Malfar Mechanical Inc.
144 Woodstream Boulevard, Woodbridge, Ontario L4L 7Y3
Tel: (905) 850-1242 - Fax: (905) 850-2630 - www.malfar.ca

Submittal

21-03 — FORESTSIDE ESTATES **Subject : Domestic Booster Package & Drawdown Tank (P-1)**

To

Vince Staffieri
Royal Pine Homes
3550 Langstaff Road
Suite 200
Woodbridge, ON L4L 9G3
Phone No: 416-213-7181
Mobile: 647-287-4136
Fax No: 905-856-6543
vince@royalpinehomes.com

Return To

Gaurav Sharma
Malfar Mechanical Inc.
144 Woodstream Blvd.
Woodbridge, ON L4L 7Y3
Phone No: 905-850-1242
Fax No: 905-850-2630
gauravs@malfar.ca

Copy To

Number :	**4**
Spec Section No :	22 11 13
Submittal Number:	4
Date Sent :	3/30/2021
Type :	Original Submittal
Method Sent :	Email
Reason For Sending :	For Approval
Status :	Pending

UNITED ENGINEERING INC.
PROFESSIONAL CONSULTING ENGINEERS

THIS SHOP DRAWING IS:
- [x] REVIEWED
- [ ] REVIEWED AS MODIFIED
- [ ] REVISE AND RESUBMIT
- [ ] SUBMIT HYDRO FOR APPROVAL

The review of these shop drawings is for general design only and shall not relieve the contractor from conforming to the contrct drawings and specifications.

All dimensions and sizes shall be checked

DATE:	CHECKED BY:	
Apr.8, 2021	MECH.	L. Matthews
	ELEC.	

Details

none

Notes

*Please return submitted items by **4/13/2021**.*

Signed By:

Gaurav Sharma
Project Coordinator

Dated: 3/30/2021

Submittal

To: MALFAR MECHANICAL **Date:** 2020-03-08

Attn: AJAY BAGHEL

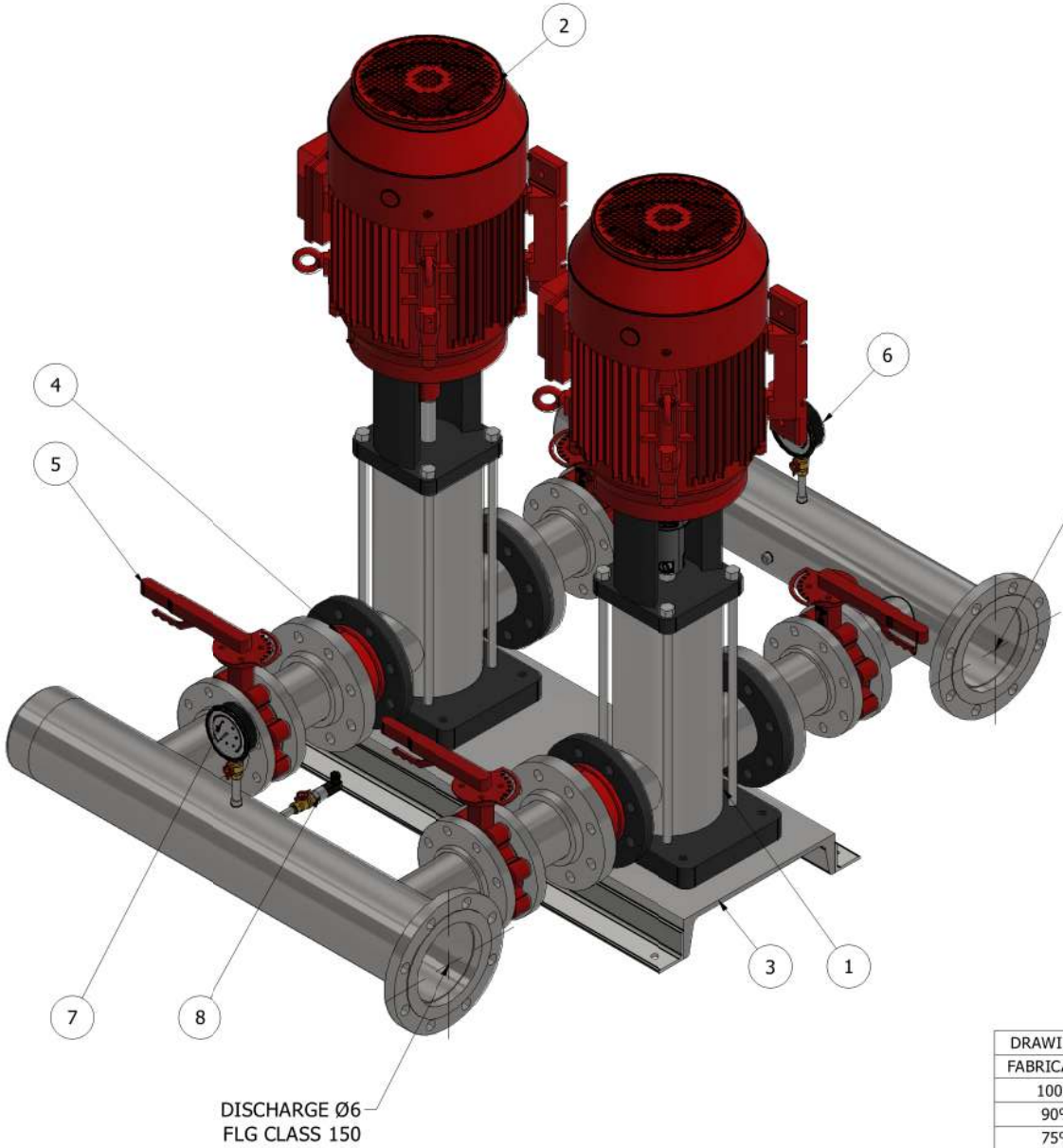
Project Name: FOREST SIDE ESTATES
Danfoss Sales Office: Kildonan Energy Products
Kildonan Job # 23656
Submittal for: _____ **Record**
X **Approval**

