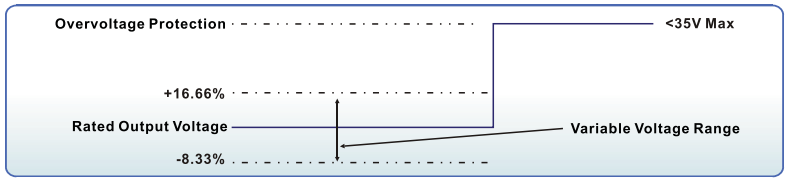
Overload Protection

CliQ series power supply offers overload protection (OLP/OCP) to prevent damages resulted from overcurrent.When the rated current is higher than 150%, the output voltage will start to drop automatically. When the power exceeds the maximum limit and reaches UVLO (under voltage point), the power supply will enter the bouncing mode. Once the overload is eliminated, the output voltage will return to its normal volume.



Overvoltage Protection

When error occurs in the feedback device inside the power supply, the overvoltage protection (OVP) will force the power supply to enter level 2 output (30 ~ 32VDC) and the output voltage to be lower than 35V. After the error is eliminated, the output voltage will restore to 24V automatically.



Short Circuit Protection

When short circuit occurs at the output voltage terminal, the short circuit protection will force the power supply to enter the bouncing mode until the fault is eliminated.

Thermal Protection

When the overcurrent or overvoltage persists for a period of time and causes high temperature, the thermal protection will force the power supply to enter the bouncing mode until the fault is eliminated.

Redundancy Mode

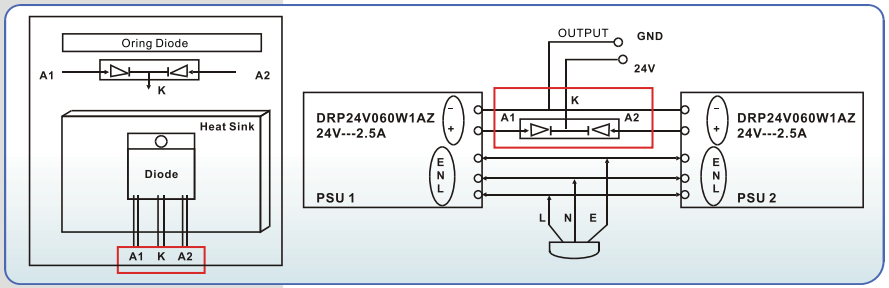
Connect the 2 power supplies, PSU1 and PSU2 as shown in the illustration below, and the power supply of bigger load will take over the entire load. The other will enter the redundancy mode.

Parallel Mode

The parallel mode is shown as the wiring method below. Each of the 2 power supplies is responsible for half of the load.

- Step 1: Measure the voltage from A1 to GND of PSU1 and the voltage from A2 to GND of PSU2. If the voltages measured are the same, skip to step 3; otherwise, move on to step 2.
- Step 2: Adjust the output voltage with the help of VR available on the front panel of the PSU marked as ADJUST for both PSU1 and PSU2 at the same level.
- Step 3: Confirm the output voltages from PSU1 and PSU2 are the same at a tolerance of ±25mV.

Note: The oring diode has to be of appropriate rating. Minimum 20Amps and 50Vrr are recommended for DRP024V060W1AZ model.



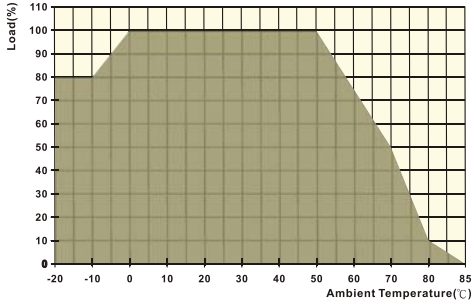
Output Voltage Adjustment

The output voltage is 24VDC, which can be adjusted from 22 ~ 28VDC on the potentiometer ADJUST on the front panel of each power supply.

Note:

1. DO NOT use the power supply in the area outside the shaded portion as shown in the graph ; otherwise the internal parts may be damaged.
2. If the ambient temperature is higher than 50℃, the output capacity will drop 2.5% per Kelvin increase in the temperature. If the output capacity does not drop, the power supply will enter the thermal protection mode.
3. If you would like to mount the power supply in other directions, please contact your supplier for technical supports.
4. Please leave 2cm space between the power supply and other devices.

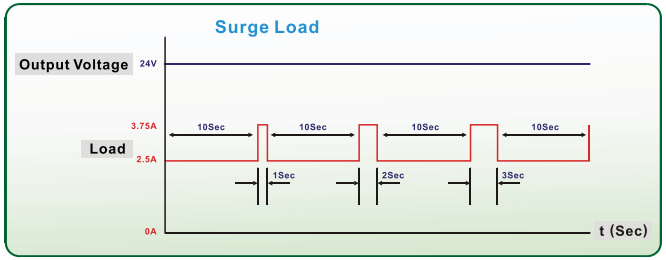
Derating Curve



Other Features

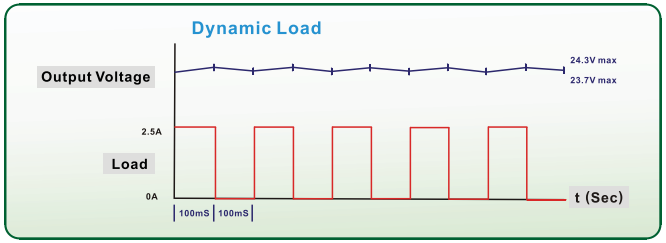
Surge Load

The graph below illustrates a typical surge load capability of the power supply. The power supply is capable of enduring 3 seconds of a surge load of 150% of output voltage ±5% of regulated limit.



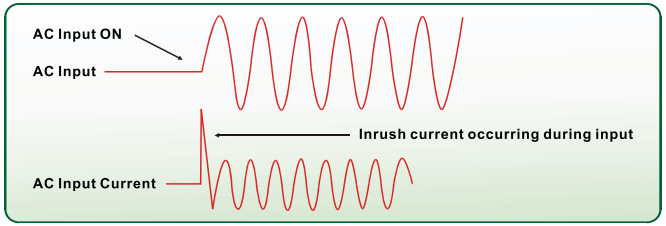
Dynamic Load

The power supply is capable of accepting a dynamic change of load from 0% to 100% with output voltage ±5% of regulated limit.



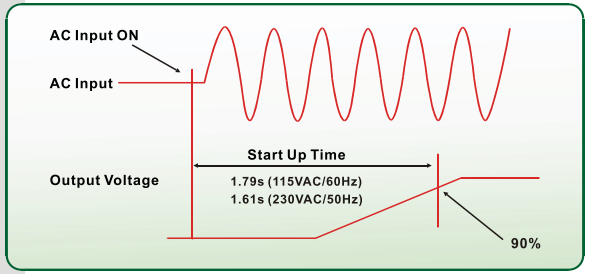
Start Up Current

The inrush current is the first surge current occurring when the AC input is applied to the power supply.



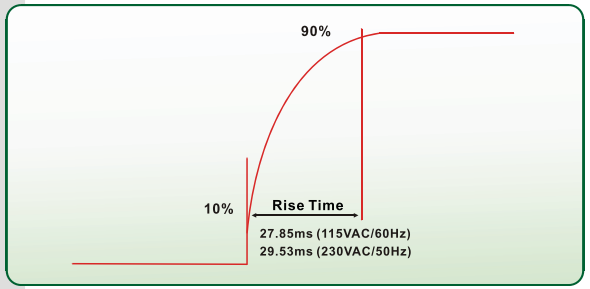
Start Up Time

The time measured from the AC input voltage is applied to it reaches 90% of the rated voltage.



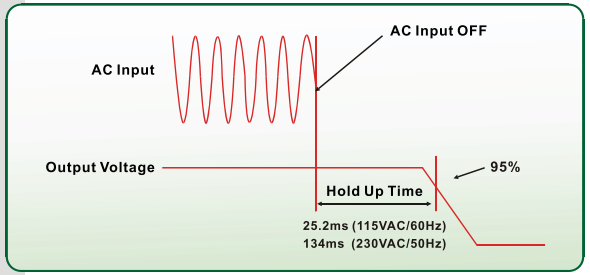
Rise Time

The time measured from 10% of the rated output voltage to 90% of the rated voltage.



Hold Up Time

The time measured from the input collapse to the output voltage drops to 95%.

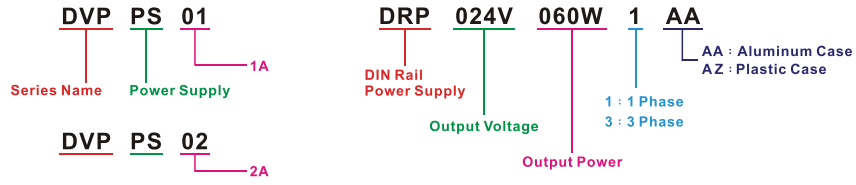


● Take DRP024V060W1AZ as example.

Ordering Information

Series Name	Power Supply	Input	Output	Model Name	Certificates
DVP	1 Phase	85 ~ 264 VAC/ 120~375 VDC	24V	DVPPS01	
		85 ~ 264 VAC/ 120~375 VDC	24V	DVPPS02	
CliQ		85 ~ 264 VAC/ 120~375 VDC	24V	DRP024V060W1AZ	
		85 ~ 264 VAC/ 120~375 VDC	24V	DRP024V060W1AA	
		85 ~ 264 VAC/ 120~375 VDC	24V	DRP024V120W1AA	
		85 ~ 264 VAC/ 120~375 VDC	24V	DRP024V240W1AA	
		85 ~ 264 VAC/ 120~375 VDC	24V	DRP024V480W1AA	
	3 Phase	320~575 VAC/ 450~800 VDC	24V	DRP024V060W3AA	
		320~575 VAC/ 450~800 VDC	24V	DRP024V120W3AA	
		320~575 VAC/ 450~800 VDC	24V	DRP024V240W3AA	
		320~575 VAC/ 450~800 VDC	24V	DRP024V480W3AA	

Model Name Explanation



MicroLogix 1100 PLC

MicroLogix 1100 Controllers

General Specifications

Specification	1763 Controllers
Operating Temperature	-20...65 °C (-4...149 °F)
Storage Temperature	-40...85 °C (-40...185 °F)
Relative Humidity	5...95% non-condensing
Vibration	Operating: 10...500 Hz, 5 g, 0.015 in max. peak-to-peak (Relay Operation: 1.5 g)
Shock, Operating	30 g; 3 pulses each direction, each axis (Relay Operation: 10 g)
Shock, Non-Operating	50 g panel mounted (40 g Din Rail mounted); 3 pulses each direction, each axis
Certifications	UL Listed Industrial Control Equipment for use in class 1, Division 2, Hazardous Locations, Groups A, B, C, D
	C-UL Listed Industrial Control Equipment for use in Canada
	CE marked for all applicable directives
	C-Tick marked for all applicable acts

MicroLogix 1100 Controllers

	1763-L16AWA	1763-L16BWA	1763-L16BBB
Input Power	120/240V ac		24V dc
Memory	non-volatile battery backed RAM		
User Program / User Data Space	4 Kbytes / 4 Kbytes		
Data Logging / Recipe Storage	Up to 128 Kbytes for data logging and up to 64 Kbytes for recipe (recipe memory subtracted from available data logging)		
Battery Back-up	Yes		
Back-up Memory Module	Yes		
Digital Inputs	• 10 120V ac	• 6 24V dc • 4 fast 24V dc	
Analog Inputs	Embedded, 2 in local, with additional 1762 analog modules		
Digital Outputs	• 6 relay		• 2 relay • 2 24V dc FET • 2 high-speed 24V dc FET
Serial Ports	One RS-232 / RS-485 Combo Port		

Serial Protocols	• DF1 Full Duplex • DF1 Half Duplex Master/Slave • DF1 Radio Modem • DH-485 • Modbus RTU Master/Slave • ASCII		
Ethernet Ports	One 10/100 Mbps port		
Ethernet Protocols	EtherNet/IP messaging only		
Trim Potentiometers	2 digital		
High-Speed Inputs (Pulse Catch)	—	4 @ 20 kHz	
Real-Time Clock	Yes (embedded)		
PID	Yes (multiple loops only limited by program and stack memory)		
PWM / PTO	—		2 @ 20 kHz
Dual Axis Servo Control	—		Through embedded PTO
Embedded LCD	Yes		
Floating Point Math	Yes		

I/O Modules

1762 MicroLogix 1200 I/O

Expansion I/O Modules

If an application requires more I/O than the built-in I/O provided by the MicroLogix 1200 controller, you can connect up to six 1762 expansion I/O modules to the MicroLogix 1200 controller to provide expanded I/O capacity. You can use digital and analog I/O modules in many combinations. The current loading capacity of the controller's built-in power supply may limit the number of I/O modules that can be connected to the controller.

MicroLogix 1200 expansion I/O modules include an integral high-performance I/O bus. Software keying prevents incorrect positioning within the system.

You may install expansion I/O modules to the right of the MicroLogix 1200 controller either on a panel with two mounting screws or on a DIN rail. Each expansion I/O module includes finger-safe terminal blocks for I/O wiring and a label to record I/O terminal designations.

NOTE: THE MICROLOGIX 1762 EXPANSION I/O MODULES ARE FOR OUR MICROLOGIX 1100 PLC. HSI IS NOT SUPPLYING A MICROLOGIX 1200 PLC

1762 MicroLogix 1200 I/O

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Specifications

Dimensions (HxWxD), Approx.	90 x 40 x 87mm (3.543 x 1.575 x 3.425 in)✶
Operating Temperature	0…55 °C (32…131 °F)
Operating Humidity	5…95% (without condensation)
Operating Altitude, Max.	2,000 m (6,561 ft)
Vibration	
Operating	10…500 Hz, 5 g, 0.015 in peak-to-peak
Relay Operation	2 g
Shock	
Operating	30 g panel mounted 20 g DIN-rail mounted
Relay Operation	7.5 g panel mounted 5 g DIN rail mounted
Non-Operating	40 g panel mounted 30 g DIN rail mounted
Agency Certification	• C-UL certified (under CSA C22.2 No. 142) • UL 508 Listed • CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
ESD Immunity (IEC 1000-4-2)	4 kV contact, 8 kV air, 4 kV indirect
Radiated Immunity (IEC 1000-4-3)	10V/m, 80-1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
Fast Transient Burst (IEC 1000-4-4)	2 kV, 5 kHz
Surge Immunity (IEC 1000-4-5)	2 kV common mode, 1 kV differential mode
Conducted Immunity (IEC 1000-4-6)	10V, 0.15…80 MHz❄

✶ Height including mounting tabs is 110 mm (4.33 in).
❄ Conducted immunity frequency range may be 150 kHz…30 MHz if the radiated immunity frequency range is 30 MHz…1000 MHz.

Digital Output Modules

Cat. No.	Number of Outputs	Continuous Current per Output, Max.	Continuous Current per Module, Max.	Voltage Category	Operating Voltage Range	Off-State Leakage Current, Max.	Bus Current Load, Max.	Power Supply Distance Rating✶

1762-OA8	8 (2 sets of 4)	0.25A @ 55 °C (131 °F) 0.5A @ 30 °C (86 °F)	2.0A (1A per common) @ 55 °C (131 °F) 4.0A (2A per common) @ 30 °C (86 °F)	100…240V ac	85…265V ac	2 mA @ 132V 2.5 mA @ 265V	115 mA @ 5V dc (0.575W)	6
1762-OB8	8	0.5A @ 55 °C (131 °F) 1.0A @ 30 °C (86 °F)	4.0A @ 55 °C (131 °F) 8.0A @ 30 °C (86 °F)	24V dc	20.4…26.4V dc	1.0 mA	115 mA @ 5V dc (0.575W)	6
1762-OB16	16	0.5A @ 55 °C (131 °F) 1.0A @ 30 °C (86 °F)	4.0A @ 55 °C (131 °F) 8.0A @ 30 °C (86 °F)	24V dc	20.4…26.4V dc	1.0 mA	175 mA @ 5V dc (0.88W)	6
1762-OW8	8 (2 sets of 4)	2.5A✶	16A (8A per common)	AC/DC normally open contact	5…265V ac 5…125V dc	0 mA	80 mA @ 5V dc (0.40W) 90 mA @ 24V dc (2.16W)	6
1762-OW16	16 (2 sets of 8)	2.5A❄	16A (8A per common)	AC/DC normally open contact	5…265V ac 5…125V dc	0 mA	120 mA @ 5V dc (0.60W) 90 mA @ 24V dc (3.36W)	6

✶ The module may not be more than the specified number of modules away from the power supply of the controller.
❄ See relay contact rating table.

Digital Input Modules

Cat. No.	Number of Inputs	Voltage Category	Operating Voltage Range	On-State Current, Max.	Impedance, Nom.	Signal Delay, Max.	Off-State Voltage and Current, Max.	IEC Input Compatibility	Bus Current Load, Max.	Power Supply Distance Rating✶
1762-IA8	8	100/120V ac	79…132V ac @ 47…63 Hz	16 mA @ 132V ac, 63 Hz	12 kΩ @ 50 Hz 10 kΩ @ 60 Hz	On/Off: 20 ms	20V ac 2.5 mA	Type 1+	50 mA @ 5V dc (0.25W)	6
1762-IQ8	8	24V dc (sink or source)	10…26.4V dc @ 55 °C (131 °F)	12 mA @ 30V dc	3 kΩ	On/Off: 8 ms	5V dc 1.5 mA	Type 1+	50 mA @ 5V dc (0.25W)	6
1762-IQ16	16	24V dc (sink or source)	10…30V dc @ 30 °C (86 °F)	12 mA @ 30V dc	3 kΩ	On/Off: 8 ms	5V dc 1.5 mA	Type 1+	60 mA @ 5V dc (0.3W)	6

✶ The module may not be more than the specified number of modules away from the power supply of the controller.

Analog I/O Modules

Cat. No.	Number of Inputs/ Outputs	Analog Ranges	Bus Current Load, Max.	Overall Accuracy✶	Resolution Across Full Range	Typical Update Period	Power Supply Distance Rating❄
1762-IF4	4 differential (bipolar) inputs	Voltage: ±10V Current: 4…20 mA	40 mA @ 5V dc 50 mA @ 24V dc	±0.3% full scale @ 55 °C (131 °F) ±0.24% full scale @ 25 °C (77 °F)	15 bits	130, 250, 290, 450, or 530 ms (selectable)	6
1762-OF4	4 single-ended bipolar outputs	Voltage: 0…10V Current: 4…20 mA	40 mA @ 5V dc 165 mA @ 24V dc	±1.0% full scale @ 0…55 °C (131 °F) ±0.5% full scale @ 25 °C (77 °F)	12 bits	2.5 ms	6

1762-IF2OF2	2 differential (unipolar) inputs 2 single-ended (unipolar) outputs	Voltage: 0…10V Current: 4…20 mA	40 mA @ 5V dc 105 mA @ 24V dc	±0.5% full scale @ 55 °C (131 °F) ±0.3% full scale @ 25 °C (77 °F)	12 bits	2.5 ms	6
1762-IR4	4 RTD inputs	Input Types: 100Ω Platinum 385 200Ω Platinum 385 500Ω Platinum 385 1000Ω Platinum 385 100Ω Platinum 3916 200Ω Platinum 3916 500Ω Platinum 3916 1000Ω Platinum 3916 10Ω Copper 426 120Ω Nickel 672 120Ω Nickel 618 604Ω Nickel-Iron 518 0 to 150Ω 0 to 500Ω 0 to 1000Ω 0 to 3000Ω	40 mA @ 5V dc 50 mA @ 24V dc	[Autocalibration Enabled] @ 25 °C (77 °F) Ambient with Module Operating Temperature @ 25 °C (77 °F)‡ ±0.5 °C (°F) for Pt 385 ±0.4 °C (°F) for Pt 3916 ±0.2 °C (°F) for Ni ±0.3 °C (°F) for NiFe ±0.6 °C (°F) for Cu ±0.15Ω for 150Ω range ±0.5Ω for 500Ω range ±1.0Ω for 1000Ω range ±1.5Ω for 3000Ω range	Input filter and configuration dependent. Refer to the MicroLogix™ 1200 RTD/ Resistance Input Module User Manual, publication number 1762-UM003, for more information.	Input filter and configuration dependent. Refer to the MicroLogix™ 1200 RTD/ Resistance Input Module User Manual, publication number 1762-UM003, for more information.	6
1762-IT4	4 Thermocouple inputs	Input Types: Thermocouple Type J -210 to +1200 °C (-346 to +2192 °F) Thermocouple Type K -270 to +1370 °C (-454 to +2498 °F) Thermocouple Type T -270 to +400 °C (-454 to +752 °F) Thermocouple Type E -270 to +1000 °C (-454 to +1832 °F) Thermocouple Type R 0 to +1768 °C (+32 to +3214 °F) Thermocouple Type S 0 to +1768 °C (+32 to +3214 °F) Thermocouple Type B +300 to +1820 °C (+572 to +3308 °F) Thermocouple Type N -210 to +1300 °C (-346 to +2372 °F) Thermocouple Type C 0 to +2315 °C (+32 to + 4199 °F) millivolt inputs -50 to +50 mV -100 to +100 mV	40 mA @ 5V dc 50 mA @ 24V dc	±1.3 °C (±2.34 °F)	15 bits plus sign	Input filter and configuration dependent.	6

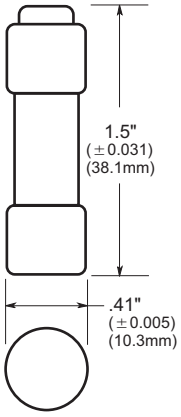
✶ Includes offset, gain, non-linearity, and repeatability error terms.
❄ The module may not be more than the specified number of modules away from the power supply of the controller.
‡ Accuracy is dependent upon the Analog/Digital converter filter rate selection, excitation current selection, data format, and input noise.

Fuses

CC-TRON®
Time-Delay Fuses
13/32″ × 1½″, 600 Volt, ¼ to 30 Amps

FNQ-R

Dimensional Data



General Information:

- The Bussmann CC-TRON® (FNQ-R) was designed to meet the needs of control circuit transformer protection.
- Current-limitation protects down stream components against damaging thermal and magnetic effects of short-circuit currents.
- **High inrush time-delay.** Control circuit transformers can experience inrush currents up to 85 times their full-load current rating. FNQ-R fuses can be sized according to NEC and UL requirements and still allow the high inrush currents, with significantly more time-delay than the UL minimum value of 12 seconds at 200% for Class CC fuses.
- Melamine tube. Nickel-plated brass endcaps.

Catalog Symbol: FNQ-R
Time-Delay
Application: Circuit Transformer Protection
Ampere Rating: ¼ to 30A
Voltage Rating: 600Vac (or less)†
Interrupting Rating: 200,000A RMS Sym. (UL)
Agency Information:
UL Listed, Std. 248-4, Class CC, Guide JDDZ, File E4273
CSA Certified, Class CC CSA, Class 1422-01,
File 53787–HRC-MISC

†12-30A is 300Vdc and 10k AIR.