Approved By: _____
Released For: _____
Manufacturing and Shipment: _____
Hold For Release: _____
Approved: _____
Approved as Noted: _____
Disapproved: _____
Explanation for Disapproval: _____

Explanation: SHOP DRAWINGS - BOOSTER PACKAGE SUBMITTALS

Please Return Drawings to:

Kildonan Energy Products
195 Clayton Drive, Unit 8 & 9
Markham, On, L3R 7P3
Attn: Arash Ahmadi
aahmadi@kildonanenergy.com



PARTS LIST		
ITEM	DESCRIPTION	ITEM QTY
1	MULTISTAGE PUMP MODEL PSM85-20-2	2
2	MOTOR 25HP	2
3	STEEL BASE	1
4	BRAY WAFER CHECK VALVE 4" - CLASS 150	2
5	BRAY BUTTERFLY VALVE 4" CL-150	4
6	LEAD FREE PRESSURE GAUGE - 0-100 PSI	1
7	LEAD FREE PRESSURE GAUGE - 0-200 PSI	1
8	PRESSURE TRANSMITTER	1

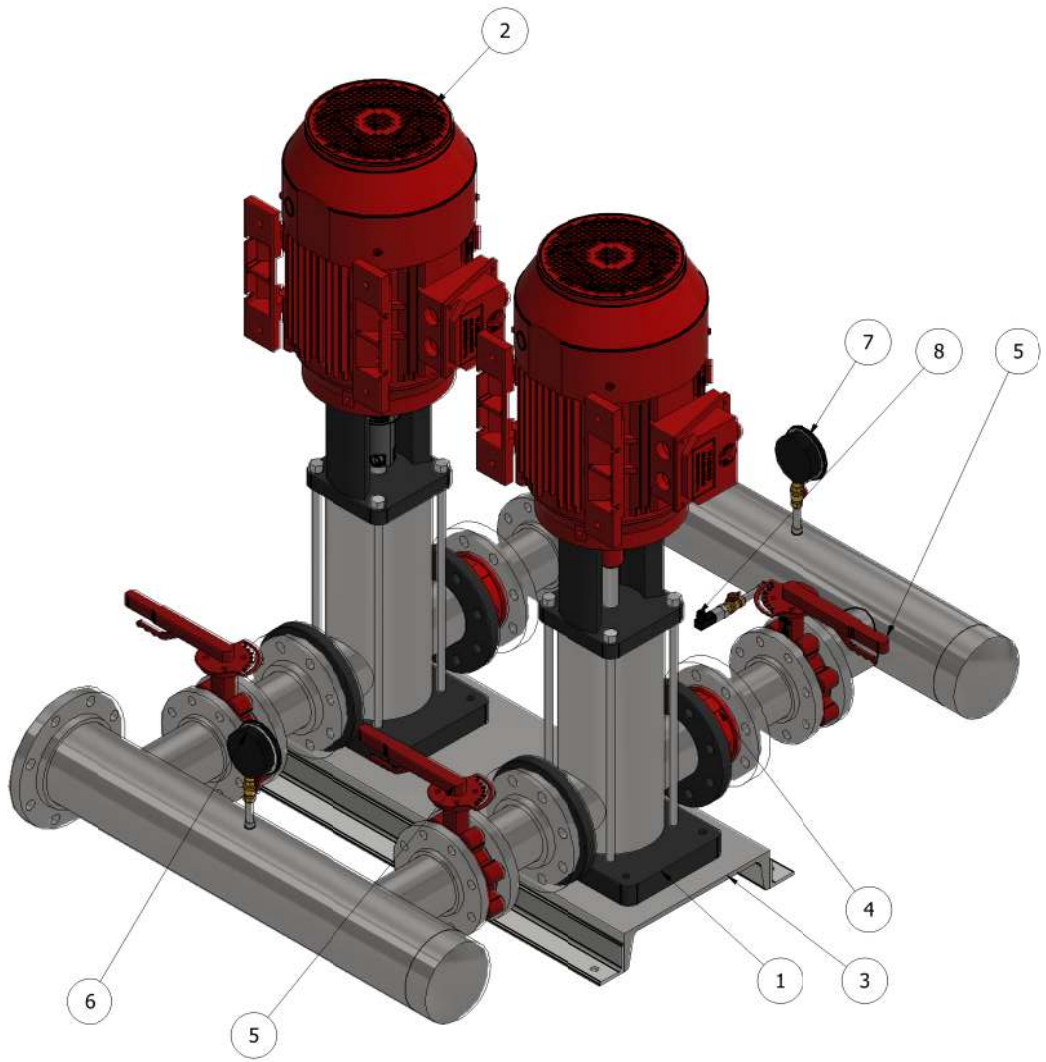
REVISION HISTORY		
REV	DESCRIPTION	DATE
1	PRELIMINARY DRAWINGS (C.T.)	2018-07-03

THIS DRAWING MUST BE SENT WITH PURCHASE ORDER