Maximum Acceptable Rating of Overcurrent Device*

Rated Primary Current (Amperes)	Maximum Rating of Overcurrent Protective Device Expressed As A Percent of Transformer Primary Current Rating
Less than 2A	500**
2A to less than 9A	167
9A or more	125

*UL 508A Table 42.1.
**300% for other than motor control applications.

CE CE logo denotes compliance with European Union Low Voltage Directive (50-1000Vac, 75-1500Vdc). Refer to Data Sheet: 8002 or contact Bussmann Application Engineering at 636-527-1270 for more information.

Electrical Ratings (Catalog Symbol and Amperes)

FNQ-R-¼	FNQ-R-1 3/10	FNQ-R-3 2/10	FNQ-R-8
FNQ-R-3/10	FNQ-R-1 1/10	FNQ-R-3½	FNQ-R-9
FNQ-R-4/10	FNQ-R-1½	FNQ-R-4	FNQ-R-10
FNQ-R-½	FNQ-R-1 6/10	FNQ-R-4½	FNQ-R-12
FNQ-R-6/10	FNQ-R-1 8/10	FNQ-R-5	FNQ-R-15
FNQ-R-¾	FNQ-R-2	FNQ-R-5 6/10	FNQ-R-17½
FNQ-R-8/10	FNQ-R-2¼	FNQ-R-6	FNQ-R-20
FNQ-R-1	FNQ-R-2½	FNQ-R-6¼	FNQ-R-25
FNQ-R-1⅛	FNQ-R-2 8/10	FNQ-R-7	FNQ-R-30
FNQ-R-1¼	FNQ-R-3	FNQ-R-7½	—

Carton Quantity and Weight

Ampere Ratings	Carton Qty.	Weight*	
		Lbs.	Kg.
¼-30	10	.200	.091

*Weight per carton

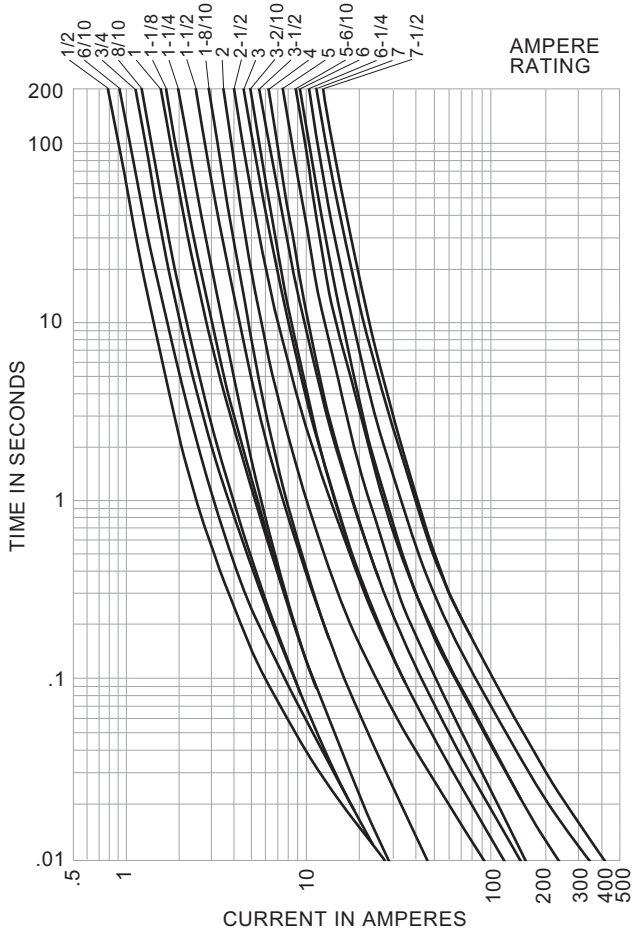
CC-TRON®

FNQ-R

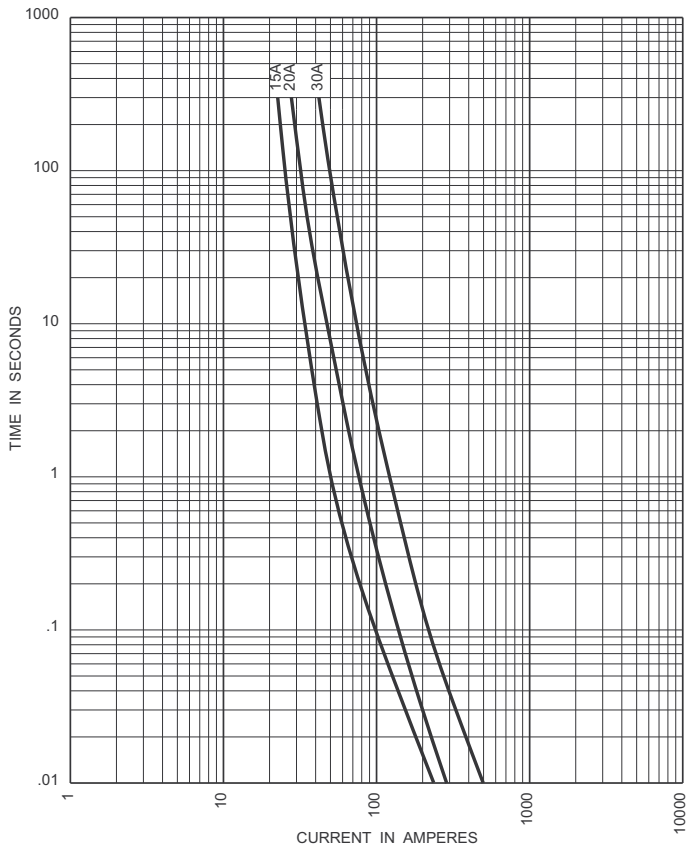
Time-Delay Fuses

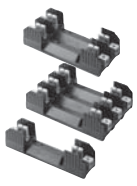
13/32″ × 1½″, 600 Volt, ¼ to 30 Amps

Time-Current Characteristics–Average Melt



Time-Current Characteristics–Average Melt





Recommended fuseblocks/fuseholders for Class CC 600V fuses

See Data Sheets listed below

- Open fuseblocks - 1105
- Finger-safe fuseholders - 1109, 1102, 1103, 1151
- Panel-mount fuseholders - 2114, 2113
- In-line fuseholders - 2126

Transformer

General Purpose Transformers in Enclosures

Dry-Type/Cased

Isolated
General Purpose
Single-Phase

Type QB, .050 kVA-3 kVA, Single-Phase

Type QMS, 5 kVA-25 kVA, Single-Phase

General Information

The complete family of transformers from GE provide quiet, reliable transformer operation.

All of the dry-type transformers through 1,000 kVA are UL listed under the requirements of Standard 506 and 1561. In addition, each transformer meets the requirements of NEMA ST-20, 1992. Type QB, QMS, and QMS 3 models are C-UL listed.

General-purpose transformers are rated 600 Volts and below for supplying appliance, lighting, and power loads from electrical distribution systems. Standard distribution voltages are 600, 480, and 240 Volts; standard load voltages are 480, 240, 208, and 120 Volts. The transformer is used to obtain the load voltage from the distribution voltage. Since no vaults are required for installation, these transformers can be located right at the load to provide the correct voltage for the application. This eliminates the need for long, costly, low-voltage feeders.

Construction—Types QB, QMS, and QMS 3

Core and coils are contained within a NEMA 3R nonventilated weatherproof enclosure. Type QB, QMS, and QMS 3 units feature encapsulated core and coils.

.050 - 3 kVA Indoor/Outdoor Type QB UL Listed C-UL Listed

Input Voltage	Output Voltage	KVA	Frequency (Hz)	Taps	Wiring Diagram No.[1]	Product Number
240 x 480 Volts, 480 Volts	120/240 Volts	0.05	60 Hz	No taps	1	9T51B0002
240 x 480 Volts	120/240 Volts	0.05	50/60 Hz	No taps	1	9T51B0502
240 x 480 Volts, 480 Volts	120/240 Volts	0.075	60 Hz	No taps	1	9T51B0003
240 x 480 Volts	120/240 Volts	0.075	50/60 Hz	No taps	1	9T51B0503
240 x 480 Volts, 480 Volts	120/240 Volts	0.1	60 Hz	No taps	1	9T51B0004
240 x 480 Volts	120/240 Volts	0.1	50/60 Hz	No taps	1	9T51B0504
240 x 480 Volts, 480 Volts	120/240 Volts	0.15	60 Hz	No taps	1	9T51B0005
240 x 480 Volts	120/240 Volts	0.15	50/60 Hz	No taps	1	9T51B0505
240 x 480 Volts, 480 Volts	120/240 Volts	0.25	60 Hz	No taps	1	9T51B0007
240 x 480 Volts	120/240 Volts	0.25	50/60 Hz	No taps	1	9T51B0507
240 x 480 Volts, 480 Volts	120/240 Volts	0.5	60 Hz	No taps	1	9T51B0008
240 x 480 Volts	120/240 Volts	0.5	50/60 Hz	No taps	1	9T51B0508
240 x 480 Volts, 480 Volts	120/240 Volts	0.75	60 Hz	No taps	1	9T51B0009
240 x 480 Volts	120/240 Volts	0.75	50/60 Hz	No taps	1	9T51B0509
240 x 480 Volts, 480 Volts	120/240 Volts	1	60 Hz	No taps	1	9T51B0010
240 x 480 Volts	120/240 Volts	1	50/60 Hz	No taps	1	9T51B0510
240 x 480 Volts, 480 Volts	120/240 Volts	1.5	60 Hz	No taps	1	9T51B0011
240 x 480 Volts	120/240 Volts	1.5	50/60 Hz	No taps	1	9T51B0511
240 x 480 Volts, 480 Volts	120/240 Volts	2	60 Hz	No taps	1	9T51B0012
240 x 480 Volts	120/240 Volts	2	50/60 Hz	No taps	1	9T51B0512
240 x 480 Volts, 480 Volts	120/240 Volts	3	60 Hz	No taps	1	9T51B0013
240 x 480 Volts	120/240 Volts	3	50/60 Hz	No taps	1	9T51B0513
480 Volts	120/240 Volts	0.25	50/60 Hz	(2) 5% taps below rated primary volts	2	9T51B0547
480 Volts	120/240 Volts	0.5	50/60 Hz	(2) 5% taps below rated primary volts	2	9T51B0548
480 Volts	120/240 Volts	0.75	50/60 Hz	(2) 5% taps below rated primary volts	2	9T51B0549
480 Volts	120/240 Volts	1	60 Hz	(2) 5% taps below rated primary volts	2	9T51B0050
480 Volts	120/240 Volts	1	50/60 Hz	(2) 5% taps below rated primary volts	2	9T51B0550
480 Volts	120/240 Volts	1.5	60 Hz	(2) 5% taps below rated primary volts	2	9T51B0051
480 Volts	120/240 Volts	1.5	50/60 Hz	(2) 5% taps below rated primary volts	2	9T51B0551
480 Volts	120/240 Volts	2	60 Hz	(2) 5% taps below rated primary volts	2	9T51B0052
480 Volts	120/240 Volts	2	50/60 Hz	(2) 5% taps below rated primary volts	2	9T51B0552
480 Volts	120/240 Volts	3	60 Hz	(2) 5% taps below rated primary volts	2	9T51B0053
480 Volts	120/240 Volts	3	60 Hz	(4) 2 1/2% taps: 2 above and 2 below rated primary volts	3	9T51B0135
480 Volts	120/240 Volts	3	50/60 Hz	(2) 5% taps below rated primary volts	2	9T51B0553

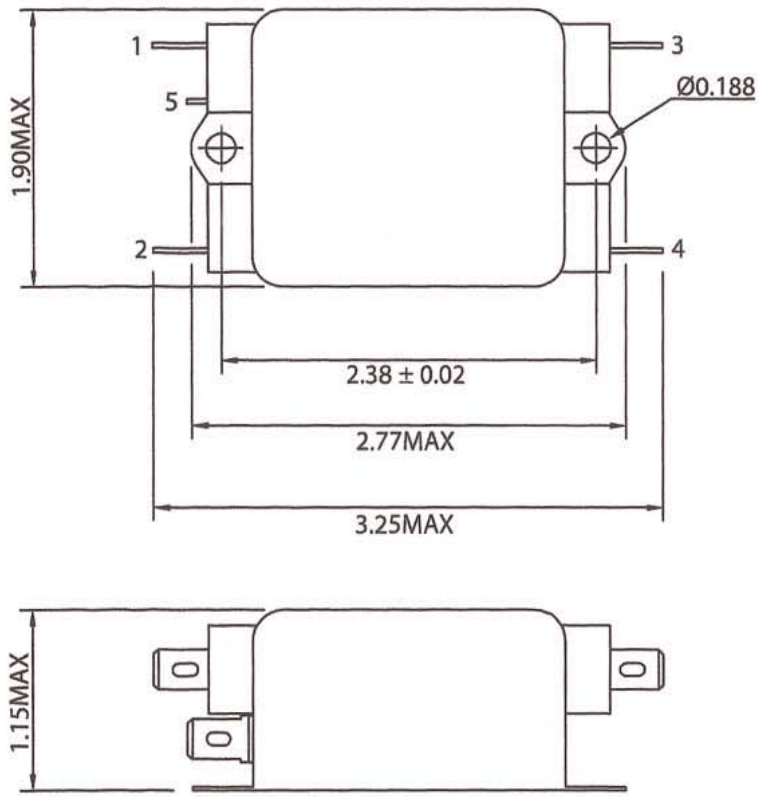
[1]See page 15-14 for wiring diagrams.

Publications and Reference: See Section 17 for a complete list of additional product-related publications

EMI Filter

REVISION			
REV.	DESCRIPTION	DATE	APPROVED
B	RoHS Compliancy	06-01-06	DP

PHYSICAL DIMENSIONS:



ELECTRICAL CHARACTERISTICS:

1-1. VOLTAGE RATING.....115/250VAC

1-2. CURRENT RATING
A. @ 115 VAC.....3 A RMS MAX
B. @ 250 VAC.....3 A RMS MAX

1-3. OPERATING FREQUENCY.....50/60Hz

1-4. LEAKAGE CURRENT: EACH LINE TO GROUND
A. @ 115 VAC 60Hz.....0.45 mA MAX
B. @ 250 VAC 50Hz.....0.90 mA MAX

1-5. HIPOT RATING (FOR ONE MINUTE)
A. LINE TO GROUND.....2250 VDC
B. LINE TO LINE.....1450 VDC

1-6. MINIMUM INSERTION LOSS IN dB: (AT 50 OHM SYSTEM)

FREQ. MHz	.01	.05	.10	.15	.50	1.0	5.0	10	30
COM. MODE dB	1	7	10	12	25	30	45	60	35
DIF. MODE dB	0	1	10	20	50	60	45	45	45

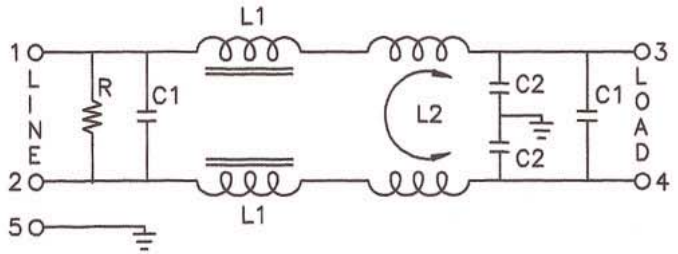
1-7. OPERATING TEMPERATURE.....-25° TO +85° C

1-8. SAFETY:

1-9. RoHS COMPLIANT

CONTROLLED

SCHEMATIC:



L1: 30.0uH
L2: 1.0mH
C1: 0.22uF
C2: 3300+2200pF
R: 330KΩ

Dim range (mm)	Tolerance +/- (mm)
0-1	0.15
1-6	0.20
6-18	0.30
18-50	0.50
50-120	0.70
120-250	0.90
250-500	1.20

Qualtek Electronics Corp.
PPC DIVISION

Part Number: 848-03/001 RoHS Compliant

Description: EMI FILTER

	UNIT: in	REV. B
Drawn / Date	Checked / Date	Approved / Date
B.ZHANG 02-07-03	02-07-03	JJH / 02-07-03

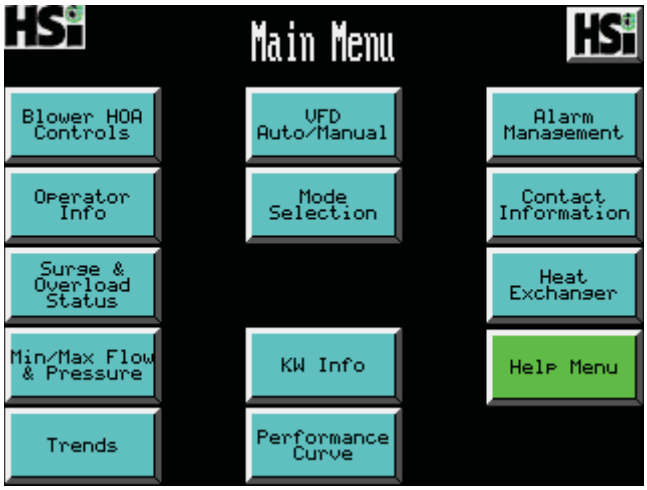
HMI Operation

Getting Started with the HMI Touch Screen / Main Menu

The turbo blower provides a Human Machine Interface (HMI) touch screen. The HMI enables you to operate the blower by interfacing directly with the blower controls.

The HMI displays the HSI screen:

Touch anywhere on the screen to display the HMI Main Menu screen:



Touch the button for the operation that you want to perform, and the related screen will be displayed.

The following sections discuss each of the operations listed on the Main Menu.

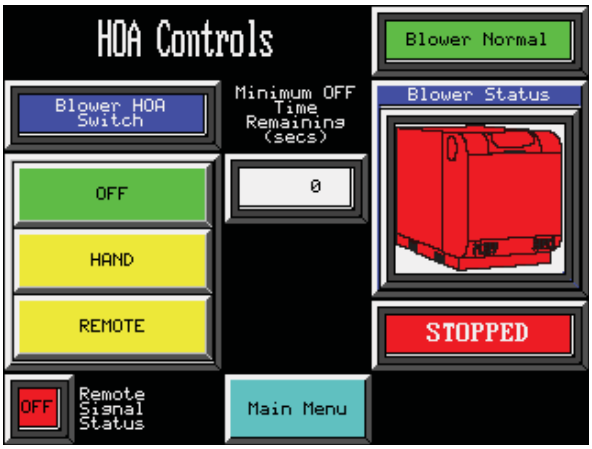
Note:	**All screens provide a**  **button for returning to the HMI Main Menu.**

Operating description for the local control panels from a generic version of our IO&M manual. The job specific manuals will be delivered after the blower is built and tested.

Using the Blower Hand-Off-Auto (HOA) Controls

Before you begin working with the HOA Controls, you must set the blower control mode for Auto or Manual mode. See **VFD Control Setting (Auto or Manual)** on page 34.

From the Main Menu, press **Blower HOA Controls** to display the screen:



Field	Description	Action
Blower HOA Switch	Label for the three HOA switches: OFF, HAND, REMOTE. The current HOA status is highlighted in green over one of the three switches. For example, in the HOA Controls screen shown here, the current HOA status is OFF.	n/a
OFF	Switch to turn the blower off.	See Stopping the Blower, p. 30.
HAND	Switch to start the blower.	See Starting the Blower, p. 30.
REMOTE	Switch to put the blower in remote mode, where it can be started / stopped remotely.	See Putting the Blower in Remote Mode, p. 30.
Remote Signal Status	Indicates if a remote signal is being sent to the blower. This allows the operator to know if the blower is being sent a request to run remotely, and the operator can then switch the blower into Remote mode.	n/a
Blower Status	Displays a graphic and text to indicate if the blower is ON (running) or OFF (stopped). If the blower is On, the graphic will be green and “Running” will be displayed. If the blower is Off, the graphic will be red and “Stopped” will be displayed (as shown in the HOA Controls screen here). **Note:** Some sites require red for ON and green for OFF.	n/a

Field	Description	Action
Minimum Off Time Remaining (secs)	Displays the amount of time remaining until the blower can be restarted. After the blower is shutdown (for any reason), it cannot be restarted until this time expires.	n/a

If the blower is shutdown due to an interlock, such as a high discharge temperature, the status box at the top/middle of the HOA Controls Screen will display "Blower Shutdown".

This indicates that the blower cannot be restarted until the operator determines the cause of the shutdown and resets the shutdown condition.

For more information, see Managing Alarms on page 39.

Starting the Blower

Before you start the blower, you must set the blower control mode for Auto or Manual mode.

See VFD Control Setting (Auto or Manual) on page 34.

Step	Action
1	From the Main Menu, press **Blower HOA Controls**. The HOA Controls screen is displayed.
2	Press **HAND**. The blower starts. The Blower Status graphic will display in green and the text will display STARTED.

Stopping the Blower

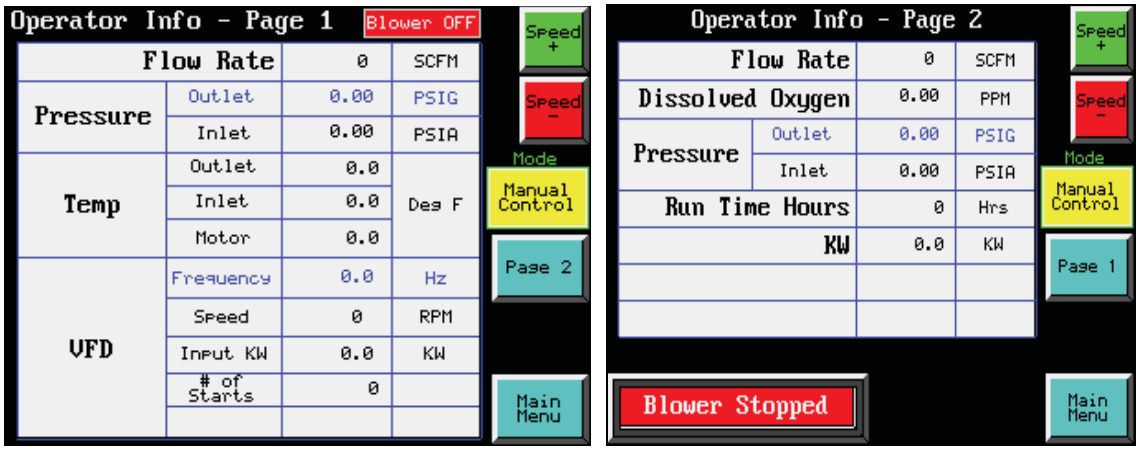
Step	Action
1	From the Main Menu, press **Blower HOA Controls**. The HOA (Hand-Off-Auto) screen is displayed.
2	Press **OFF**. The blower stops running. The Blower Status graphic will display in red and the text will display STOPPED.

Putting the Blower in Remote Mode

Step	Action
1	From the Main Menu, press **Blower HOA Controls**. The HOA (Hand-Off-Auto) screen is displayed.
2	Press **REMOTE**. The blower is now in remote mode, and can be controlled by an external source, such as a remote PLC. The Blower Status graphic will display in yellow and the text will display REMOTE.

Viewing the Operator (Status) Info

From the Main Menu, press **Operator Info** to display the screen (and, press **Page 2** for the second screen):



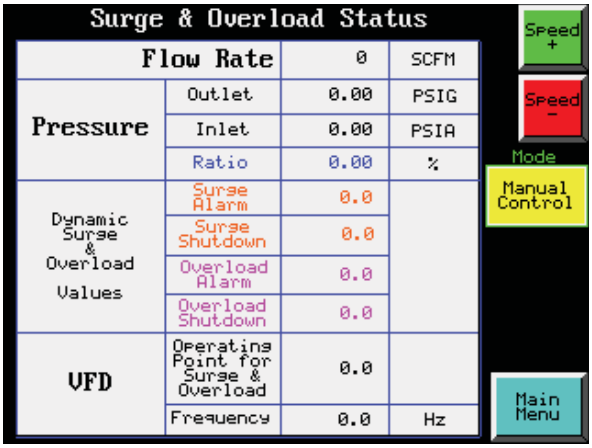
Field	Description	Action
various	Displays • all analog input signals and calculated values • ON / OFF status of the blower • mode (of operation) If the blower is in Manual (VFD) Control mode, you can incrementally increase or decrease the blower speed by pressing the appropriate Speed button (green + for increase; red - for decrease).	View information and, as needed, Press the Speed button (+ or -) to increase or decrease blower speed.

The SCFM is a calculated value based on parameters and information received from transmitters and the VFD, and from parameters and equations that are specific to each blower. The SCFM calculation is highly accurate.

Viewing the Surge & Max Flow Status

This screen is helpful during blower start-up or when analyzing potential surge conditions.

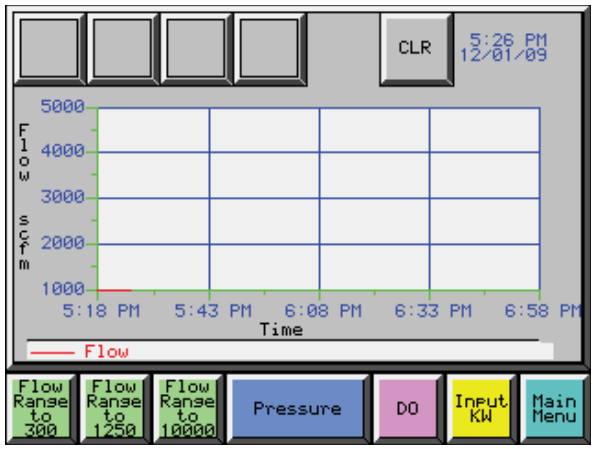
From the Main Menu, press **Surge & Max Flow Status** to display the screen:



Field	Description	Action
various	Displays • potential Surge or Max Flow conditions • flow rate • pressures • pressure ratio • Dynamic Surge and Max Flow alarm and shutdown points • RPM The blower Surge and Max Flow points are dynamic since they are based on current operating conditions and are functions of kilowatt.	View information

Trends

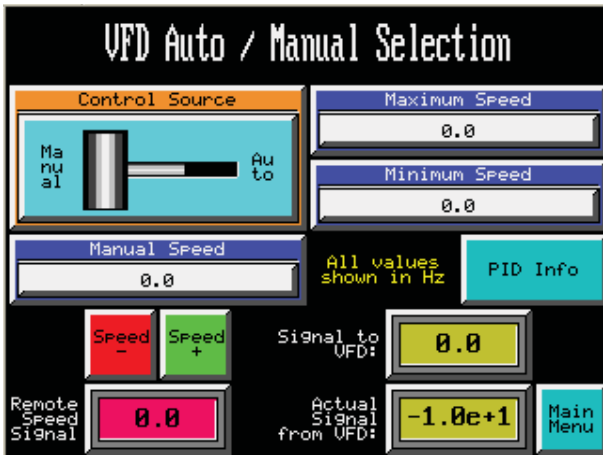
From the Main Menu, press **Trends** to display the screen:



Field	Description	Action
graph	Displays flow activity for the blower.	View
Control buttons **<**, **>**	Use to move the graph display forward or back.	Press control buttons.
CLR	Use to clear the current graph, and start a new graph.	Press **CLR.**
Flow Range buttons	Use to view flow at different ranges. This allows for better viewing of different resolutions or scaling. For example, you can view a flow trend range from 0 to 300 and another trend ranged from 0 to 10,000.	Press desired flow range field.
Pressure	Display pressure values.	Press **Pressure.**
DO	Display Dissolved Oxygen values.	Press **DO.**
Input KW	Display Input power values.	Press **Input KW**.

VFD Control Setting (Auto or Manual)

From the Main Menu, press **VFD Auto/Manual** to display the screen:



Use this screen to set how the VFD will be controlled (Auto or Manual), and to view status information on the various control signals that determine the actual VFD speed.

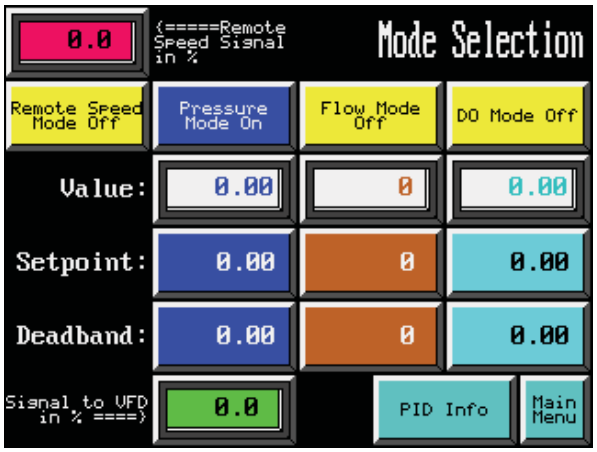
Note:	**The Speed fields have a Level 1 security and require a password to change. For information on all passwords, see Passwords on Setpoint , page 44.**

Field	Description	Action
Control Source	Label for Manual / Auto mode field.	n/a
Manual / Auto mode	Use to set the control source mode (manual / auto) for the VFD. When in Manual, the VFD will simply go to the speed as entered by the operator in the Manual Speed entry. When in Automatic, the PID equation will send a signal to the VFD.	**1.** Press for Manual or Auto mode. The Security Code screen is displayed. **2.** Type the Level 1 security code and press **Enter**. The mode is changed to Manual or Auto, and the “lever” in the display points to the selected mode.
Maximum Speed and Minimum Speed	Use to limit how slow or fast the VFD can run. These limits take precedence whether the VFD is Manual or Auto mode.	**1.** Type the desired value. The Security Code screen is displayed. **2.** Type the Level 1 security code and press **Enter**. The Speed is set / changed.

Field	Description	Action
Manual Speed	Displays the manual speed of the VFD.	Press the Speed button (+ or -) to increase or decrease blower speed.
Signal to VFD	Displays amount of manual speed.	n/a
Actual Hz	Displays HZ value.	n/a

Setting the Control Strategy through Mode Selection

From the Main Menu, press **Mode Selection** to display the screen:



Use this screen to set-up the required control strategy for your site, display the value of each applicable signal, and adjust (as needed) the Setpoint and Deadband for each signal.

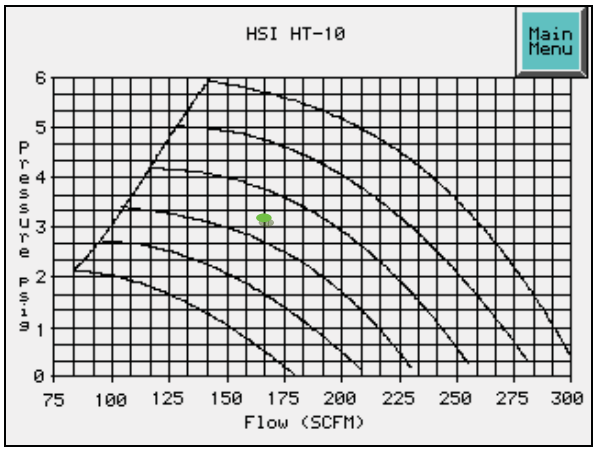
Note:	**The Value field has a security level and requires a password to change. For information on all passwords, see Passwords on Setpoint on page 44.**

Field	Description	Action
(=====Remote Speed Signal in %	Displays value when blower is in remote mode.	n/a
Remote Speed Mode	Allows a remote system such as a Master Panel or a Plant Control System to send a 4-20mA for the Actual Speed of the Blower	n/a
Pressure Mode	Indicates the Blower speed is controlled by pressure. This uses a Pressure PID loop to maintain a Constant Outlet Pressure.	n/a
Flow Mode	Indicates the Blower speed is controlled by flow. This uses a Flow PID loop to maintain a Constant Flow. Note that the flow is a calculated flow based on process conditions.	n/a
DO Mode	Indicates the Blower speed is controlled by Dissolved Oxygen. This uses a Pressure PID loop to maintain the DO.	n/a
Value	Allows you to set the value for pressure, flow, and/or DO.	**1.** Type the desired value. The Security Code screen is displayed. **2.** Type the security

Field	Description	Action
		code and press **Enter**. The Value is set / changed.
Setpoint	Displays the setpoint values for pressure, flow, and/or DO.	n/a
Deadband	Displays the deadband values for pressure, flow, and/or DO.	n/a
Signal to VFD in % ====)	Displays the value when blower is in remote mode.	n/a
PID Info	Allows you to go to the PID (Proportional, Integral, Derivative) Info screen (described in the next sub-section)	Press to display the PID Info screen.

Performance Curve

From the Main Menu, press **Performance Curve** to display the screen:



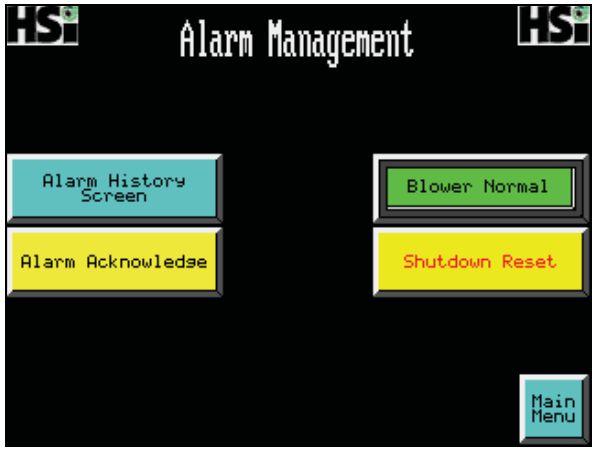
Field	Description	Action
n/a	Use to view the performance of the blower. A moveable green dot is shown based on Flow and Pressure, showing the exact operating conditions and where on the curve the blower is currently operating.	n/a

Managing Alarms

The HSTB is capable of alarming and shutting down due to:

- Blower surge
- Max flow
- High enclosure temperature
- High inlet filter pressure
- E-stop actuation
- High inlet and/or outlet temperature
- High motor temperature
- Transmitter or signal failures
- VFD fault
- No Run Signal upon Start Command

To manage an alarm, from the HMI Main Menu, press **Alarm Management** to display the screen:



Use this screen to view all alarms, acknowledge all alarms, and to reset the Shutdown Interlock when a blower is shutdown.

Field	Description	Action
Alarm History Screen	Displays the Alarm History screen.	Press
Alarm Acknowledge	Use to acknowledge an active alarm.	Press
Blower status	Displays the status of the blower: normal or shutdown.	n/a
Shutdown Reset	Use to reset a shutdown condition after the blower has been shutdown due to an interlock, such as high Vibration After the blower is shutdown, it is locked out and cannot be restarted (either locally or remotely) until you determine the cause of the problem. Once the problem has been	Press

Field	Description	Action
	identified/resolved, you must press this reset button before the blower can be restarted.	

5.10.1 Displaying the Alarm History

From the Alarm Management screen, press **Alarm History Screen** to display the screen:

Press the desired button to navigate the screen.

5.10.2 Resolving an Alarm

When an alarm occurs, the red indicating light on the front of the Blower Control Panel (see Chapter 3 on page 11) will flash.

Note:	The most recent active alarm is shown on the bottom of all screens.

To resolve the alarm, do the following:

Step	Action
1	On the Main Menu screen, press **Alarm Management**. The Alarm Management Screen is displayed.
2	Press **Alarm Acknowledge**. The red indicating light will stop flashing, but will stay on until the alarm condition is resolved. **Note:** If a new alarm occurs while a previously acknowledged alarm is still active, the red indicating light will start flashing again, until **Alarm Acknowledge** is pressed again.
3	Press **Alarm History Screen**. The Alarm History screen is displayed, showing all active and previous alarms. (See page 40.)

Step	Action
4	Review the alarm condition, and all details provided, including an alarm counter showing the number of times the alarm has occurred. **Note:** The alarm counter can be reset, as needed, via a password entry.
5	Press **Clear All** in Alarm History Screen, which will stop the red light on the control panel.

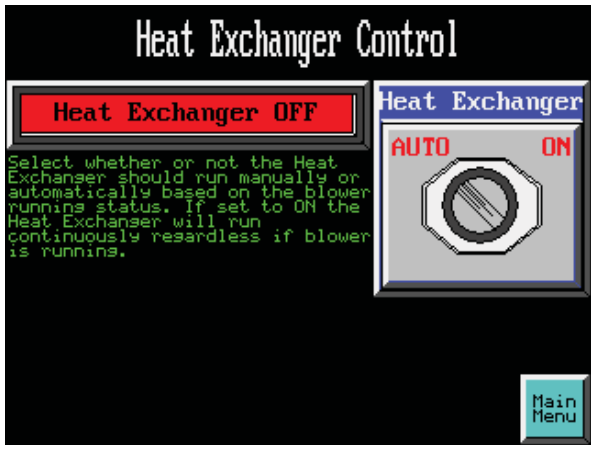
Displaying HSI Contact Information

From the Main Menu, press **Contact Information** to display the screen:

Use this information to contact HSI.

Heat Exchanger

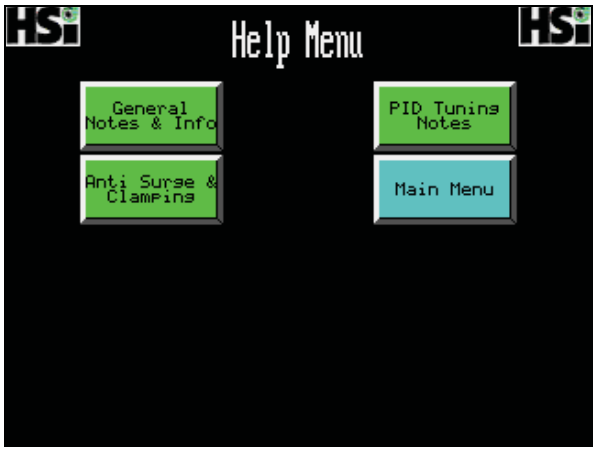
From the Main Menu, press **Heat Exchanger** to display the screen:



Field	Description	Action
Heat Exchanger OFF	Displays status of the Heat Exchanger	n/a
Heat Exchanger AUTO/ ON	Selects whether or not the Heat Exchanger should run manually or automatically based on the blower running status. If set to ON, the Heat Exchanger will run continuously regardless of the status of the blower.	Press to change to manual or auto mode.

Finding Help Information

From the Main Menu, press **Help Menu** to display the screen:



Press the button for the information needed, and the related screen will be displayed.

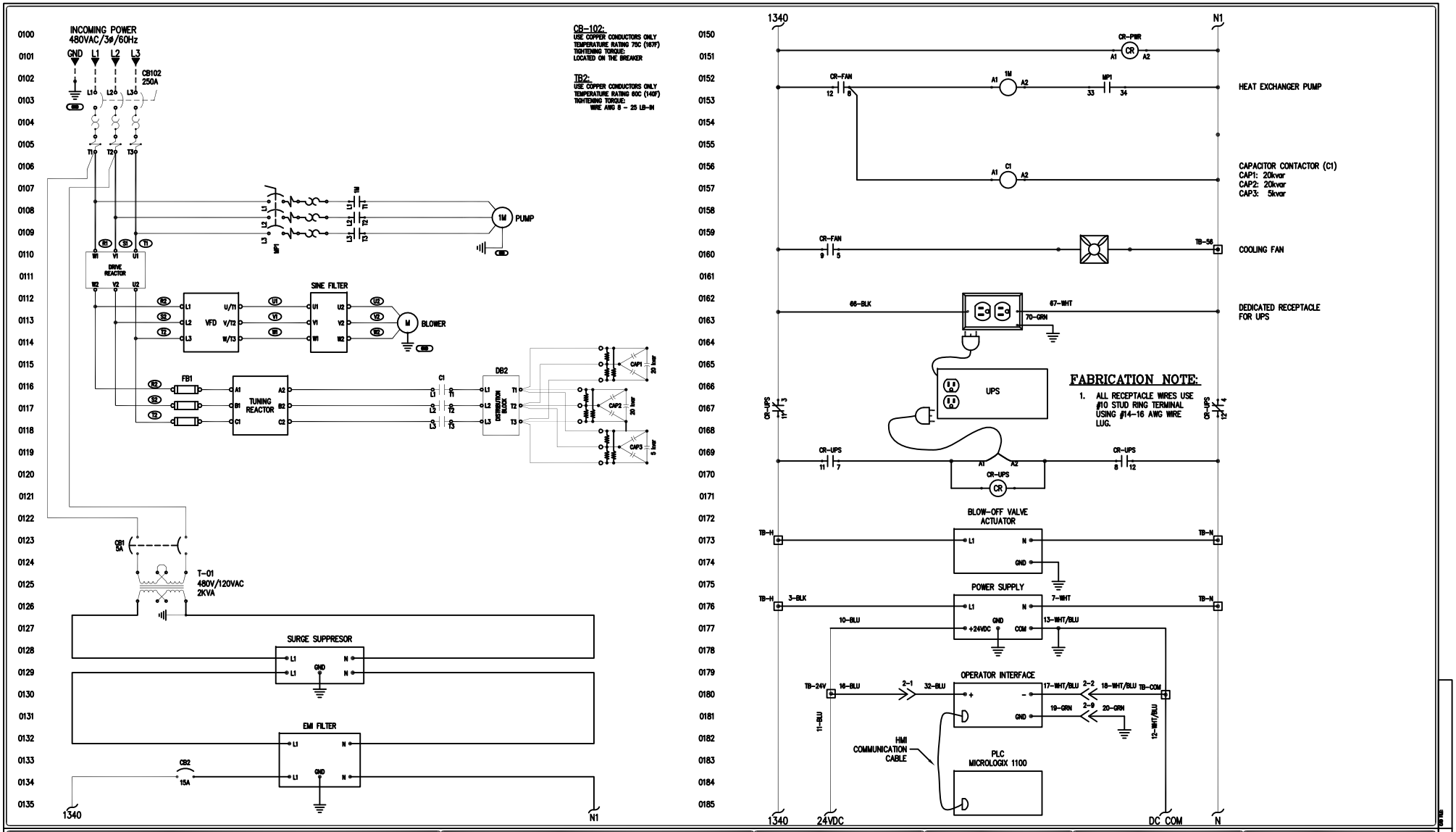
The following subsections discuss each of the information items listed on the Help Menu.

Note:	**All Setpoint screens provide a Help Menu button for returning to the Setpoints Menu.**

Section 3 – Wiring Diagrams

- Electrical Schematic 11”X17”

Electrical Schematic 11”X17”



REV	DATE	APP	DESCRIPTION

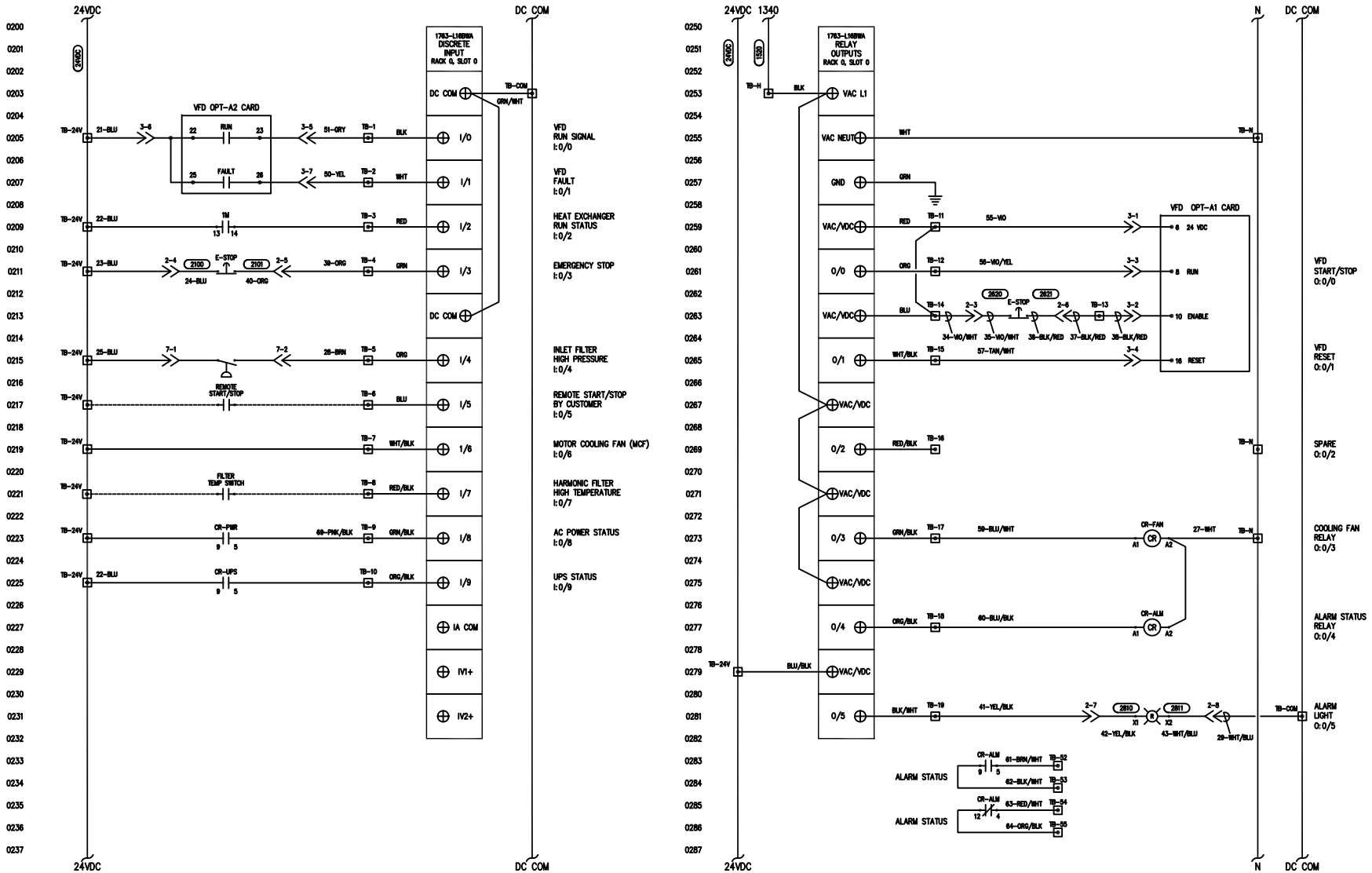
DESIGNER	GJG
DRAWN BY:	GG
DATE:	07/02/2012
CHECKED BY:	
DRAWING STATUS:	

CLIENT:

HOUSTON SERVICE INDUSTRIES

HSTB - FRAME 4
INTERNAL HEAT EXCHANGER
INTERNAL HARMONIC FILTER
ELECTRICAL SCHEMATIC

JOB NO.	WO34756/1	DWG. NO.	HSI-WO34756-01
SCALE	N.T.S.	SHEET	E-1.1
		REV.	0



REV	DATE	APP	DESCRIPTION

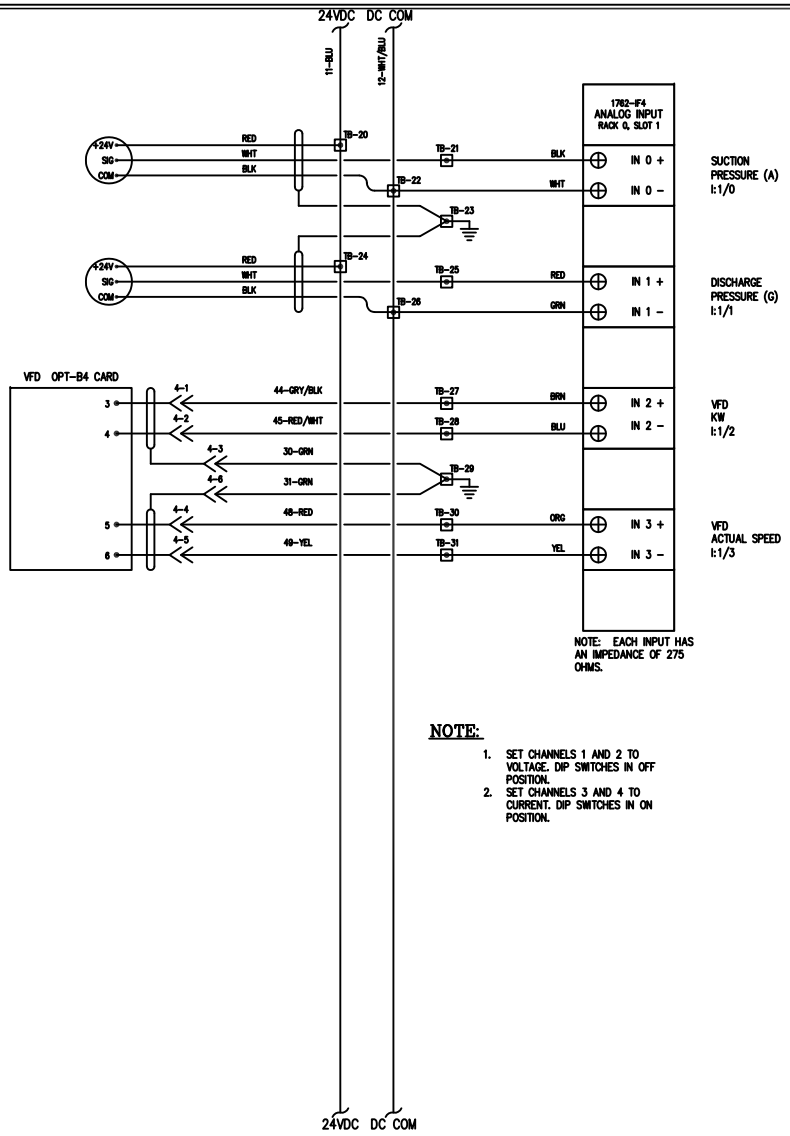
DESIGNER	GJG
DRAWN BY:	GG
DATE:	07/02/2012
CHECKED BY:	
DRAWING STATUS:	

CLIENT:

HOUSTON SERVICE INDUSTRIES

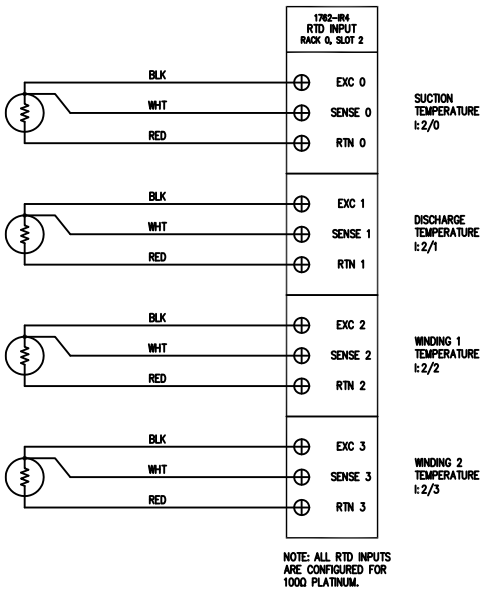
HSTB – FRAME 4
INTERNAL HEAT EXCHANGER
INTERNAL HARMONIC FILTER
ELECTRICAL SCHEMATIC

JOB NO.	WO34756/1
DWG. NO.	HSI-WO34756-01
SCALE	N.T.S.
SHEET	E-1.2
REV.	0



NOTE:

1. SET CHANNELS 1 AND 2 TO VOLTAGE. DIP SWITCHES IN OFF POSITION.
2. SET CHANNELS 3 AND 4 TO CURRENT. DIP SWITCHES IN ON POSITION.



REV	DATE	APP	DESCRIPTION

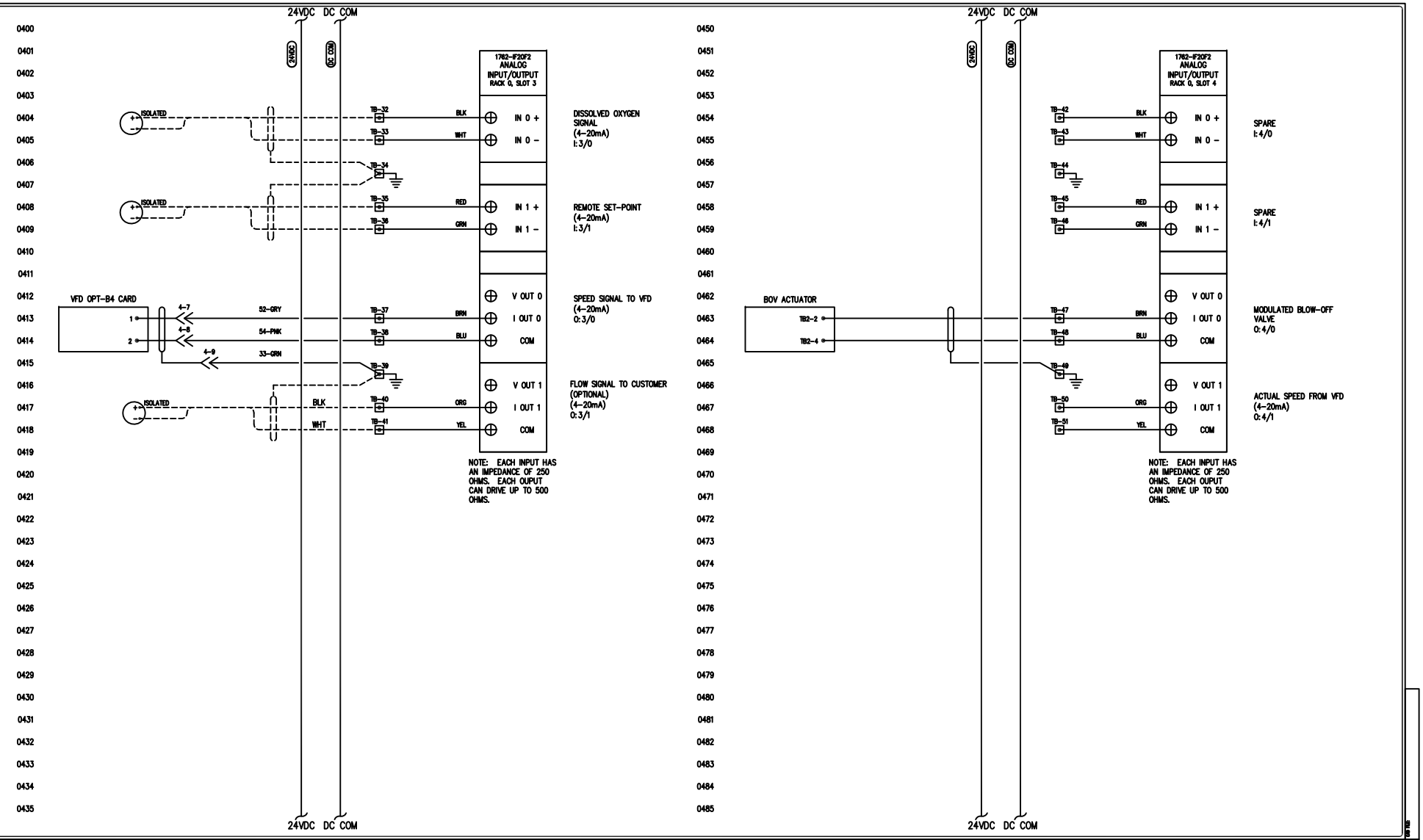
DESIGNER: GJG
DRAWN BY: GG
DATE: 07/02/2012
CHECKED BY:
DRAWING STATUS:

CLIENT:

HOUSTON SERVICE INDUSTRIES

HSTB – FRAME 4
INTERNAL HEAT EXCHANGER
INTERNAL HARMONIC FILTER
ELECTRICAL SCHEMATIC

JOB NO. WO34756/1
DWG. NO. HSI-WO34756-01
SCALE N.T.S.
SHEET E-1.3
REV. 0



REV	DATE	APP	DESCRIPTION

DESIGNER: GJG
DRAWN BY: GG
DATE: 07/02/2012
CHECKED BY:
DRAWING STATUS:

CLIENT:
HOUSTON SERVICE INDUSTRIES

HSTB – FRAME 4
INTERNAL HEAT EXCHANGER
INTERNAL HARMONIC FILTER
ELECTRICAL SCHEMATIC

JOB NO. WO34756/1
DWG. NO. HSI-WO34756-01
SCALE N.T.S.
SHEET E-1.4
REV. 0

Section 4 – Field Mounted Accessories

- Inlet Expansion Joint
- Inlet Filter Silencer
- Discharge Expansion Joint
- Discharge Butterfly Valve
- Discharge Check Valve
- Blow-off Silencer

Inlet Expansion Joint

Maxi-Joint®

Wide Arch Expansion Joints

Style 1015

Features:

- Wide Flowing Arch Design
- Exceptional All Directional Movement Capability
- Virtually Eliminates Sediment Buildup
- Higher Pressure Rating than Conventional Expansion Joints
- Excellent Chemical and Abrasion Resistance
- Full Vacuum Rating (30" Hg) in All Sizes
- 250ºF Continuous Service Standard, 400ºF Available
- Filled Arch Design Available
- Economical Fully Molded Construction
- Standard Face to Face Dimensions with ANSI 125/150 lb. Drilling
- Hot Dipped Galvanized Retaining Rings Standard
- Wide Variety of Tube and Cover Elastomers Available, Including Pure Gum Rubber, EPDM, Neoprene, Butyl, Nitrile, Hypalon®, Viton®, Food Grade, and More
- Absorbs Noise, Vibration and Shock
- Compensates for Minor Misalignment and Offset
- Low Stiffness and Deflection Forces
- Integrally Flanged Design, No Gaskets Required
- Large Inventory Means Quick Shipments
- Simple to Install, Lightweight and High Strength
- Provides Easy Access to Piping and Equipment

Notes:

1.) All parts listed are designed for 30" Hg (full vacuum) and have a maximum test at 26" Hg due to facility altitude and equipment limitations.

2.) Maximum operating temperature of 250ºF for EPDM, Butyl, Hypalon®, and Viton®; 225ºF for Neoprene; 210ºF for Nitrile; 180ºF for Pure Gum Rubber; 300ºF for EPDM and Butyl in air service at 25 PSI maximum; higher pressure and temperature ratings available.

3.) All sizes can be supplied with a filled arch reducing their movements by 50% and increasing the spring rates fourfold.

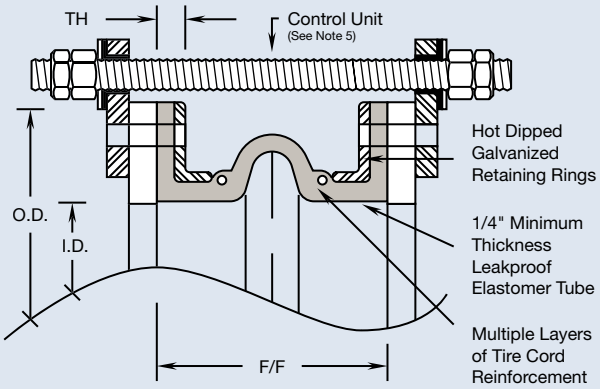
4.) For full product specifications and installation instructions, see SPEC 1015-1 and ININ 1015-1. Gross weights include retaining rings.

5.) **WARNING**: Control units (sold separately) must be used when piping is not properly anchored. Number of rods are dependent upon maximum field test pressures. Expansion joints may operate in pipelines carrying fluids at elevated temperatures and pressures, so precaution should be taken to ensure proper installation and regular inspection. Care is required to protect personnel in the event of leakage or splash. Adequate floor drains are always recommended.

6.) Movements are non-concurrent. Contact General Rubber for concurrent movements, and for sizes not shown up to 144" I.D.

7.) Retaining rings are typically "L" shaped and can be flat depending on internal reinforcements.

8.) Standard 125/150 lb. drilling includes, 1"-24" with ANSI B16.1 Class 125 lb./B16.5 Class 150 lb., 30"-60" with ANSI B16.1 Class 125 lb./ B16.47 series A, Class 150 lb., 72"-108" with ANSI B16.1 Class 125 lb./ AWWA C207 Class B.



Toll Free: 800-233-6294
Web: www.general-rubber.com

general rubber corporation

Fax: 201-641-4710
sales@general-rubber.com

STYLE 1015 EPDM

BLOWER SERVICE

XJ-105

General Rubber Corporation
11-A Empire Boulevard
S. Hackensack, NJ 07606
Requested by: _____

Tel: (201)641-4700
Fax:(201)641-4710

SUBMITTAL DATA

Job: _____
Purchase order: _____
Date: _____

MAXI-JOINT STYLE 1015E FOR BLOWER APPLICATIONS

☐ With Control Units
☐ Less Control Units

Standard dimensions for flanged spool type Expansion Joints

TABLE I — DIMENSIONAL DATA (ALL DIMENSIONS EXPRESSED IN INCHES)

SIZE I.D.	Flange O.D.	BOLT CIRCLE	BOLT HOLES		DIMENSIONS										STD. F/F
			No.	Diam.	A	B	C	D	E	G	H	J *	K	L	
1	4-1/4	3-1/8	4	5/8	1/2	1/2	1-1/2	3/4	1/2	3/8	5/8	10-1/2	7-1/2	1-1/4	6
1-1/2	5	3-7/8	4	5/8	7/16	7/16	1-1/2	3/4	7/16	3/8	5/8	10-1/2	8-1/2	1-3/8	6
2	6	4-3/4	4	3/4	7/16	7/16	2	1	7/16	3/8	5/8	10-1/2	9-1/4	1-1/8	6
2-1/2	7	5-1/2	4	3/4	7/16	1/2	2	1	1/2	3/8	5/8	10-1/2	10-1/4	1-1/16	6
3	7-1/2	6	4	3/4	7/16	1/2	2	1	1/2	3/8	5/8	10-1/2	10-3/4	1-1/16	6
4	9	7-1/2	8	3/4	7/16	1/2	2	1	1/2	3/8	5/8	11	12-1/4	1-1/16	6
5	10	8-1/2	8	7/8	7/16	1/2	2	1	1/2	1/2	5/8	11	14-1/4	1-1/16	6
6	11	9-1/2	8	7/8	7/16	1/2	2	1	1/2	1/2	5/8	11	15-1/4	1-1/16	6
8	13-1/2	11-3/4	8	7/8	1/2	9/16	2	1	9/16	9/16	3/4	12 & 14	19-1/4	1-1/16	6 & 8
10	16	14-1/4	12	1	1/2	9/16	2	1	9/16	3/4	1	15	22-3/4	1-15/16	8
12	19	17	12	1	1/2	5/8	2	1	5/8	3/4	1	15	24-3/4	1-7/8	8
14	21	18-3/4	12	1-1/8	9/16	11/16	2-1/2	1-1/4	11/16	3/4	1	15	25-1/4	1-1/2	8
16	23-1/2	21-1/4	16	1-1/8	9/16	11/16	2-1/2	1-1/4	11/16	3/4	1-1/8	15	28-1/4	1-1/2	8
18	25	22-3/4	16	1-1/4	5/8	3/4	2-1/2	1-1/4	3/4	3/4	1-1/8	15	29-7/8	3/4	8
20	27-1/2	25	20	1-1/4	5/8	3/4	2-1/2	1-1/4	3/4	3/4	1-1/8	15	32-1/8	3/4	8
24	32	29-1/2	20	1-3/8	3/4	7/8	3	1-1/2	7/8	1	1-1/4	20	37-5/16	1-3/8	10
30	38-3/4	36	28	1-3/8	3/4	3/4	3	1-1/2	3/4	1-1/4	1-1/2	20	44	1-3/8	10
36	46	42-3/4	32	1-5/8	3/4	3/4	3	1-1/2	3/4	1-1/2	1-1/2	22	52-1/2	1-3/8	10
42	53	49-1/2	36	1-5/8	3/4	3/4	3	2	3/4	1-1/2	1-1/2	24	59-1/4	1-7/8	12
48	59-1/2	56	44	1-5/8	3/4	3/4	3	2	3/4	1-1/2	1-3/4	24	65-3/4	1-7/8	12

RETAINING RINGS	
SIZE	# Segments
1-14	2
16-24	4
30	7
36	8
42	9
48	11

All retaining rings are segmented

CONTROL UNITS	
SIZE	# Rods (**Max WP**)
2-24	2
30-36	2
42-48	2

RATED	
** TEMPERATURE	300 Deg. F
PRESSURE	25 PSIG
VACUUM	26 In. Hg.

* The length of the control rod (J) is governed by the mating flange thickness meeting ANSI B16.5; Class 150 or AWWA C207, Table 3, Class E. If the mating flange thickness is different, advise factory so the rod length can be changed to accommodate the installation.

**Based on air as the transport media through Expansion Joint. Parts listed have a design rating of 30 In. Hg. (Full Vacuum)

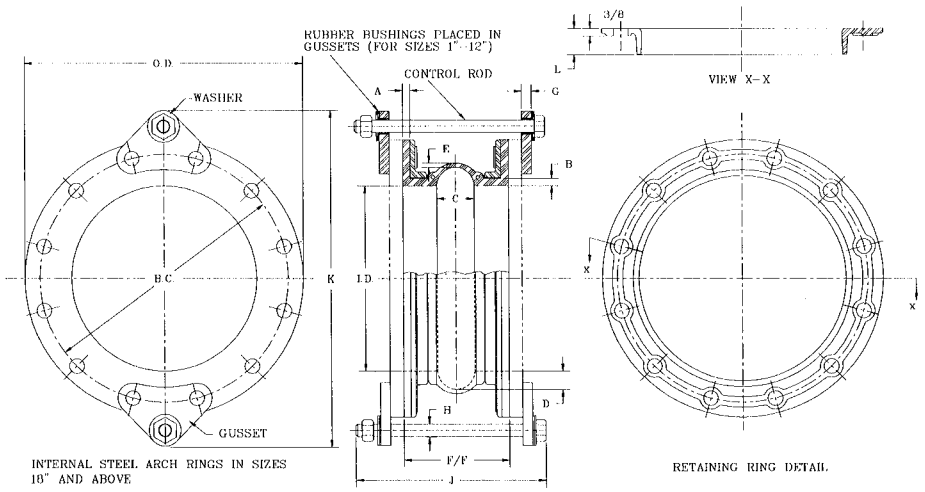


TABLE II

		MOVEMENT CAPABILITY & FORCES							
		AXIAL				DEFLECTION			
Size I.D. (Inch)	F/F (Inch)	Compr. (Inch)	Force (Lbs.)	Elong. (Inch)	Force (Lbs.)	Lateral (Inch)	Force (Lbs.)	Angular (Deg.)	WEIGHT ea.(Lbs.)
1*	6	5/8	374	1/4	204	1/4	272	15	4
1-1/2*	6	5/8	391	1/4	221	1/4	289	15	5
2	6	1-3/4	374	3/4	204	3/4	272	30	6
2-1/2	6	1-3/4	476	3/4	255	3/4	289	30	8
3	6	1-3/4	561	3/4	306	3/4	323	30	9
4	6	1-3/4	765	3/4	425	3/4	357	25	10
5	6	1-3/4	935	3/4	527	3/4	425	25	13
6	6	1-3/4	1139	3/4	629	1	629	20	17
8	6	1-3/4	1258	3/4	697	1	765	20	22
10	8	1-3/4	1581	3/4	884	1	816	15	34
12	8	1-3/4	1649	3/4	935	1	969	15	45
14	8	2	2023	7/8	1139	1-1/8	1275	12	55
16	8	2	2159	7/8	1224	1-1/8	1479	12	64
18	8	2	2431	7/8	1377	1-1/8	1632	9	71
20	8	2	2703	7/8	1530	1-1/8	1819	9	82
24	10	2-1/4	3638	1	2108	1-1/8	1955	9	102
30	10	2-1/4	4590	1	2660	1-1/8	2466	6	140
36	10	2-1/4	5610	1	3250	1-1/8	3013	5	190
42	12	2-1/4	6375	1	3655	1-1/8	3391	4	235
48	12	2-1/4	7140	1	4153	1-1/8	3837	3	290

* 1 & 1-1/2" available with filled arches only.

STYLE 1015E CONSTRUCTION DETAILS

HIGH STRENGTH polyester reinforcement provides higher rated working pressure in all sizes.
STANDARD ELASTOMER MATERIALS ARE: EPDM. Other materials are available upon request Contact the factory for their physical properties as required.
FLANGES are full faced and flat 125/150 Lbs. ANSI B16.1 and ANSI B16.5 standard drilling, mating to all types of full faced metal and fragile plastic pipe, eliminating problems of fracturing mating flanges, as can happen with raised face flanges. Retaining rings are cast ductile iron, ASTM A-536-67. Do not interface with wafer type flanges on valves or fittings.

EXPANSION JOINT INSTALLATION INSTRUCTIONS

To satisfactorily function as flexible member between rigid metal piping, a number of engineering and installation precautions should be taken:

1. Proper anchoring of the rigid metal piping at both ends of the Expansion Joint unit is ESSENTIAL to eliminate the danger of over elongation. In the event anchoring is not possible, control units must be used as approved by General Rubber Corporation.
2. The span between the rigid piping should have the same overall length as the Expansion Joint.
3. The Expansion Joint must be installed in a relatively straight line to eliminate twisting the unit.
4. Tighten flange bolts until the rubber flange bulges slightly. CAUTION - Tighten bolts in equal steps to maintain uniform tension and alignment.
5. Check bolt tightness periodically. As any rubber-like material takes a set after a period of compression, the bolts may loosen and result in a break in the seal. It is particularly important to check bolts in a hot and cold water system before changing over from one medium to another.