DESIGNER: Khalid	DATE: 2021-03-08
TITLE / TITRE: Duplex booster system	
PROJECT / PROJET: Forestside Estate Brampton -Final	
CUSTOMER / CLIENT: KILDONAN ENERGY	
QUOTE: 143168	TAG: P-1
DWG NO.	REV: 1
SCALE / ECHELLE: 0.12	JOB NO.
SHEET 1 OF 3	

DRAWING %	
FABRICATION	
100%	
90%	X
75%	
50%	
PRELIMINARY	

MONTREAL, (QC), CANADA
TORONTO, (ON), CANADA
LAKE WORTH, (FL), USA
WWW.FLOFAB.COM



PARTS LIST		
ITEM	DESCRIPTION	ITEM QTY
1	MULTISTAGE PUMP MODEL PSM85-20-2	2
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6	LEAD FREE PRESSURE GAUGE - 0-100 PSI	1
7	LEAD FREE PRESSURE GAUGE - 0-200 PSI	1
8	PRESSURE TRANSMITTER	1

THIS DRAWING MUST BE SENT WITH PURCHASE ORDER

DESIGNER: Khalid
DATE: 2021-03-08
TITLE / TITRE:
PROJECT / PROJET: Forestside Estate Brampton -Final
CUSTOMER / CLIENT: KILDONAN ENERGY
QUOTE: 143168
TAG: P-1
DWG NO.:
REV: 1
SCALE / ECHELLE: 0.11
JOB NO.:
SHEET 2 OF 3