CONTROL UNIT INSTALLATION

1. Control units MUST be used when the piping is not anchored on both sides of the Expansion Joints.
2. The function of the control unit is to allow the Expansion Joint to move axially and laterally within its capabilities, but to eliminate the danger of excessive elongation axially.
3. Installation of the control unit is done after the Expansion Joint is in place. The component parts of the control unit are packaged separately from the Expansion Joint because they are fitted to the backside of the companion flange - interfacing with the Expansion Joint (See line drawing).
4. The control unit should be installed to allow the Expansion Joint to extend to the maximum axial capability. The nut should then be "set" in a permanent position. Remember, the axial elongation of the Expansion Joint varies depending on size (See table II). DO NOT exceed the published figures at the time of installation.
5. To prevent over-compression of the Expansion Joint, compression sleeves can be furnished as an accessory, if requested. Generally, over-compression is not as serious a problem as excessive elongation. Compression sleeves are fitted over each of the rods with sufficient clearance to provide axial compression within the movement capability of the Expansion Joint.
6. Materials of Construction 1 set consists of the following:

2 Steel Rods	ASTM-A-307
4 Ductile gusset plates	ASTM-A-536
4 Neoprene Bushings	ASTM-D-735-SC-725-BF (1-12" ONLY)
4 Steel Washers	ASTM-A-307
2 Steel Nuts	ASTM-A-307

Inlet Filter Silencer

CARTRIDGE FILTERS AND FILTER-SILENCERS

FOR BLOWERS, COMPRESSORS, AND ENGINES

Outstanding Features

- **Weatherhoods for CCF and CCS sizes 2½ in. through 5 in. are rugged blue ABS composite material that may be painted. All other components are carbon steel construction with a high-quality semi-gloss enamel finish.**
- **Unique design options, combined with the latest manufacturing techniques, ensure optimum performance and long life even under demanding conditions.**
- **Choice of filter only or filter-silencer.**
- **Female pipe thread connections are standard for pipe sizes ½ in. through 3½ in. and optional for pipe sizes 4 in. and 5 in.**
- **Removable lightweight weatherhood (CCS and CCF) or removable top plate (CS and CF) for easy access to the filter element.**
- **Interchangeable element options for desired filtration characteristics in the same housing.**
- **Filter restriction gauges are optional for all units.**

Advanced Design and Testing

- **Our extensive in-house engineering, manufacturing, and testing facilities ensure optimized process, mechanical, and acoustic performance for your application.**

Universal Silencer's cartridge filters and filter-silencers offer high-performance filtration and silencing in a convenient, economical cartridge configuration. Choose from four standard models for pipe sizes ranging from ½ in. to 16 in. and for flow capacities ranging from 15 to 7700 CFM. Three types of filter element media — pleated paper, pleated felt, or wire mesh — are available to suit your application.

The CCF and CF series filters are high-quality air filters without a silencing section. The CCF has a removable weatherhood, and the CF has a removable top plate. Our CCS and CS intake filter-silencers have a built-in silencing section. The CCS features a removable weatherhood, and the CS has a removable top plate for easy access to the filter element.

UNIVERSAL™

UNIVERSAL SILENCER

A FLEETGUARD/NELSON COMPANY

Noise Control and Air Filtration

UNIVERSAL SILENCER

CARTRIDGE AIR FILTERS AND FILTER-SILENCERS

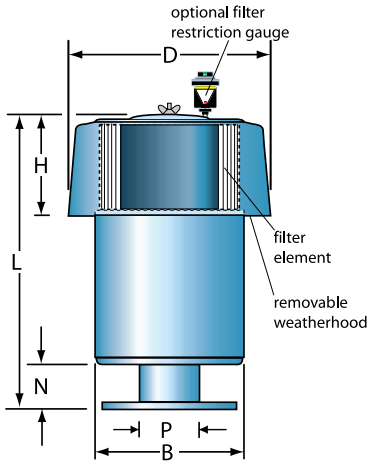
Product Catalog 242-C

SPECIFICATIONS

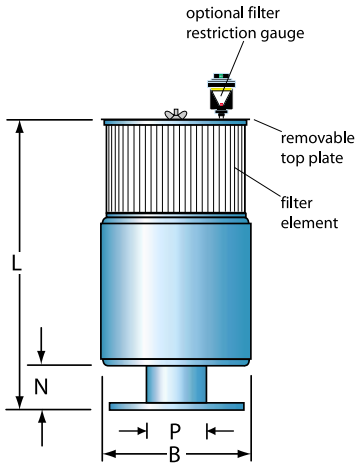
CCS and CS Filter-Silencers

Noise Attenuation, CCS and CS Filter-Silencers

Octave Band Center Frequency, Hz	63	125	250	500	1 k	2 k	4 k	8 k
Attenuation, dB	5	8	10	12	14	14	14	14

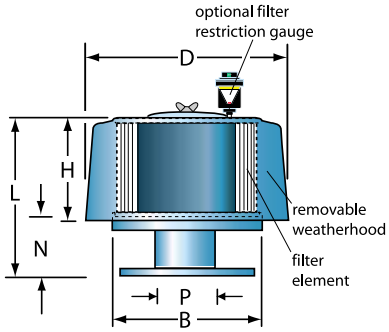


CCS Series (with weatherhood)

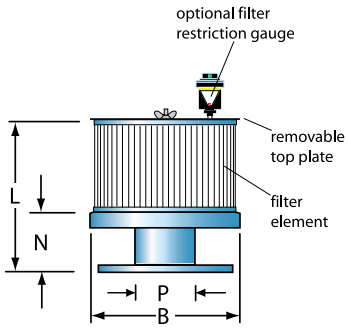


CS Series (with top plate)

CCF and CF Filters



CCF Series (with weatherhood)



CF Series (with top plate)

DIMENSIONS AND WEIGHTS

P (size)	Rated Flow Capacity (CFM)	D	H	B	N				L				Approximate Weight with Paper Elements			
					CCF	CCS	CF	CS	CCF	CCS	CF	CS	CCF	CCS	CF	CS
½	15	8.00	3.13	6.00	Use	—	Use	—	Use	6.50	Use	6.50	Use	7	Use	7
¾	22	8.00	3.13	6.00	CCS	—	CS	—	CCS	6.50	CS	6.50	CCS	7	CS	7
1	35	8.00	3.13	6.00	Series.	—	Series.	—	Series.	6.50	Series.	6.50	Series.	7	Series.	7
1¼	60	9.00	3.50	6.50	—	—	—	—	3.50	7.88	3.50	7.88	9	10	5	9
1½	75	9.00	3.50	6.50	—	—	—	—	3.50	7.88	3.50	7.88	9	10	5	9
2	120	9.00	3.50	6.50	—	—	—	—	3.50	7.88	3.50	7.88	8	10	5	8
2½	190	13.44	6.75	10.00	1.00	1.00	1.00	1.00	7.50	17.69	7.13	17.31	11	19	10	18
3	275	13.44	6.75	10.00	1.00	1.00	1.00	1.00	7.50	17.69	7.13	17.31	10	18	9	17
3½	375	13.44	6.75	10.00	1.13	1.13	1.13	1.13	7.63	17.69	7.25	17.31	13	2012	19	
4 (NPT)	500	13.44	6.75	10.00	1.13	1.13	1.13	1.13	7.63	17.69	7.25	17.31	12	19	11	18
4 (flanged)	500	13.44	6.75	10.00	4.00	3.00	4.00	3.00	10.50	19.63	10.13	19.25	14	21	13	20
5 (NPT)	750	13.44	6.75	10.00	1.81	1.81	1.81	1.81	8.38	18.25	8.00	17.88	12	19	11	18
5 (flanged)	750	13.44	6.75	10.00	4.00	3.00	4.00	3.00	10.50	19.56	10.13	19.13	16	23	15	22
6	1100	18.00	9.50	14.00	4.00	3.00	4.00	3.00	13.31	25.25	12.75	24.75	31	43	23	35
8	2200	18.00	18.00	14.00	4.00	3.00	4.00	3.00	21.88	33.88	21.38	33.38	43	56	30	43
10	3000	24.00	11.50	18.00	4.00	3.00	4.00	3.00	15.38	29.25	14.19	28.13	52	83	41	67
12	4300	24.00	11.50	18.00	4.00	3.00	4.00	3.00	15.38	29.25	14.19	28.13	64	91	48	75
14	5900	30.00	15.44	24.00	4.00	3.00	4.00	3.00	19.38	36.25	18.25	35.06	97	143	75	121
16	7700	30.00	15.44	24.00	4.00	3.00	4.00	3.00	19.38	36.25	18.25	35.06	101	145	79	123

- All models have a 1/8-in. FNPT tap for installation of a gauge or manometer to monitor pressure drop.
- Sizes ½ in. through 3½ in. are standard with female pipe thread connection (FNPT).
- Sizes 4 in. and 5 in. are available with female threads or flanges. Please specify "threaded" or "flanged" when you order 4 in. and 5 in. sizes.
- Sizes 6 in. through 16 in. are standard with 150# ANSI drilled plate flanges.
- Rated capacity is based upon exit velocity of approximately 5500 ft/min. If pressure drop allowance permits, capacity may be increased by as much as 50%.

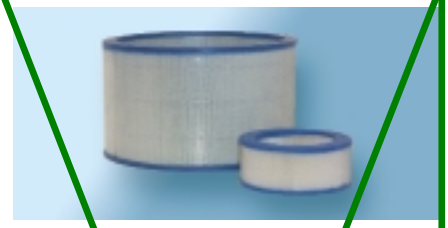
PRESSURE DROP, CLEAN, ALL MODELS

Percentage of Rated Flow	50	75	100	125	150
Pressure Drop, Inches H_2O	0.7	1.6	2.8	4.4	6.3

FILTER ELEMENTS

Three types of filter elements are available for Universal's cartridge filters and filter-silencers. The pleated paper elements provide the highest efficiency and are considered standard. Pleated felt and wire mesh elements are available for less demanding service, with respect to efficiency. The three types of elements are completely interchangeable and will fit the CCS, CS, CF, or CCF filter housings.

SERVICE INTERVALS: Paper and felt elements are typically cleaned or replaced when the air flow resistance has increased by 4 inches of water over the initial clean resistance. The maximum restriction recommended across the filter elements is 20 inches of water, but this value may be greater than the equipment can tolerate for best efficiency. The wire mesh elements should be cleaned when they are visibly dirty and re-treated with Universal Oil-Free Adhesive or motor oil. Resistance is typically not a good indicator for cleaning wire mesh elements; a periodic cleaning schedule is recommended.



Pleated Paper Element

SPECIFICATIONS:

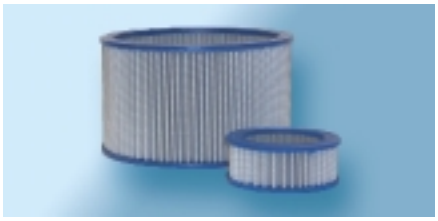
- **High-quality industrial grade filter paper—pleated and oven-cured during production.**
- **Oven-cured plastisol end caps with molded sealing beads (larger elements for pipe sizes (P) 10 in., 12 in., 14 in., and 16 in. have metal end caps and closed-cell rubber gaskets).**
- **Media efficiency: 99.5% on 2 microns; 97% on 1 micron.**
- **Maximum operating temperature: 200° F for units with ½ in. through 16 in. pipe sizes.**

SERVICE INSTRUCTIONS:

Because of the low cost of the paper element, it is generally treated as a consumable and replaced when dirty. However, depending upon customer preference, the paper element may be cleaned with compressed air and reused.

Compressed Air Cleaning:

Carefully direct compressed air (100 PSI maximum) through the dry element, opposite the normal direction of flow. After cleaning, inspect carefully for holes or cracks. If damaged, replace element.



Pleated Felt Element

SPECIFICATIONS:

- **Durable polyester felt media — pleated.**
- **Oven-cured plastisol end caps with molded sealing beads (larger elements for pipe sizes (P) 10 in., 12 in., 14 in., and 16 in. have metal end caps with closed cell rubber gaskets).**
- **Media efficiency: 99% on 10 microns.**
- **Maximum operating temperature: 200° F for units with ½ in. through 8 in. pipe sizes.**

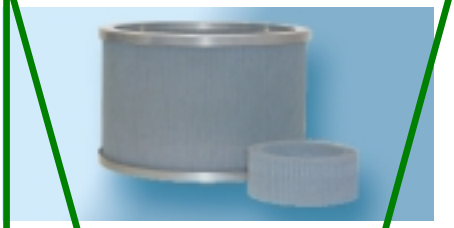
  250° F for units with 10 in. through 16 in. pipe sizes using elements with metal end caps.

SERVICE INSTRUCTIONS:

Pleated felt elements may be cleaned with compressed air (as described for paper elements) or water and reused.

Water Cleaning:

Rap gently to dislodge accumulated dirt, soak thoroughly approximately 15 minutes in warm water and mild detergent. Rinse thoroughly under low-pressure water. Air dry—do not dry with compressed air. After cleaning, inspect carefully for holes or cracks. If damaged, replace element.



Wire Mesh Element

SPECIFICATIONS:

- **Galvanized wire-mesh media—corrugated construction.**
- **Larger elements for pipe sizes (P) 6 in., 8 in., 10 in., 12 in., 14 in., and 16 in. have metal end caps.**
- **For best efficiency, wire mesh elements must be treated with oil or oil-free adhesive.**
- **May be cleaned and reused indefinitely.**
- **Wire mesh elements are considered "roughing" filters and are not recommended for applications that require efficient filtration of fine particles.**
- **Approximate efficiency: 93% on 10 microns. Efficiency will vary with element oil or adhesive coverage.**
- **Maximum operating temperature: 200° F for ½ in. through 16 in. with oil-free adhesive (the flash point for oil-free adhesive is 235° F).**

  300° F for ½ in. through 16 in. without oil-free adhesive. Filter efficiency is much lower without oil-free adhesive on the filter. Higher temperatures can be used with uncoated ½ in. through 5 in. filter elements without end caps.

SERVICE INSTRUCTIONS:

New elements are delivered pre-treated with Universal Silencer's oil-free adhesive. See the back page for details. For best efficiency, wire mesh elements must be re-treated after each cleaning. Spray the element on both sides with Universal Oil-Free Adhesive, P/N 81-0323, following the directions on the container. For oil treatment, dip the element in SAE 30-50 motor oil and drain thoroughly before using.

To clean wire mesh elements, wash in solvent or warm water and detergent in a container large enough for complete immersion of element. Rinse completely, drain, and either air dry or use compressed air. After cleaning and drying, re-treat the element with oil-free adhesive or oil as described.

	Replacement Element Part No.		
P (nom.)	Paper	Felt	Wire
1/2	81-0470	81-1202	81-1035
3/4	81-0470	81-1202	81-1035
1	81-0470	81-1202	81-1035
1 1/4	81-0471	81-1203	81-1036
1 1/2	81-0471	81-1203	81-1036
2	81-0471	81-1203	81-1036
2 1/2	81-1063, 81-0472 (old)	81-1205, 81-1204 (old)	81-1038, 81-1037 (old)
3	81-1063, 81-0472 (old)	81-1205, 81-1204 (old)	81-1038, 81-1037 (old)
3 1/2	81-1063	81-1205	81-1038
4	81-1063	81-1205	81-1038
5	81-1063, 81-0474 (old)	81-1205, 81-1206 (old)	81-1038, 81-1039 (old)
6	81-0475	81-1207	81-1040
8	(2) 81-0475	(2) 81-1207	(2) 81-1040, (1) 81-1199 (old)
10	81-1163	81-1209	81-1200
12	81-1163	81-1209	81-1200
14	81-1164	81-1210	81-1201
16	81-1164	81-1210	81-1201

UNIVERSAL SILENCER

Cartridge Air Filters and Filter-Silencers

Our corporate headquarters are located in Stoughton, Wisconsin, just southeast of Madison, the state capital. This new building houses administration, sales, and engineering departments.

Manufacturing facilities are in Muscoda (above), 75 miles west of Stoughton, and Montello (below), 70 miles north.

DNV Certification, Inc. ISO 9001 REGISTERED FIRM

Our products have been used to protect, quiet, and optimize the performance of industrial equipment for 40 years. We maintain a fully equipped testing facility to qualify filters and silencers. We are an ISO 9001 registered firm and ASME Code certified.

AIR FILTER RESTRICTION GAUGE

Universal's Filter Restriction Gauge provides a convenient, accurate means of monitoring filter pressure drop as the filter element becomes increasingly loaded with dirt. Cartridge filters and filter-silencers are standard with threaded connections for direct mounting of the gauge. See product bulletin 81-1234 for a complete description.

OIL-FREE ADHESIVE FOR WIRE MESH ELEMENTS

This is an oil-free product developed for use on viscous impingement filters. It is a substitute for applications that do not permit oil wetting of the filter elements, such as oil-free compressors. Universal oil-free filter adhesive is available in 16-ounce aerosol spray cans, packaged 6 cans per case. Order by part number 81-0323.

Contact us for more information about our complete line of industrial silencers, air filters, and filter-silencers:

- **Air filters and filter-silencers, catalog 241-A**
- **CB compact blower silencers, catalog 255-A**
- **CBF/CBFI compact blower filter-silencers, catalog 261-A**
- **Air filter restriction gauge, catalog 81-1234**
- **Reciprocating engine silencers and filters, catalog 246-A**
- **Rotary positive blower silencers, catalog 244-D**
- **Absorptive silencers, catalog 245-B**
- **Vent and blowdown silencers, catalog 243-C**
- **Compressor silencers and filters, information provided by application**
- **Vacuum pump separator silencers, catalog 222-B**
- **Industrial fan silencers, catalog 249-A, 249-D**
- **Steam ejectors, pressure reduction valves, and other special applications**
- **Gas turbine silencers and filters, catalog B-249-A**
- **Acousti-Tube® Silencers, catalog 260**
- **Acousti-Tube® Silencer Series, technical bulletin 94-1315**
- **StrataClean™ barrier air filter systems, catalog 268**
- **StrataClean™ Pulse air filter systems, catalog 269**

Keeping industrial equipment clean and quiet.

UNIVERSAL™

UNIVERSAL SILENCER

A FLEETGUARD/NELSON COMPANY

P. O. Box 411, Stoughton, Wisconsin 53589

608-873-4272 Fax 608-873-4298

Internet E-mail: ***US@universal-silencer.com***

On the Web: ***www.universal-silencer.com***

Discharge Expansion Joint

Maxi-Joint®

Wide Arch Expansion Joints

Style 1015

Features:

- Wide Flowing Arch Design
- Exceptional All Directional Movement Capability
- Virtually Eliminates Sediment Buildup
- Higher Pressure Rating than Conventional Expansion Joints
- Excellent Chemical and Abrasion Resistance
- Full Vacuum Rating (30" Hg) in All Sizes
- 250ºF Continuous Service Standard, 400ºF Available
- Filled Arch Design Available
- Economical Fully Molded Construction
- Standard Face to Face Dimensions with ANSI 125/150 lb. Drilling
- Hot Dipped Galvanized Retaining Rings Standard
- Wide Variety of Tube and Cover Elastomers Available, Including Pure Gum Rubber, EPDM, Neoprene, Butyl, Nitrile, Hypalon®, Viton®, Food Grade, and More
- Absorbs Noise, Vibration and Shock
- Compensates for Minor Misalignment and Offset
- Low Stiffness and Deflection Forces
- Integrally Flanged Design, No Gaskets Required
- Large Inventory Means Quick Shipments
- Simple to Install, Lightweight and High Strength
- Provides Easy Access to Piping and Equipment

Notes:

1.) All parts listed are designed for 30" Hg (full vacuum) and have a maximum test at 26" Hg due to facility altitude and equipment limitations.

2.) Maximum operating temperature of 250ºF for EPDM, Butyl, Hypalon®, and Viton®; 225ºF for Neoprene; 210ºF for Nitrile; 180ºF for Pure Gum Rubber; 300ºF for EPDM and Butyl in air service at 25 PSI maximum; higher pressure and temperature ratings available.

3.) All sizes can be supplied with a filled arch reducing their movements by 50% and increasing the spring rates fourfold.

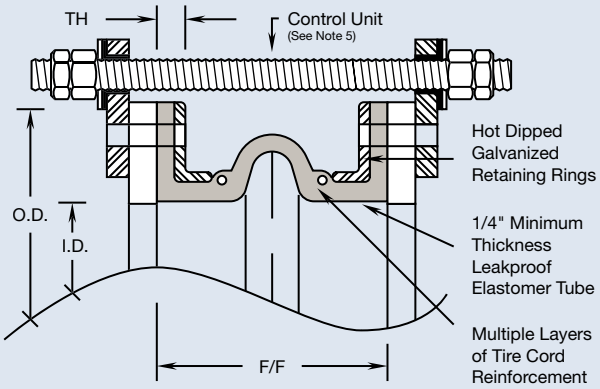
4.) For full product specifications and installation instructions, see SPEC 1015-1 and ININ 1015-1. Gross weights include retaining rings.

5.) **WARNING**: Control units (sold separately) must be used when piping is not properly anchored. Number of rods are dependent upon maximum field test pressures. Expansion joints may operate in pipelines carrying fluids at elevated temperatures and pressures, so precaution should be taken to ensure proper installation and regular inspection. Care is required to protect personnel in the event of leakage or splash. Adequate floor drains are always recommended.

6.) Movements are non-concurrent. Contact General Rubber for concurrent movements, and for sizes not shown up to 144" I.D.

7.) Retaining rings are typically "L" shaped and can be flat depending on internal reinforcements.

8.) Standard 125/150 lb. drilling includes, 1"-24" with ANSI B16.1 Class 125 lb./B16.5 Class 150 lb., 30"-60" with ANSI B16.1 Class 125 lb./ B16.47 series A, Class 150 lb., 72"-108" with ANSI B16.1 Class 125 lb./ AWWA C207 Class B.