MONTREAL, (QC), CANADA
TORONTO, (ON), CANADA
LAKE WORTH, (FL), USA
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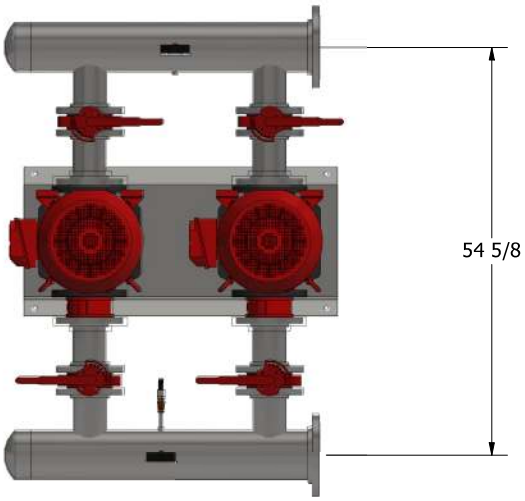
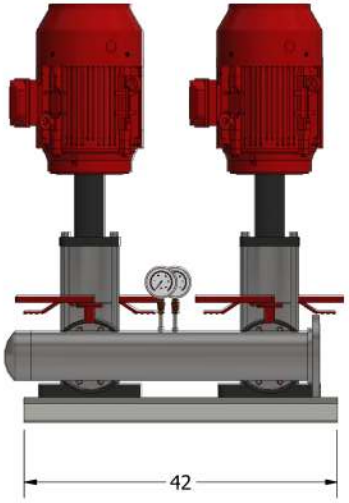
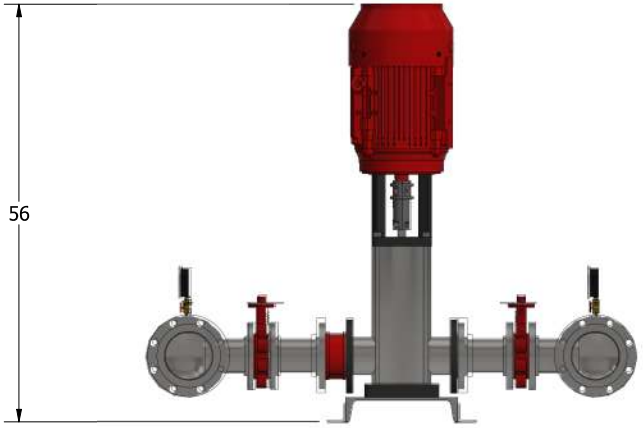






THIS DRAWING MUST BE SENT WITH PURCHASE ORDER

DESIGNER: Khalid	DATE: 2021-03-08
TITLE / TITRE:	
PROJECT / PROJET: Forestside Estate Brampton -Final	
CUSTOMER / CLIENT: KILDONAN ENERGY	
QUOTE: 143168	TAG: P-1
DWG NO.	REV: 1
SCALE / ECHELLE: 0.06	JOB NO.

MONTREAL, (QC), CANADA
TORONTO, (ON), CANADA
LAKE WORTH, (FL), USA
WWW.FLOFAB.COM

March 08, 2021

Quote:	Job Name:
143168	Forestside Estate Brampton -Final

Tag	Qty
P-1	1

System Description

Flo Fab Duplex booster system series D-CPS-Variable Frequency Drive consisting of:

Pumps with motors,
Butterfly valve(s),
Check valves,
Pressure gauge(s),
Suction and 1 discharge headers fabricated in stainless steel,
Pressure transducer
Variable frequency drive VFD
System are UL/C-UL and NSF/ANSI-61 compliant

All is factory tested and assembled on structural steel baseplate.

Tag	Qty
Duplex Booster Pumps	2

Pump Information

Pump Type	Pump Model	Construction	Manufacturer
PSM Multi Stage Pumps	PSM85-20-2	All Stain. Steel 304	Flo Fab

Flange Type	Glycol(%)	Head	Flow Rate	Impeller Diameter
250 lbs	0.00	184	280 U.S. GPM (63.58 M³/H or 17.66 L/Sec.)	5.73

Pump Notes

Motor Information

Power	Frame	Volt/PH/Hz	Design RPM	Type	Manufacturer	Motor Efficiency
25	256T	575/3/60	3450	TEFC	Factory s choice	Premium Efficiency

Motor Notes

Total Weight	Suction	Discharge
940.80 lbs (426.73 kg)	4	4

March 08, 2021

Pump data sheet

Pump Model	Pump Type	FLOW	HEAD	IMP. DIA	BHP	NOL	NPSHR	EFF
PSM85-20-2	PSM Multi Stage Pumps	280.00	184	5.73	24.80	24.80	1.33 ft	

Pump Dimensions (All dimensions are in inches. For certified dimensions, you must contact factory .)