Toll Free: 800-233-6294
Web: www.general-rubber.com

general rubber corporation

Fax: 201-641-4710
sales@general-rubber.com

STYLE 1015 EPDM

BLOWER SERVICE

XJ-105

General Rubber Corporation
11-A Empire Boulevard
S. Hackensack, NJ 07606
Requested by: _____

Tel: (201)641-4700
Fax:(201)641-4710

SUBMITTAL DATA

Job: _____
Purchase order: _____
Date: _____

MAXI-JOINT STYLE 1015E FOR BLOWER APPLICATIONS

☐ With Control Units
☐ Less Control Units

Standard dimensions for flanged spool type Expansion Joints

TABLE I — DIMENSIONAL DATA (ALL DIMENSIONS EXPRESSED IN INCHES)

SIZE I.D.	Flange O.D.	BOLT CIRCLE	BOLT HOLES		DIMENSIONS										STD. F/F
			No.	Diam.	A	B	C	D	E	G	H	J *	K	L	
1	4-1/4	3-1/8	4	5/8	1/2	1/2	1-1/2	3/4	1/2	3/8	5/8	10-1/2	7-1/2	1-1/4	6
1-1/2	5	3-7/8	4	5/8	7/16	7/16	1-1/2	3/4	7/16	3/8	5/8	10-1/2	8-1/2	1-3/8	6
2	6	4-3/4	4	3/4	7/16	7/16	2	1	7/16	3/8	5/8	10-1/2	9-1/4	1-1/8	6
2-1/2	7	5-1/2	4	3/4	7/16	1/2	2	1	1/2	3/8	5/8	10-1/2	10-1/4	1-1/16	6
3	7-1/2	6	4	3/4	7/16	1/2	2	1	1/2	3/8	5/8	10-1/2	10-3/4	1-1/16	6
4	9	7-1/2	8	3/4	7/16	1/2	2	1	1/2	3/8	5/8	11	12-1/4	1-1/16	6
5	10	8-1/2	8	7/8	7/16	1/2	2	1	1/2	1/2	5/8	11	14-1/4	1-1/16	6
6	11	9-1/2	8	7/8	7/16	1/2	2	1	1/2	1/2	5/8	11	15-1/4	1-1/16	6
8	13-1/2	11-3/4	8	7/8	1/2	9/16	2	1	9/16	9/16	3/4	12 & 14	19-1/4	1-1/16	6 & 8
10	16	14-1/4	12	1	1/2	9/16	2	1	9/16	3/4	1	15	22-3/4	1-15/16	8
12	19	17	12	1	1/2	5/8	2	1	5/8	3/4	1	15	24-3/4	1-7/8	8
14	21	18-3/4	12	1-1/8	9/16	11/16	2-1/2	1-1/4	11/16	3/4	1	15	25-1/4	1-1/2	8
16	23-1/2	21-1/4	16	1-1/8	9/16	11/16	2-1/2	1-1/4	11/16	3/4	1-1/8	15	28-1/4	1-1/2	8
18	25	22-3/4	16	1-1/4	5/8	3/4	2-1/2	1-1/4	3/4	3/4	1-1/8	15	29-7/8	3/4	8
20	27-1/2	25	20	1-1/4	5/8	3/4	2-1/2	1-1/4	3/4	3/4	1-1/8	15	32-1/8	3/4	8
24	32	29-1/2	20	1-3/8	3/4	7/8	3	1-1/2	7/8	1	1-1/4	20	37-5/16	1-3/8	10
30	38-3/4	36	28	1-3/8	3/4	3/4	3	1-1/2	3/4	1-1/4	1-1/2	20	44	1-3/8	10
36	46	42-3/4	32	1-5/8	3/4	3/4	3	1-1/2	3/4	1-1/2	1-1/2	22	52-1/2	1-3/8	10
42	53	49-1/2	36	1-5/8	3/4	3/4	3	2	3/4	1-1/2	1-1/2	24	59-1/4	1-7/8	12
48	59-1/2	56	44	1-5/8	3/4	3/4	3	2	3/4	1-1/2	1-3/4	24	65-3/4	1-7/8	12

RETAINING RINGS	
SIZE	# Segments
1-14	2
16-24	4
30	7
36	8
42	9
48	11

All retaining rings are segmented

CONTROL UNITS	
SIZE	# Rods (**Max WP**)
2-24	2
30-36	2
42-48	2

RATED	
** TEMPERATURE	300 Deg. F
PRESSURE	25 PSIG
VACUUM	26 In. Hg.

* The length of the control rod (J) is governed by the mating flange thickness meeting ANSI B16.5; Class 150 or AWWA C207, Table 3, Class E. If the mating flange thickness is different, advise factory so the rod length can be changed to accommodate the installation.

**Based on air as the transport media through Expansion Joint. Parts listed have a design rating of 30 In. Hg. (Full Vacuum)

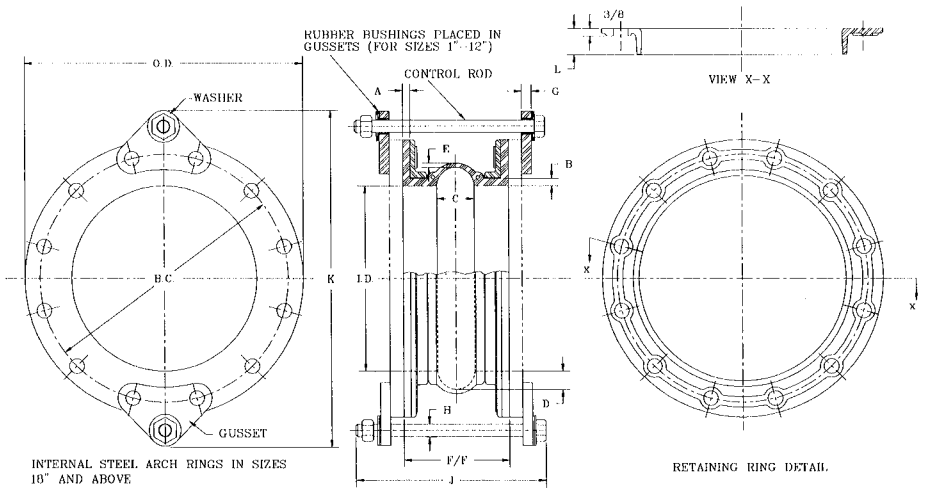


TABLE II

		MOVEMENT CAPABILITY & FORCES							
		AXIAL				DEFLECTION			
Size I.D. (Inch)	F/F (Inch)	Compr. (Inch)	Force (Lbs.)	Elong. (Inch)	Force (Lbs.)	Lateral (Inch)	Force (Lbs.)	Angular (Deg.)	WEIGHT ea.(Lbs.)
1*	6	5/8	374	1/4	204	1/4	272	15	4
1-1/2*	6	5/8	391	1/4	221	1/4	289	15	5
2	6	1-3/4	374	3/4	204	3/4	272	30	6
2-1/2	6	1-3/4	476	3/4	255	3/4	289	30	8
3	6	1-3/4	561	3/4	306	3/4	323	30	9
4	6	1-3/4	765	3/4	425	3/4	357	25	10
5	6	1-3/4	935	3/4	527	3/4	425	25	13
6	6	1-3/4	1139	3/4	629	1	629	20	17
8	6	1-3/4	1258	3/4	697	1	765	20	22
10	8	1-3/4	1581	3/4	884	1	816	15	34
12	8	1-3/4	1649	3/4	935	1	969	15	45
14	8	2	2023	7/8	1139	1-1/8	1275	12	55
16	8	2	2159	7/8	1224	1-1/8	1479	12	64
18	8	2	2431	7/8	1377	1-1/8	1632	9	71
20	8	2	2703	7/8	1530	1-1/8	1819	9	82
24	10	2-1/4	3638	1	2108	1-1/8	1955	9	102
30	10	2-1/4	4590	1	2660	1-1/8	2466	6	140
36	10	2-1/4	5610	1	3250	1-1/8	3013	5	190
42	12	2-1/4	6375	1	3655	1-1/8	3391	4	235
48	12	2-1/4	7140	1	4153	1-1/8	3837	3	290

* 1 & 1-1/2" available with filled arches only.

STYLE 1015E CONSTRUCTION DETAILS

HIGH STRENGTH polyester reinforcement provides higher rated working pressure in all sizes.
STANDARD ELASTOMER MATERIALS ARE: EPDM. Other materials are available upon request Contact the factory for their physical properties as required.
FLANGES are full faced and flat 125/150 Lbs. ANSI B16.1 and ANSI B16.5 standard drilling, mating to all types of full faced metal and fragile plastic pipe, eliminating problems of fracturing mating flanges, as can happen with raised face flanges. Retaining rings are cast ductile iron, ASTM A-536-67. Do not interface with wafer type flanges on valves or fittings.

EXPANSION JOINT INSTALLATION INSTRUCTIONS

To satisfactorily function as flexible member between rigid metal piping, a number of engineering and installation precautions should be taken:

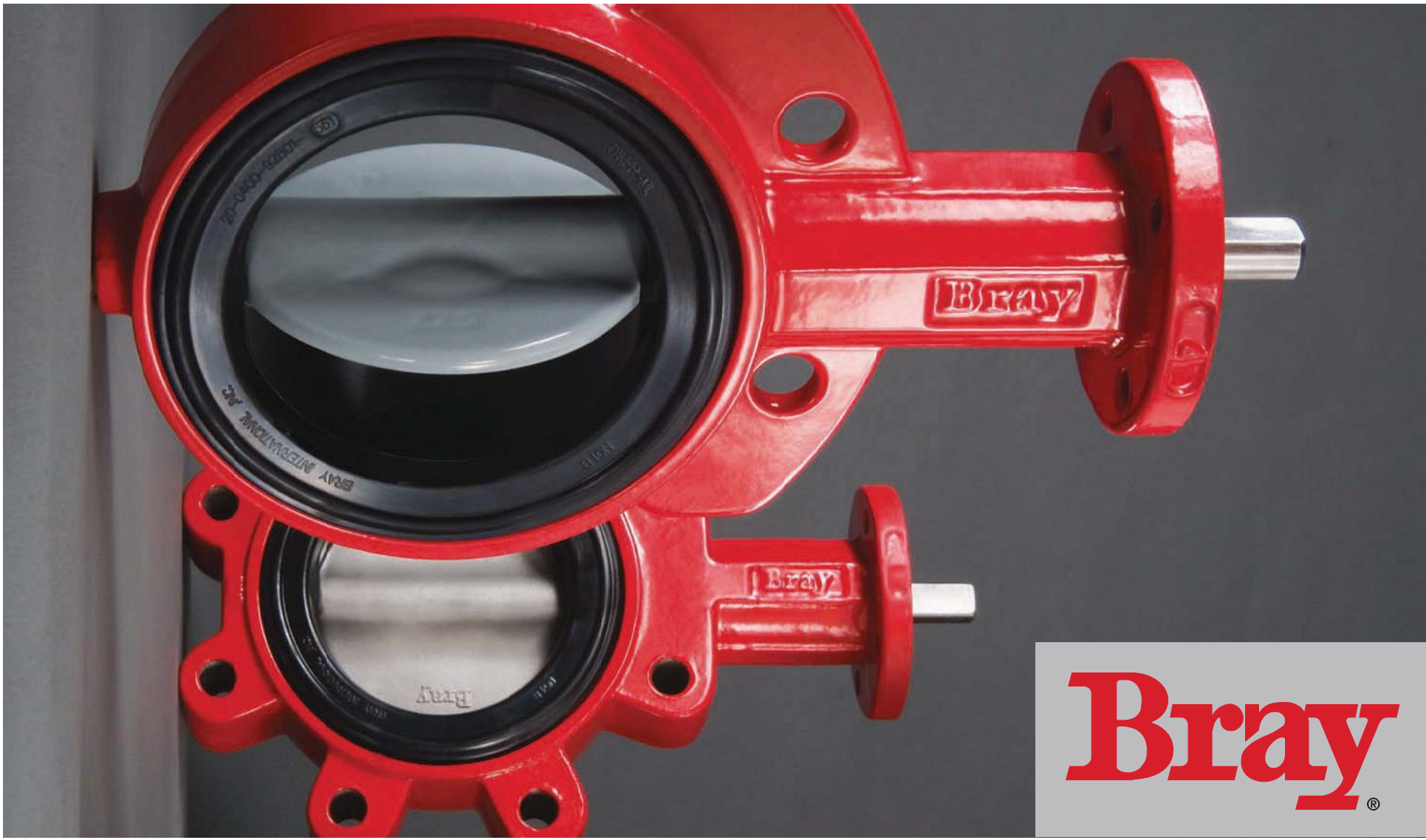
1. Proper anchoring of the rigid metal piping at both ends of the Expansion Joint unit is ESSENTIAL to eliminate the danger of over elongation. In the event anchoring is not possible, control units must be used as approved by General Rubber Corporation.
2. The span between the rigid piping should have the same overall length as the Expansion Joint.
3. The Expansion Joint must be installed in a relatively straight line to eliminate twisting the unit.
4. Tighten flange bolts until the rubber flange bulges slightly. CAUTION - Tighten bolts in equal steps to maintain uniform tension and alignment.
5. Check bolt tightness periodically. As any rubber-like material takes a set after a period of compression, the bolts may loosen and result in a break in the seal. It is particularly important to check bolts in a hot and cold water system before changing over from one medium to another.

CONTROL UNIT INSTALLATION

1. Control units MUST be used when the piping is not anchored on both sides of the Expansion Joints.
2. The function of the control unit is to allow the Expansion Joint to move axially and laterally within its capabilities, but to eliminate the danger of excessive elongation axially.
3. Installation of the control unit is done after the Expansion Joint is in place. The component parts of the control unit are packaged separately from the Expansion Joint because they are fitted to the backside of the companion flange - interfacing with the Expansion Joint (See line drawing).
4. The control unit should be installed to allow the Expansion Joint to extend to the maximum axial capability. The nut should then be "set" in a permanent position. Remember, the axial elongation of the Expansion Joint varies depending on size (See table II). DO NOT exceed the published figures at the time of installation.
5. To prevent over-compression of the Expansion Joint, compression sleeves can be furnished as an accessory, if requested. Generally, over-compression is not as serious a problem as excessive elongation. Compression sleeves are fitted over each of the rods with sufficient clearance to provide axial compression within the movement capability of the Expansion Joint.
6. Materials of Construction 1 set consists of the following:

2 Steel Rods	ASTM-A-307
4 Ductile gusset plates	ASTM-A-536
4 Neoprene Bushings	ASTM-D-735-SC-725-BF (1-12" ONLY)
4 Steel Washers	ASTM-A-307
2 Steel Nuts	ASTM-A-307

Discharge Butterfly Valve



The High Performance Company

BUTTERFLY VALVES

RESILIENT SEATED

SERIES 30/31 Wafer/Lug

2" - 20" (50mm-500mm)

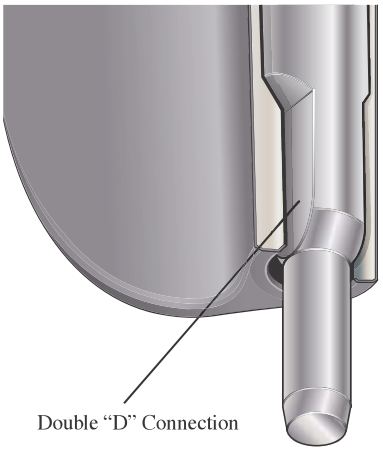
Bray®

SERIES 30

2"–20" (50mm–500mm)
Bray® Controls is proud to offer a high quality line of butterfly valves to meet the requirements of today's market. Combining years of field application experience, research and development, Bray has designed many unique features in the Series 30/31 not previously available. The results are longer service life, greater reliability, ease of parts replacement and interchangeability of components.

DISC AND STEM CONNECTION

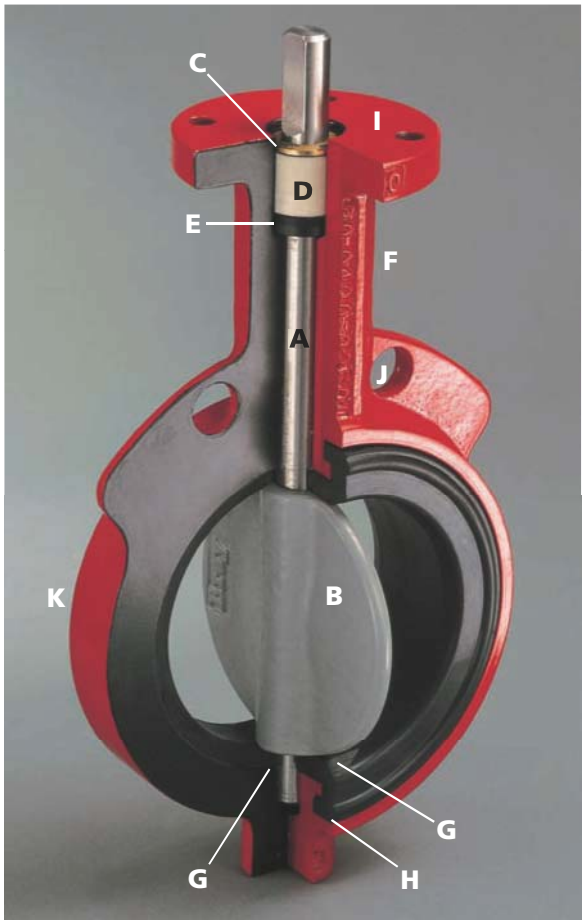
(**A**) Features a high-strength through stem design. The close tolerance, double "D" connection that drives the valve disc is an exclusive feature of the Bray valve. It eliminates stem retention components being exposed to the line media, such as disc screws and taper pins, which commonly result in leak paths, corrosion, and vibration failures. Disc screws or taper pins, due to wear and corrosion,



Double "D" Connection

often require difficult machining for disassembly. Disassembly of the Bray stem is just a matter of pulling the stem out of the disc. Without fasteners obstructing the line flow, the Series 30/31 C_V values are higher than many other valves, turbulence is reduced, and pressure recovery is increased. The stem ends and top mounting flange are standardized for interchangeability with Bray actuators.

DISC (**B**) Casting is spherically machined and hand polished to provide a bubble-tight shut off, minimum torque, and longer seat life. The disc O.D. clearance is designed to work with all standard piping.



STEM BUSHING (D)

Non-corrosive, heavy duty acetal bushing absorbs actuator side thrusts.

STEM SEAL (E)

Double "U" cup seal design is self-adjusting and gives positive sealing in both directions. Prevents external substances from entering the stem bore.

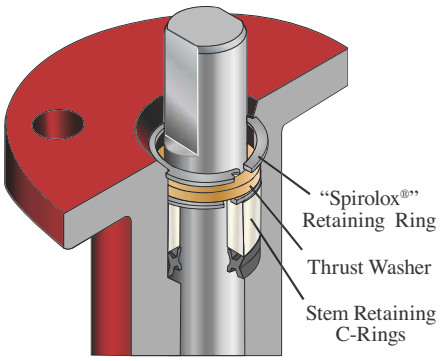
NECK (**F**) Extended neck length allows for 2" of piping insulation and is easily accessible for mounting actuators.

PRIMARY AND SECONDARY SEALS (G)

The Primary Seal is achieved by an interference fit of the molded seat flat with the disc hub. The Secondary Seal is created because the stem diameter is greater than the diameter of the seat stem hole. These seals prevent line media from coming in contact with the stem or body.

STEM RETAINING ASSEMBLY (C)

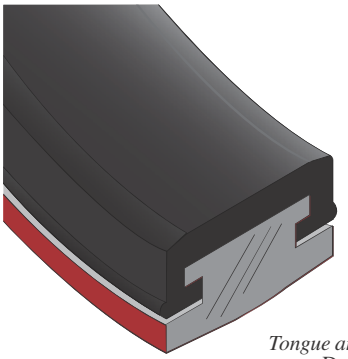
The stem is retained in the body by means of a unique Stainless Steel "Spirolox®" retaining ring, a thrust washer and two C-rings, manufactured from brass as standard, stainless steel upon request. The retaining ring may be easily removed with a standard hand tool. The stem retaining assembly prevents unintentional removal of the stem during field service.



*"Spirolox®" designation is a registered trademark of Kaydon Ring and Seal, Inc.

BRAY UNIQUE SEAT DESIGN (H)

One of the valve's key elements is Bray's unique *tongue and groove* seat design. This resilient seat features lower torque than many valves on the market today and provides complete isolation of flowing media from the body. The tongue-and-groove seat to body retention method is superior to traditional designs, making field replacement simple and fast. The seat is specifically designed to seal with slip-on or weld-neck flanges. The seat features a molded O-ring which eliminates the use of flange gaskets. An important maintenance feature is



Tongue and Groove Design

that all resilient seats for Bray butterfly valves Series 20, 21, 30 and 31 are completely interchangeable.

ACTUATOR MOUNTING FLANGE AND STEM CONNECTION (I)
Universally designed to ISO 5211 for direct mounting of Bray® power actuators and manual operators.

FLANGE LOCATING HOLES (J)
Provide quick and proper alignment during installation.

BODY (K) One-piece wafer or lug style. Polyester coating for excellent corrosion resistance. Bray valve bodies meet ANSI 150 pressure ratings for hydrostatic shell test requirements.

DESIGN FEATURES

Bray's Series 30 valve is a wafer version with flange locating holes, and the Series 31 is the companion lug version for dead-end service and other flange requirements. All Bray valves are tested to 110% of full pressure rating before shipment.

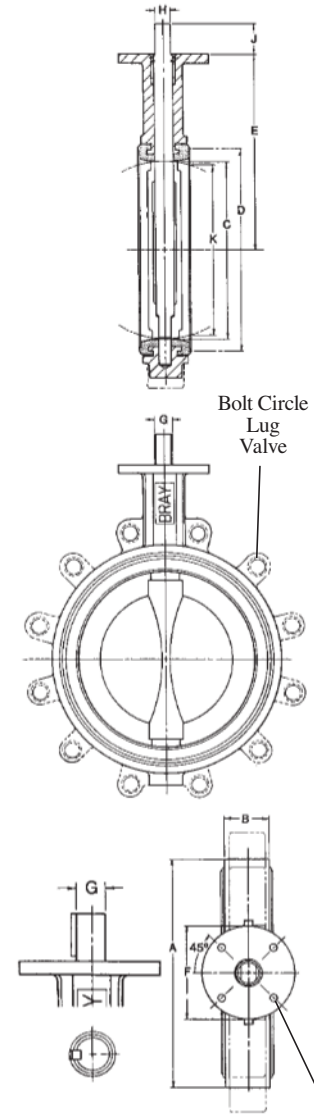
A major design advantage of Bray valve product lines is international compatibility. The same valve is compatible with most world flange standards – ANSI Class 125/150, BS 10 Tables D and E, BS 4504 NP 10/16, DIN ND 10/16, AS 2129 and JIS10. In addition the valves are designed to comply with ISO 5752 face-to-face and ISO 5211 actuator mounting flanges. Therefore, one valve design can be used in many different world markets.

Due to a modular concept of design, all Bray® handles, manual gear operators and pneumatic and electric actuators mount directly to Bray valves. No brackets or adapters are required.

Bray interchangeability and compatibility offers you the best in uniformity of product line and low-cost performance in the industry today.

POLYESTER COATING CORROSION PROTECTION Bray's standard product offers valve bodies with a polyester coating, providing excellent corrosion and wear resistance to the valve's surface. The Bray polyester coating is a hard, gloss red finish.
Chemical Resistance –resists a broad range of chemicals including: dilute aqueous acids and alkalies, petroleum solvents, alcohols, greases and oils. Offers outstanding resistance to humidity and water.
Weatherability–outdoor tested resistant to ultra-violet radiation.
Abrasion Resistance – excellent resistance to abrasion.
Impact Resistance–withstands impact without chipping or cracking.

NYLON 11 COATING
Optionally available for valve bodies where outstanding protection and performance is needed. A thermoplastic produced from a vegetable base, this coating is inert to fungus growth and molds. Nylon 11 is *USDA Approved*, as well as certified to ANSI/NSF 61 for water service.
Corrosion Resistance – superior resistance to a broad range of chemical environments. Salt spray tested in excess of 2,000 hours and seawater immersion tested for over 10 years without corrosion to metal substrates.
Nylon 11 features a very low coefficient of friction and excellent resistance to impact and ultra-violet radiation.



Bolt Circle Lug Valve

DIMENSIONS SERIES 30 Wafer

Valve Size								Mounting Flange Drig.						
Ins	mm	A	B	C	D	E	F	Bolt Circle	No. Holes	Hole Dia.	G	H	J	K
2	50	3.69	1.62	2.00	2.84	5.50	3.54	2.76	4	.39	.55	.39	1.25	1.32
21/2	65	4.19	1.75	2.50	3.34	6.00	3.54	2.76	4	.39	.55	.39	1.25	1.91
3	80	4.88	1.75	3.00	4.03	6.25	3.54	2.76	4	.39	.55	.39	1.25	2.55
4	100	6.06	2.00	4.00	5.16	7.00	3.54	2.76	4	.39	.63	.43	1.25	3.57
5	125	7.06	2.12	5.00	6.16	7.50	3.54	2.76	4	.39	.75	.51	1.25	4.63
6	150	8.12	2.12	5.75	7.02	8.00	3.54	2.76	4	.39	.75	.51	1.25	5.45
8	200	10.50	2.50	7.75	9.47	9.50	5.91	4.92	4	.57	.87	.63	1.25	7.45
10	250	12.75	2.50	9.75	11.47	10.75	5.91	4.92	4	.57	1.18	.87	2.00	9.53
12	300	14.88	3.00	11.75	13.47	12.25	5.91	4.92	4	.57	1.18	.87	2.00	11.47

SERIES 31 Lug

Lug Bolting Data		
Bolt Circle	No. Holes	Threads UNC-2B
4.75	4	5/8-11
5.50	4	5/8-11
6.00	4	5/8-11
7.50	8	5/8-11
8.50	8	3/4-10
9.50	8	3/4-10
11.75	8	3/4-10
14.25	12	7/8-9
17.00	12	7/8-9

Valve Size								Mounting Flange Drig.						
Ins	mm	A	B	C	D	E	F	Bolt Circle	No. Holes	Hole Dia.	G	H	J	K
14	350	17.05	3.00	13.25	15.28	13.62	5.91	4.92	4	.57	1.38	2.00	.39x.39	13.04
16	400	19.21	4.00	15.25	17.41	14.75	5.91	4.92	4	.57	1.38	2.00	.39x.39	13.04
18	450	21.12	4.25	17.25	19.47	16.00	8.27	6.50	4	.81	1.97	2.50	.39x.47	16.85
20	500	23.25	5.00	19.25	21.29	17.25	8.27	6.50	4	.81	1.97	2.50	.39x.47	18.73

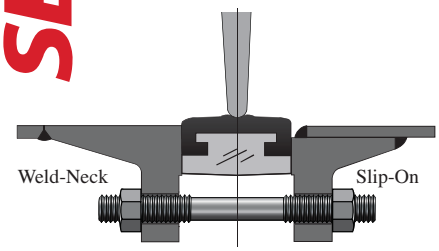
Lug Bolting Data		
Bolt Circle	No. Holes	Threads UNC-2B
18.75	12	1-8
21.25	16	1-8
22.75	16	11/8-7
25.00	20	11/8-7

See chart for Actuator Mounting Flange Drilling.

SELECTION DATA

FLANGE REQUIREMENTS

Bray valves are designed for installation between ANSI Class 125/150 lb. weld-neck or slip-on flanges, BS 10 Tables D & E, BS 4504 NP 10/16, DIN ND 10/16, AS 2129 and JIS 10, either flat faced or raised faced. While weld-neck flanges are recommended, Bray has specifically designed its valve seat to work with slip-on flanges, thus eliminating common failures of other butterfly valve designs. When using raised face flanges be sure to properly align valve and flange. Type C stub-end flanges are not recommended.



PRESSURE RATINGS*

For bi-directional bubble-tight shut off, disc in closed position:

Inches	mm	psig	bar
2-12	50-300	175	12
14-20	350-500	150	10

For Dead-end Service Applications:
With *downstream flanges installed* or with *aerospace bonded seats,* the dead-end pressure ratings are equal to valve bi-directional ratings as stated above. With no downstream flanges or with seats that are not aerospace bonded, the dead-end pressure rating for 2"-12" valves is 75 psi (5 bar) for 14"-20" valves, 50 psi (3.5 bar).

*Pressure Ratings are based on standard disc diameters. For low pressure application, Bray offers a standard reduced disc diameter to decrease seating torques and to extend seat life, thus increasing the valve's performance and reducing actuator costs for the customer.

VELOCITY LIMITS

For On/Off Services:
Fluids – 30 ft/sec (9m/s)
Gases – 175 ft/sec (54m/s)

Cv VALUES–VALVE SIZING COEFFICIENT

Valve Size		Disc Position(degrees)								
ins	mm	90°	80°	70°	60°	50°	40°	30°	20°	10°
2	50	144	114	84	61	43	27	16	7	1
21/2	65	282	223	163	107	67	43	24	11	1.5
3	80	461	364	267	154	96	61	35	15	2
4	100	841	701	496	274	171	109	62	27	3
5	125	1376	1146	775	428	268	170	98	43	5
6	150	1850	1542	1025	567	354	225	129	56	6
8	200	3316	2842	1862	1081	680	421	241	102	12
10	250	5430	4525	2948	1710	1076	667	382	162	19
12	300	8077	6731	4393	2563	1594	1005	555	235	27
14	350	10538	8874	5939	3384	2149	1320	756	299	34
16	400	13966	11761	7867	4483	2847	1749	1001	397	45
18	450	17214	14496	10065	5736	3643	2237	1281	507	58
20	500	22339	18812	12535	7144	4536	2786	1595	632	72

C_V is defined as the volume of water in U.S.G.P.M. that will flow through a given restriction or valve opening with a pressure drop of one (1) p.s.i. at room temperature. Recommended control angles are between 25°–70° open. Preferred angle for control valve sizing is 60°–65° open.

EXPECTED SEATING/UNSEATING TORQUES (Lb.-Ins.)

Valve Size		Full-Rated Pressure Valves				Reduced Disc Diameter
		ΔP (PSI)				ΔP (PSI)
ins	mm	50	100	150	175	50
2	50	125	130	135	140	125
21/2	65	195	205	215	220	195
3	80	260	275	290	297	260
4	100	400	425	450	462	267
5	125	615	670	725	755	410
6	150	783	871	953	1003	537
8	200	1475	1650	1825	1915	983
10	250	2240	2520	2800	2940	1493
12	300	3420	3870	4320	4545	2280
14	350	4950	5700	6450	—	3300
16	400	6400	7700	9000	—	4267
18	450	7850	9850	11850	—	5267
20	500	10300	12900	15500	—	6867

Valve Torque Rating – Bray has classified valve torque ratings according to 3 types: non-corrosive lubricating service, general service, and severe service. Torques listed above are for general services. Consult Bray for torque information corresponding to specific applications.

TO USE TORQUE CHART, NOTE THE FOLLOWING:
1) For Bray valves, Series 20, 21, 30, 31 and 34.
2) Review Technical Bulletin No. 1001, Expected Seating/Unseating Torques, for explanation of the 3 service classes and their related seating/unseating torque values for given pressure differentials of Full-Rated and Reduced Disc Diameter valves.
3) Dynamic Torque values are not considered. See Technical Bulletin No. 1002 for evaluation of Dynamic Torque values vs. Seating/Unseating Torque values.
4) Do not apply a safety factor to above torque values when determining actuator output torque requirement.
5) For 3 way assemblies where one valve is opening and other is closing, multiply torque by 1.5 factor.

SPECIFICATIONS

RECOMMENDED SPECIFICATIONS FOR BRAY SERIES 30/31 SHALL BE:

- Polyester coated, cast iron, wafer or lug bodies.
- With flange locating holes that meet ANSI Class 125/150 (or BS 10 Tables D & E, BS 4504 NP 10/16, DIN ND 10/16, AS 2129 and JIS 10) drillings.
- Through-stem direct drive double "D" design requiring no disc screws or pins to connect stem to disc with no possible leak paths in disc/stem connection.
- Stem mechanically retained in body neck and no part of stem or body exposed to line media.
- Tongue-and-groove seat design with primary hub seal and a molded O-ring suitable for weld-neck and slip-on flanges. Seat totally encapsulates the body with no flange gaskets required.
- Spherically machined, hand polished disc edge and hub for minimum torque and maximum sealing capability.
- Equipped with non-corrosive bushing and self-adjusting stem seal.
- Bi-directional and tested to 110% of full rating.
- Bi-directional pressure ratings:
2"-12" valves: 175 psi, 14"-20" valves: 150 psi
Lug bodies for dead end service
With downstream flanges or aerospace bonded seats, pressure ratings are equal to bi-directional ratings as stated above.
With no downstream flanges or non-bonded seats: 2"-12" valves: 75 psi, 14"-20" valves: 50 psi
- No field adjustment necessary to maintain optimum field performance.
- The valve shall be Bray Series 30 wafer / 31 lug or equal.

WEIGHTS (lbs.)

Valve Size ins	Valve Size mm	Series 30	Series 31
2	50	5.5	7.0
2½	65	7.0	8.0
3	80	7.5	9.0
4	100	11.5	15.0
5	125	14.0	20.0
6	150	17.0	23.0
8	200	34.0	42.0
10	250	49.0	66.0
12	300	67.0	88.0
14	350	95.0	114.0
16	400	135.0	166.0
18	450	200.0	226.0
20	500	260.0	305.0

MATERIALS SELECTION

2"–20" (50mm-500mm)

BODY:
- Cast Iron ASTM A126 Class B
- Ductile Iron ASTM A536
- Cast Steel ASTM A216 WCB
- Aluminum ASTM B26

SEAT:
- Buna-N – Food Grade
- EPDM – Food Grade
- FKM*
- White Buna-N – Food Grade

STEM:
- 416 Stainless Steel ASTM A582 Type 416
- 304 Stainless Steel ASTM A276 Type 304
- 316 Stainless Steel ASTM A276 Type 316
- Monel

DISC:
- Aluminum Bronze ASTM B148-954
- Coated Ductile Iron ASTM A536 Gr. 65-45-12
- Ductile Iron, Nylon 11 Coated, ASTM A536 Gr. 65-45-12
- Ductile Iron, Halar® Coated, ASTM A536 Gr. 65-45-12
- 316 Stainless Steel ASTM A351 CF8M
- Hastelloy® C-276 ASTM B575 Alloy N10276
- 304 Stainless Steel ASTM A351 CF8M

TEMPERATURE RANGE OF SEATS

Type	Maximum	Minimum
EPDM	+250°F(121°C)	-40°F(-40°C)
Buna-N	+212°F(100°C)	0°F(-18°C)
FKM*	+400°F(204°C)	0°F(-18°C)

COMPONENTS

No.	Qty.	Description
1	1	Body
2	1	Seat
3	1	Disc
4	1	Stem
5	1	Stem Seal
6	1	Stem Bushing
7	2	Stem Retainer
8	1	Thrust Washer
9	1	Retaining Ring

*FKM is the ASTM D1418 designation for Fluorinated Hydrocarbon Elastomers (also called Fluoroelastomers).

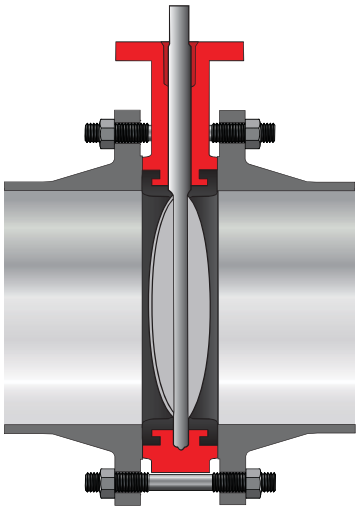
Hastelloy® is a registered trademark of Haynes International, Inc.

Halar® is a registered trademark of Ausimont U.S.A., Inc.

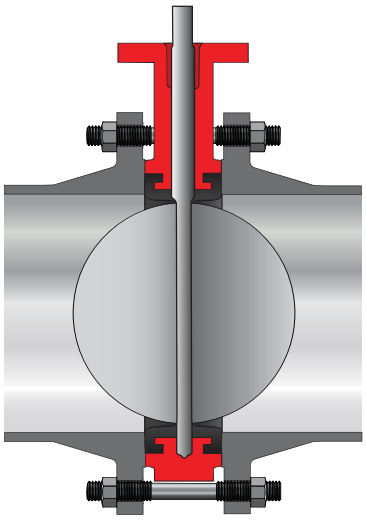
ASSEMBLY

INSTALLATION

Position the disc in the partially open position, maintaining the disc within the body face-to-face. Place the body between the flanges and install flange bolts. *Do not use flange gaskets*. Before tightening flange bolts, carefully open the disc to the full open position to ensure proper alignment and clearance of the disc O.D. with the adjacent pipe I.D. Leave disc in the full open position and tighten flange bolts per required specification. Once bolts are tightened, carefully rotate disc to closed position to ensure disc O.D. clearance.



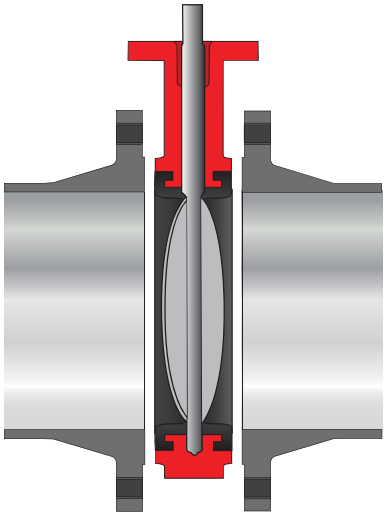
Disc in the Partially Open Position



Disc in the Full Open Position

MAINTENANCE AND REPAIR

The many Bray features minimize wear and maintenance requirements. No routine lubrication is required. All components – stem, disc, seat, bushing, stem seal, etc., are field replaceable, no adjustment is needed. If components require replacement, remove the valve from the line by placing the disc near the closed position, spread the flanges, support the valve, then remove the flange bolts. No valve maintenance, including removal of manual or power actuators, should be performed until the piping system is completely depressurized.



Disc in the Near Closed Position

DISASSEMBLY

Remove the handle, gear operator, or actuator from actuator mounting flange. Remove "Spirolox®" retaining ring. Remove stem with its thrust washer and two C-ring stem retainers. Remove bushing and seal. Remove the disc from the seat, protecting disc edge at all times. Push the seat into an oval shape, then remove the seat from the body.

ASSEMBLY

Push the valve seat into an oval and push it into the body with seat stem holes aligned to body stem holes. Push stem into the stem hole of body. For aid in inserting disc, slightly protrude stem beyond the I.D. of the top of the seat. Install a light coating of foodgrade silicone oil (for silicone free applications use soap and water) on the I.D. of seat. Insert the disc into the seat by lining up the disc hole with the stem hole of the seat. Note: the broached double "D" flats in the disc must be toward the bottom of valve body. (Take special care when lining disc up with stem.) With a downward pressure and rotating the stem back and forth, push the stem until the stem touches the bottom of the body stem hole. Make certain that when pushing the stem through disc bottom, the broached flats of stem and disc are aligned. After the stem has engaged the disc, but before the stem is firmly seated in the body, replace the stem seal and bushing. Install the two C-ring stem retainers in the groove in the stem and thrust washer on top of the C-rings. Seat the stem firmly in the body and install the "Spirolox®" retaining ring back into position.

LLOYD'S REGISTER QUALITY ASSURANCE R ISO9001

DISTRIBUTOR

Bray® CONTROLS

A Division of BRAY INTERNATIONAL, Inc.
13333 Westland East Blvd. Houston, Texas 77041
281.894.5454 FAX 281.894.9499 www.bray.com

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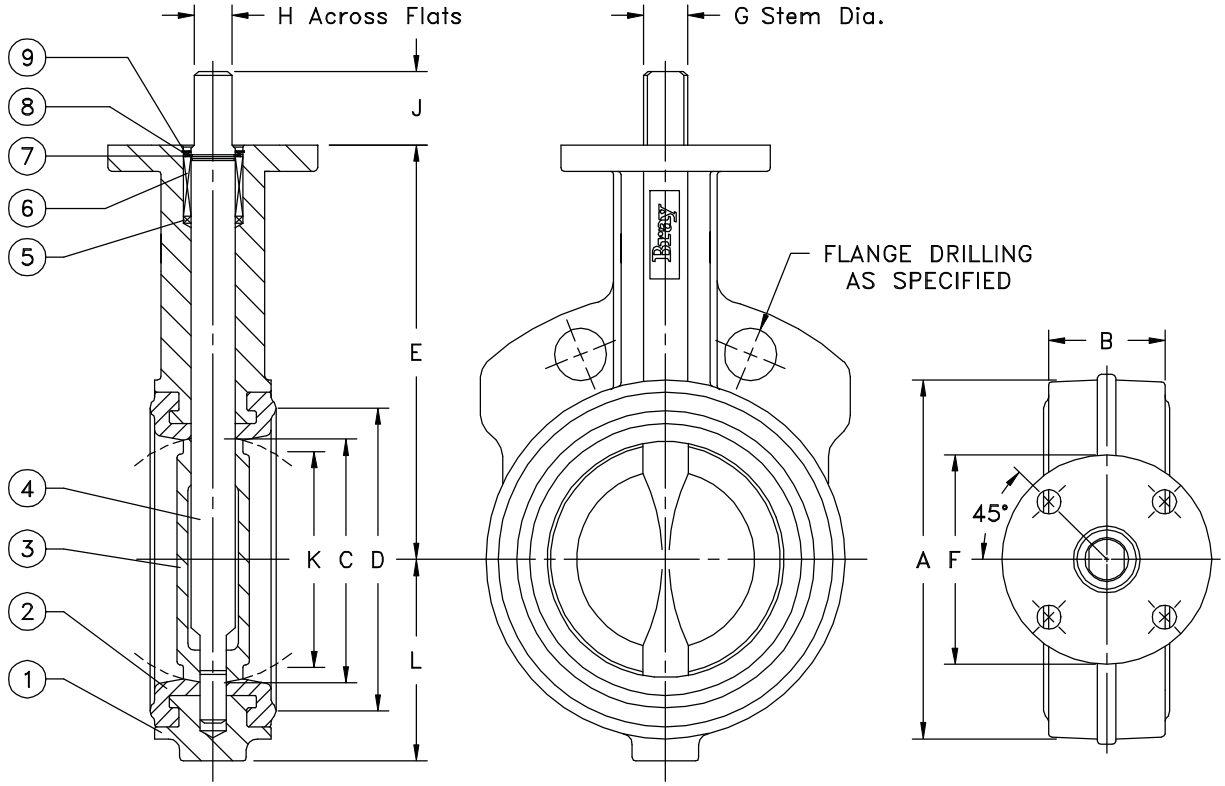
SERIES 30
ES11A-0010
Date: June 1993

Valve Size	A	B	C	D	E	F	Top Plate Drilling BC	No. of Holes	Hole Diameter	G	H	J	K	L	Adapter Code	Weight
2	3.69	1.62	2.00	2.84	5.50	3.54	2.76	4	.39	.55	.39	1.25	1.32	2.22	A	5.5
2½	4.19	1.75	2.50	3.34	6.00	3.54	2.76	4	.39	.55	.39	1.25	1.91	2.47	A	7.0
3	4.88	1.75	3.00	4.03	6.25	3.54	2.76	4	.39	.55	.39	1.25	2.55	2.81	A	7.5
4	6.06	2.00	4.00	5.16	7.00	3.54	2.76	4	.39	.63	.43	1.25	3.57	3.41	B	11.5
5	7.06	2.12	5.00	6.16	7.50	3.54	2.76	4	.39	.75	.51	1.25	4.63	4.03	C	14.0
6	8.12	2.12	5.75	7.02	8.00	3.54	2.76	4	.39	.75	.51	1.25	5.45	4.53	C	17.0
8	10.50	2.50	7.75	9.47	9.50	5.91	4.92	4	.57	.87	.63	1.25	7.45	5.75	D	34.0
10	12.75	2.50	9.75	11.47	10.75	5.91	4.92	4	.57	1.18	.87	2.00	9.53	7.12	E	49.0
12	14.88	3.00	11.75	13.47	12.25	5.91	4.92	4	.57	1.18	.87	2.00	11.47	8.12	E	67.0

Note: K dim is disc chordal dimension at valve face.



ITEM No.	NAME	No. REQUIRED	SERIES/PART No.	MATERIAL	SPECIFICATION/REMARKS
9	RETAINING RING	1			
8	THRUST WASHER	1			
7	STEM RETAINER	2			
6	BUSHING	1			
5	PACKING	1			
4	STEM	1			
3	DISC	1			
2	SEAT	1			
1	BODY	1			

Valve Size _____ Flg. Drilling _____
Pressure Rating _____
Customer/Project _____
Inq./P.O. No. _____
Bray Order No. _____
Certified Correct By _____ Date _____

The High Performance Company

BRAY VALVE & CONTROLS
A Subsidiary of BRAY INTERNATIONAL, Inc.

PARTS LIST AND DIMENSIONS (Inches)
BUTTERFLY VALVE, SERIES 30 SIZES 2"-12"

Series	Size	Part No.	Material Trim Code	Drawing No.
				ES11A-0010

Bray

REV. 1 / ERN-1238

DISK NO. 300

Bray®

MANUAL OPERATORS

HANDLE / GEAR OPERATOR / DECLUTCHABLE GEAR OPERATOR

SERIES 1 1"-12" (25mm-300mm)
SERIES 4 2"-48" (50mm-1200mm)
SERIES 5 2"-36" (50mm-900mm)

Bray Controls proudly offers three operators for manual control of valve position. All manual operators mount directly to Bray valves, and all are epoxy coated for excellent corrosion, abrasion and impact resistance.

SERIES 1 HANDLE & NOTCH PLATE

Bray offers two handles for on-off and throttling service – one for resilient seated valves from 1"-12" (25mm-300mm), and a high torque handle for high pressure valves from 2 $^{1}/_{2}$"- 8" (65mm-200mm). These quarter turn handles have a locking spring and a directional pointer for valve disc position indication. Bolted notch plates are offered. For resilient seated valves a 10 position plate is standard. For high pressure valves an 8 position plate is standard. Both contain on-off stops to prevent over rotation of the valve. Optionally available are an infinite position plate, a 180° notch plate, a memory stop, a padlock kit, and a 2" square nut version.

SERIES 4 GEAR OPERATOR

For heavy duty on-off and throttling service of 2"-48" (50mm-1200mm) valves, the Series 4 is self lubricated for smooth, trouble-free operation. The rugged, cast iron body with O-ring body seals is weatherproof to IP65. A self-locking worm and worm gear drive holds the valve in the desired position. Features include a readily accessible handwheel, a valve position indicator and mechanical travel stops which permit field adjustment of valve movement to specific degrees of rotation. Optionally available are chainwheel accessories, padlock kits and 2" square nut versions. A Gear Operator with a Stainless Steel housing is also available for valve sizes 1"-16".

SERIES 5 DECLUTCHABLE GEAR OPERATOR

Available for 2"-36" (50mm-900mm) valves, the Series 5 offers the same superior features as the Series 4 gear operator with the added ability to manually override pneumatic actuators or rotate the valve when air pressure is not available. This operator is excellent for the safe handling of spring return actuators. During pneumatic operation, the worm of the gear unit is disengaged. Should the valve require opening or closing in the event of power loss, manual rotation of the declutch lever will provide a camming action and engage the worm to the segmented worm gear, allowing rotation of the valve using the handwheel. The Series 5 can be installed in the field with existing Bray pneumatic actuators.

The High Performance Company

SERIES 1

Standard 10 Position Notch Plate has been designed to lock the handle securely in place, preventing position change of disc due to line pressure, vibration or shock. *Standard 8 Position Plate for high pressure valves is not shown.*

Infinite Position Notch Plate, for throttling applications, allows for very precise adjustments of valve disc positioning anywhere from 0° to 90°. Positioning is simply a matter of loosening the set knob, moving the handle, then retightening the knob. *For resilient seated valves only.*

Handle and 180° Notch Plate allows the operator to switch the handle to either side without removing the notch plate from the valve.

Memory Stop allows the operator to set the maximum amount the valve can open. When set, this limit will remain fixed until the stop is reset.

Padlock Kit allows the customer to lock the valve in the full open or closed position, tamper proofing the valve. By drilling a new hole in the top plate, the handle can be locked in mid travel.

2" Square Nut is used where the valve is buried under the surface. To rotate valve disc position, the nut is reached with a T handle wrench.

SERIES 4

Chainwheel for remote access to valve positioning when the handwheel is not accessible, such as valves positioned high out of reach.
A **Padlock Kit** and a **2" Square Nut** version for buried service are also available with the Series 4 *(not shown)*.

SERIES 5

Operation Any residual air pressure in the pneumatic actuator must be vented before operation of the Declutchable Gear Operator. Bray recommends the use of a vent valve to block the incoming air supply and vent residual air. Then engage the declutching lever and rotate the valve using the handwheel. When returning to automatic operation, disengage the manual override by rotating the declutching lever, turning the vent valve to off, then restoring air pressure to the actuator.

DISTRIBUTOR

Bray CONTROLS
A Division of BRAY INTERNATIONAL, Inc.
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281.894.5454 FAX 281.894.9499 www.bray.com

B-1025_S1-4-5 _EN_2008-08

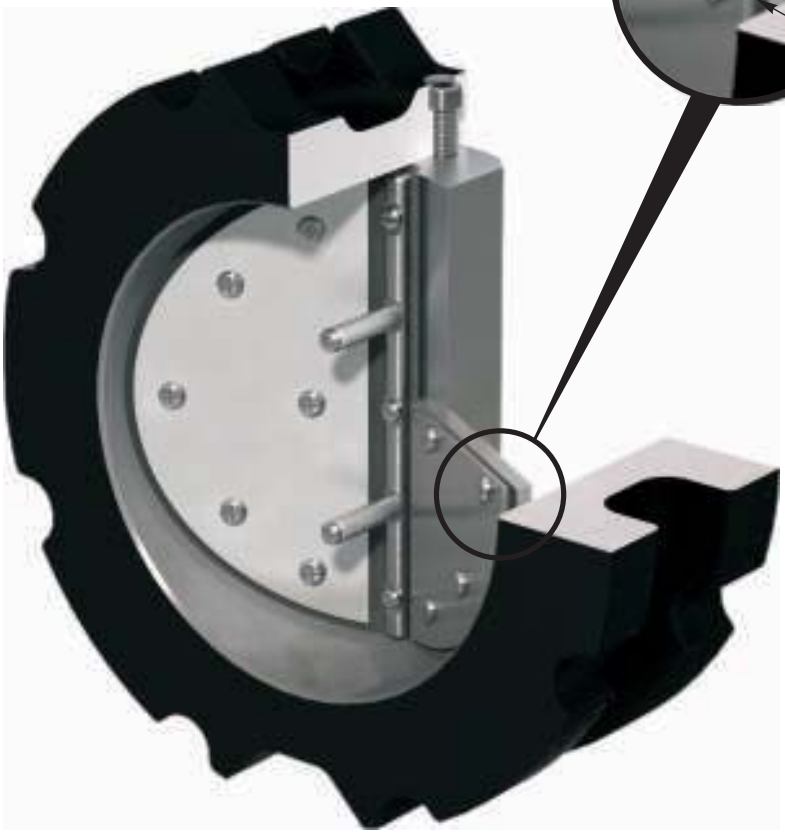
Discharge Check Valve

TECHNO™ Short Form Wafer Style Check Valves

TECHNO™

SHORT FORM WAFER STYLE CHECK VALVES

Technocheck Short Form (SF), Cost Efficient, Reliable, "Wafer Style" Check Valve



Non-Slam Quick Closure Feature
The Valve Plate Design offers Minimum Travel from Full Open to Full Closed Position and complete Metal-to-Metal Valve Plate Structural Support.

Unique Flexible Elastomer Seal
Continuous Elastomer Seal provides Final Closure around complete valve bore with the strength and durability to ensure prolonged cycle life.

Can Be Mounted In Any Position for the most efficient piping layout.

Unrestricted Full Port Seatless Design provides Free-Flow through Design with virtually no pressure loss.

Elimination of Metal-to-Metal Rotating Parts. The stationary Hinge Post and Hinge Clamp Design eliminates wear of Hinges, Pins, Valve Seats, Springs and the need for routine maintenance.

TECHNO has been a leading supplier of high quality check valves to all phases of industry for many years. Thousands of TECHNO products are presently in service demonstrating an outstanding performance record.

Exclusive Technocheck design combined with an extensive selection of materials result in exceptionally high performance and reliability for most liquid and gaseous applications.

The Short Form (SF) Technocheck split disc wafer style check valve offers compact design along with heavy duty construction.

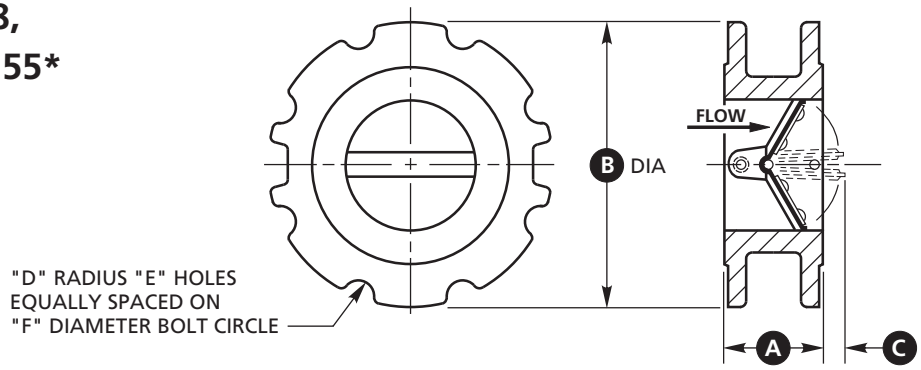
TECHNO's scalloped body design assures proper and easy alignment between mating gaskets and line flanges. It offers strength and eliminates the need for expensive supports, expansion joints and foundations that may be necessary with a conventional check valve.

Our unique design combined with many years of experience allows us to satisfy the most difficult applications.

Specials available upon request.

CERTIFICATIONS		

TECHNO SHORT FORM WAFER STYLE CHECK VALVES
STYLES 5412, 5118, 5831-F, 5831-R, 5355* AND 5355-316



GENERAL DIMENSIONS FOR STYLES 5412, 5118, 5831-F, 5831-R, 5355* AND 5355-316

VALVE SIZE in.	A	B	C	D	E	F
2	1 3/8	4 3/4	1/2	3/8	4	4 3/4
2 1/2	1 5/8	5 1/2	9/16	3/8	4	5 1/2
3	1 7/8	6	11/16	3/8	4	6
4	2 3/8	7 1/2	7/8	3/8	8	7 1/2
5	2 7/8	8 1/2	1 1/8	7/16	8	8 1/2
6	3 3/8	9 1/2	1 1/2	7/16	8	9 1/2
8	4 3/8	11 3/4	2 1/4	7/16	8	11 3/4
10	5 3/8	14 1/4	2 1/2	1/2	12	14 1/4
12	6 3/8	17	3	1/2	12	17
14	7 3/8	18 3/4	3 1/4	9/16	12	18 3/4
16	8 3/8	21 1/4	3 3/4	9/16	16	21 1/4
18	9 3/8	22 3/4	4 1/4	5/8	16	22 3/4
20	10 3/8	25	4 3/4	5/8	20	25
24	12 3/8	29 1/2	5 3/4	11/16	20	29 1/2
30	15 3/8	36	7 3/4	11/16	28	36
36	18 3/8	42 3/4	8 1/2	13/16	32	42 3/4
42	21 3/8	49 1/2	9 1/2	13/16	36	49 1/2
48	24 3/8	56	11 1/2	13/16	44	56
54	27 3/8	62 3/4	13	15/16	44	62 3/4
60	30 3/8	69 1/4	14	15/16	52	69 1/4
66	33 3/8	76	15	15/16	52	76
72	36 3/8	82 1/2	16 1/2	15/16	60	82 1/2

*For sizes 2 inch - 8 inch see style 5296 on page 4.

STANDARD MODELS AND MATERIALS

STYLE	BODY	INTERNALS	FLANGE CLASS	CWP psi
5412	Aluminum	Aluminum	125 (FF)	125
5118	Cast Iron	Aluminum	125 (FF)	125
5831-F	Bronze	Brass	125 (FF)	150
5831-R	Bronze	Brass	150 (RF)	150
5355*	Steel	Plated Steel	150 (RF)	150
5355-316	316 Stainless Steel	316 Stainless Steel	150 (RF)	150

Standard Elastomer: Buna-N (FF) = Flat Face, (RF) = Raised Face

OPTIONAL MATERIAL SELECTION

Internal Materials

- Aluminum
- Brass
- 316 Stainless Steel
- Plated Steel

SEALING MEMBER MATERIALS

Material	Temperature Range*
• Buna-N	-60°F to 225°F
• Neoprene	-40°F to 225°F
• EPDM	-40°F to 300°F
• Viton	-20°F to 400°F
• Silicone	-100°F to 500°F

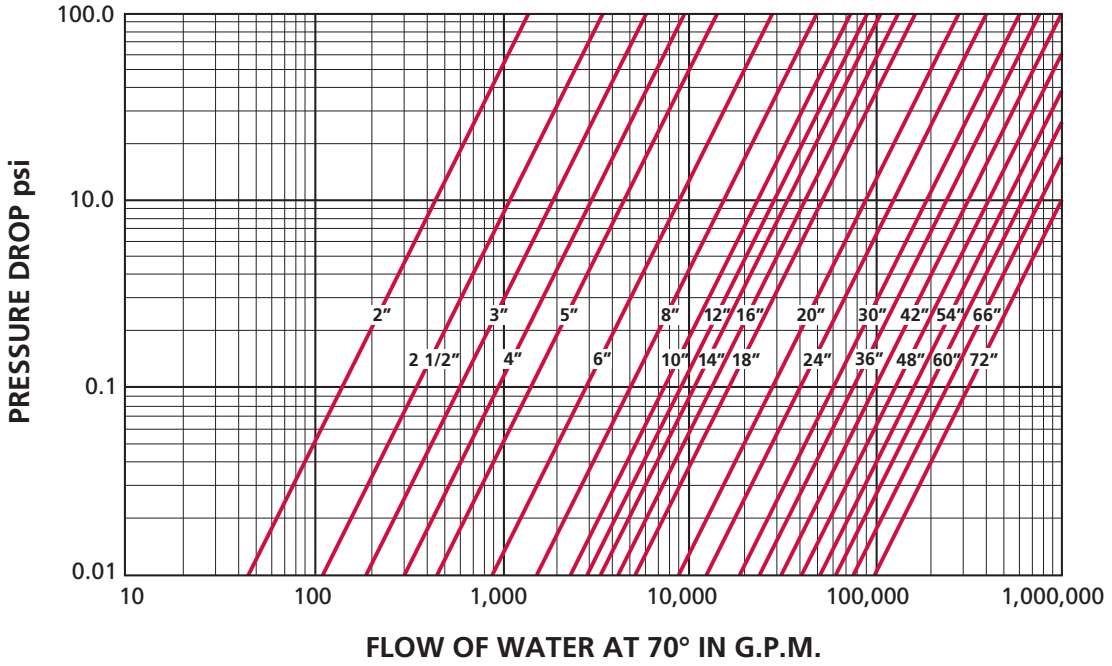
* This temperature range is for general guidance. The figures may vary with application.

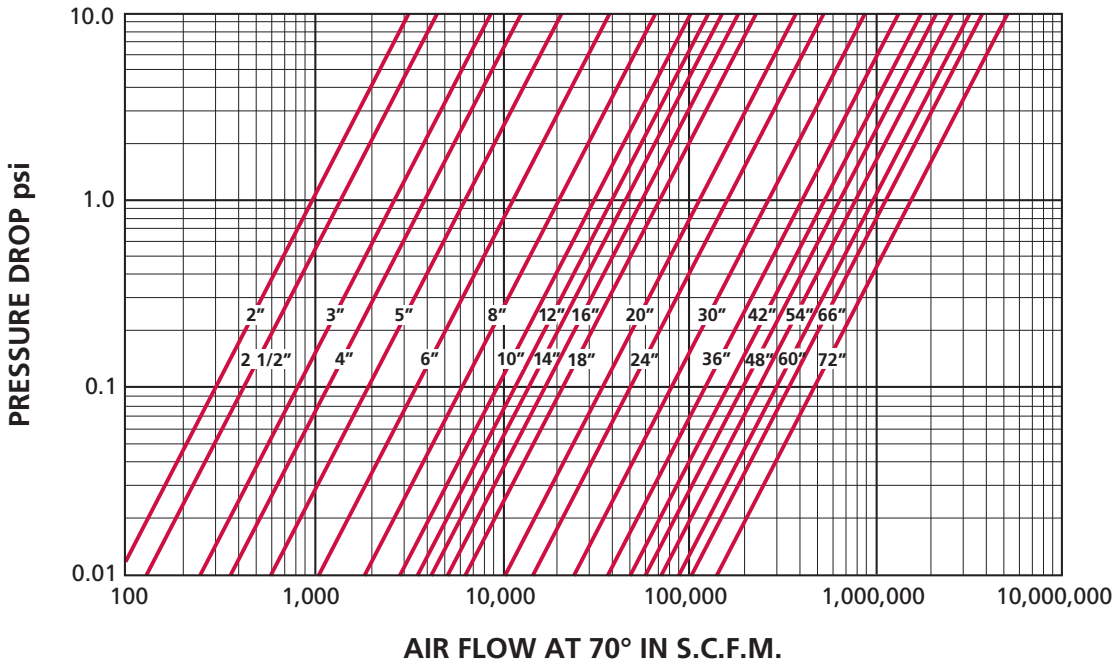
SPRING MATERIAL

- 302 Stainless Steel

TECHNO FULL FLANGED CHECK VALVES

PRESSURE DROP CHARTS FOR WATER AND AIR SERVICE





TRADEMARK INFORMATION

Blow-off Silencer

General Information

Absorptive Silencers

The Absorptive type silencer is the classic dissipative design, deriving its noise control properties from the basic fact that noise energy is effectively "absorbed" by various types of fibrous packing materials. More technically, as the sound waves pass through the spaces between the tightly-packed small-diameter fibers of the absorptive material, the resulting viscous friction dissipates the sound energy as small amounts of heat.

Absorptive silencers are highly effective on high frequency noise (500 - 8000 Hz). At frequencies above and below this range, attenuation performance progressively diminishes.

Since the noise is absorbed by the packing media, the absorptive silencer does not rely on internal baffles, tubes, or other restrictive devices to achieve noise reduction. Consequently, absorptive silencers generally employ straight-through or similar internal designs which impose very little restriction to the air flow.

U5 Series (page 3) Highly efficient straight-through silencer available in pipe sizes 1/2″ - 6″. Attenuation characteristics equivalent to SU5 series.

U2 Series (page 4) Moderately efficient straight-through silencer available in pipe sizes 5″ - 30″. For higher performance, use SU3, SU4, SU5, or U5 series.

SU5 Series (page 5) Highest efficiency full flow annular type silencer. Available in pipe sizes 4″ - 60″. Larger sizes on application.

SU4 Series (page 6) Annular type silencer with performance one grade lower than SU5 series. Available in pipe sizes 8″ - 60″. Larger sizes on request.

SU3 Series (page 7) Annular type silencer with performance two grades lower than SU5 series, available in pipe sizes 8″ - 60″ and larger. For higher attenuation, use SU4 or SU5 series.

Sizing Information, Pressure Drop Data

The flow area through the silencer must be sufficient to accommodate the maximum flow without imposing excessive pressure drop. The following instructions enable the user to 1) select proper silencer size, and 2) determine actual pressure drop. (These instructions assume air as the flowing gas. For other gases, density and other corrections may be necessary - contact Universal for assistance.)

Data Required:

Air flow rate (Actual CFM)
Temperature (°F)
Pressure (psig)
Maximum pressure drop (inches of water)

1. Determine Maximum Velocity:

$$V = 4005\sqrt{\left(\frac{\Delta P}{c}\right)\left(\frac{14.7}{P+14.7}\right)\left(\frac{T+460}{530}\right)}$$

V = Air or gas velocity, ft/min (see Note 1)
ΔP = Maximum pressure drop, inches of water
c = Silencer pressure drop coefficient (Table 1)
T = Air temperature, °F (See Note 2)
P = Operating pressure, psig (If at atmospheric pressure, pressure ratio is unity and may be omitted from equation. If P exceeds 15 psig, contact Universal for recommendations.)

2. Determine flow area required:

$$A = \frac{Q}{V}$$

A = Flow area required, ft²
Q = Air flow rate (Actual CFM)

$$\text{Actual CFM} = \text{Standard CFM}\left(\frac{14.7}{P+14.7}\right)\left(\frac{T+460}{530}\right)$$

3. From Table 2, select size with flow area equal to or greater than that calculated.

4. Determine actual gas velocity, ft/min

$$V_{actual} = \frac{Q}{A}$$

A = Flow area from Table 2.

5. Determine actual pressure drop:

$$\Delta P = c\left(\frac{V_{actual}}{4005}\right)^2\left(\frac{530}{T+460}\right)\left(\frac{P+14.7}{14.7}\right)$$

Table 1. Pressure Drop Coefficients

SILENCER SERIES	PRESSURE DROP COEFFICIENT-c
U5, U2	.25
SU5	.75
SU3, SU4	.85

Table 2. Flow Area Size

Flow Area-ft²	Dia. (Size)-in.	Flow Area-ft²	Dia. (Size)-in.
.0014	½	2.6	22
.0031	¾	3.1	24
.0055	1	3.7	26
.012	1½	4.3	28
.022	2	4.9	30
.034	2½	5.6	32
.049	3	6.3	34
.067	3½	7.1	36
.087	4	7.9	38
.136	5	8.7	40
.196	6	9.6	42
.349	8	10.6	44
.55	10	11.5	46
.79	12	12.6	48
1.07	14	15.9	54
1.4	16	19.6	60
1.8	18	23.8	66
2.2	20	28.3	72

NOTES:

1. Since self noise and aerodynamic noise generation increase with velocity, absorptive silencers are usually sized for 4,000 - 8,000 ft/min. In no case should the velocity exceed 15,000 ft/min, regardless of pressure drop allowed.

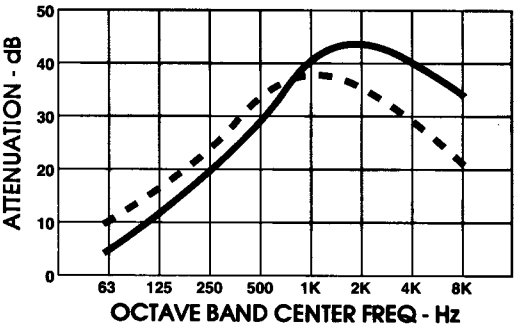
2. Typical attenuation curves are given to indicate the characteristics of the silencer series and, as such, are neither a minimum nor a guarantee for an individual silencer. Individual silencer performance can be affected by many other environmental and operational factors, such as the sound source characteristics including pure tones, flow velocity, adjacent piping and temperature.

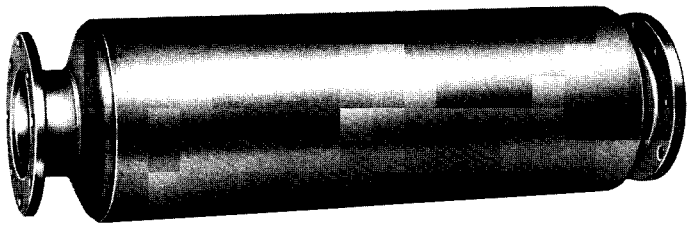
Specifications
SU5 Series

Annular Flow Silencer

NOTE: SU5 Series Standard Paint and Acoustical Packing are suitable for 325°F.

Typical Attenuation Curve

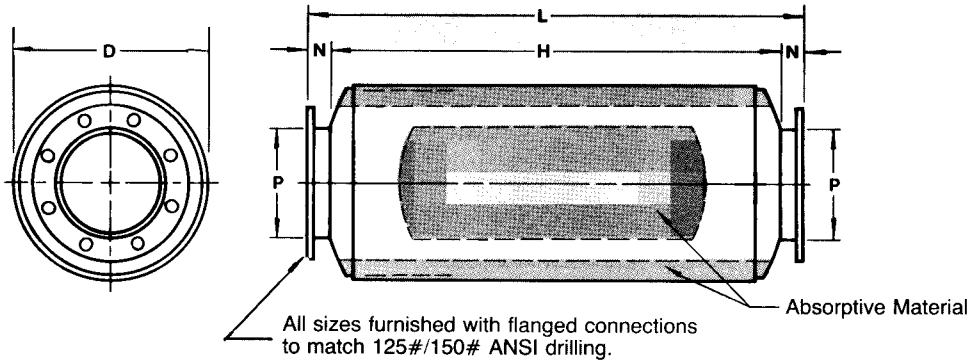




The SU5 series is our highest grade standard Absorptive silencer. Its design consists of two concentric perforated cylinders lined with acoustical pack, forming an annular flow path. This design features blocked-line-of-sight, while providing full flow area for low flow resistance. Mild steel construction, primer coated exterior.

Common Applications:

- Inlet and discharge of high speed, low pressure Centrifugal Compressors and Blowers (discharge P<15 psig)
- Inlet and discharge of Industrial Fans
- Inlet of high pressure Centrifugal Compressors
- Gas Turbine inlet
- Dry Vacuum Pump discharge
- Some low-pressure vents (<15 psig)
- Any high frequency noise source



MODEL	P	D	L	N	H	WGT.
SU5-4	4	10	21½	3	15½	30
SU5-5	5	12	26	3	20	55
SU5-6	6	12	26	3	20	60
SU5-8	8	18	36	3½	29	120
SU5-10	10	20	44½	3½	37½	195
SU5-12	12	24	53	3½	46	290
SU5-14	14	26	61½	3½	54½	390
SU5-16	16	28	68	3½	61	500
SU5-18	18	30	74	3½	67	650
SU5-20	20	36	78	4½	69	950
SU5-22	22	36	89	4½	80	1,080
SU5-24	24	42	91	4½	82	1,400
SU5-26	26	42	102	4½	93	1,580
SU5-28	28	48	104	4½	95	2,200
SU5-30	30	48	115	4½	106	2,600
SU5-32	32	54	128	6	116	3,150
SU5-34	34	60	136	6	124	3,600
SU5-36	36	60	145	6	133	4,500
SU5-42	42	66	170	6	158	6,200
SU5-48	48	78	186	6	174	8,200
SU5-54	54	84	198	6	186	10,300
SU5-60	60	90	210	6	198	12,500

Dimensions in Inches - Weight in Pounds