Weight	Suct	Disc
580.80 lbs	4	4

Suct	Disc	PL	H	G	ST	SA	SG	SF	SD	SN	SE	BM	BY1	BL	BW	CDLF 85-20 -2
4	4	35.515	5.515	14.375	1.328	3.937	5.515	10	0.906	8	7.875	7.484	10.468	9.890	13.031	

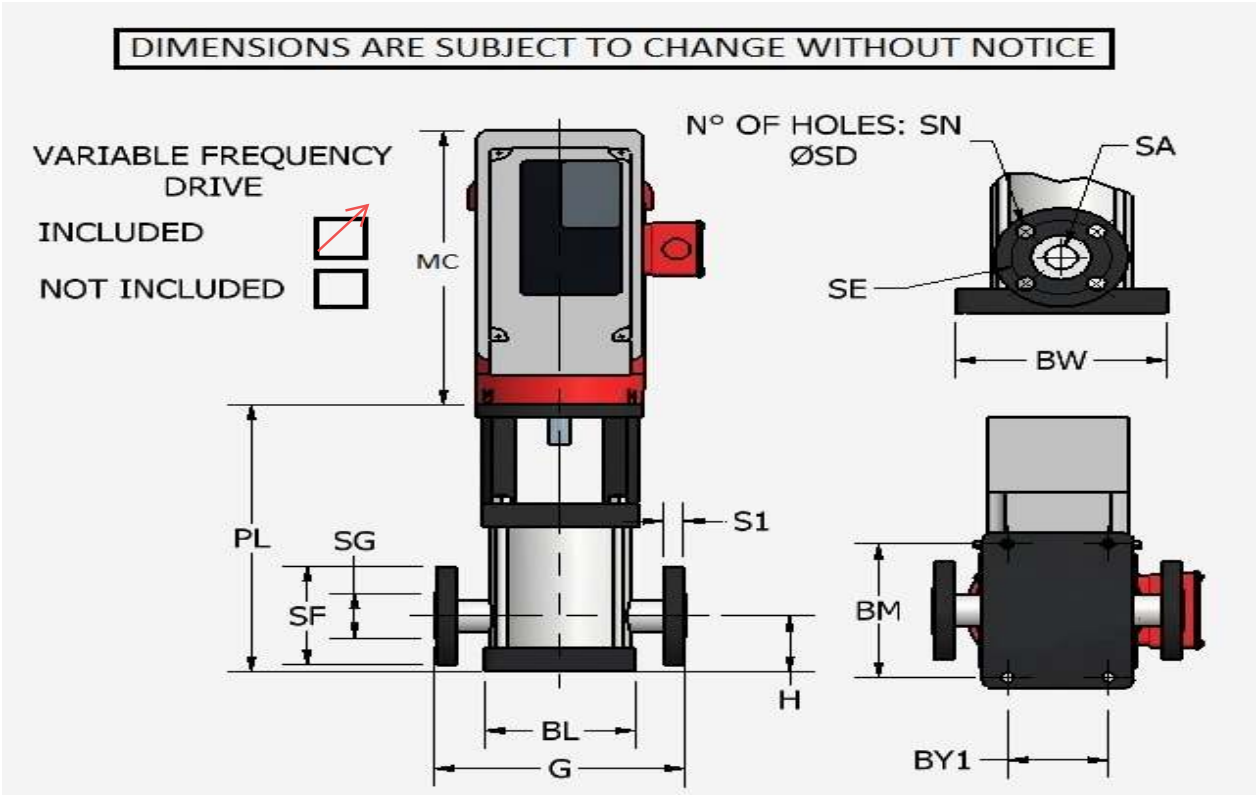
Premium Efficiency Motor: (Volt/PH/Hz)575/3/60 TEFC

(All dimensions are in inches. For certified dimensions, you must contact factory .)

hp	frame	weight	MC	MP	MBA	MJB	MD	Md1	MA/BA	MB/BB	BH	MF/BF	ME/BE	MR/BR
25	256T	360	26	14.5	4.25	10	6.25	0.519	15	36	3.4	34	12	1

Total Weight 940.80 lbs (426.73 kg)

Flange Type	250 lbs
Construction	All Stain. Steel 304
Max. Casing PSI	300 PSIG / 2068 KPa



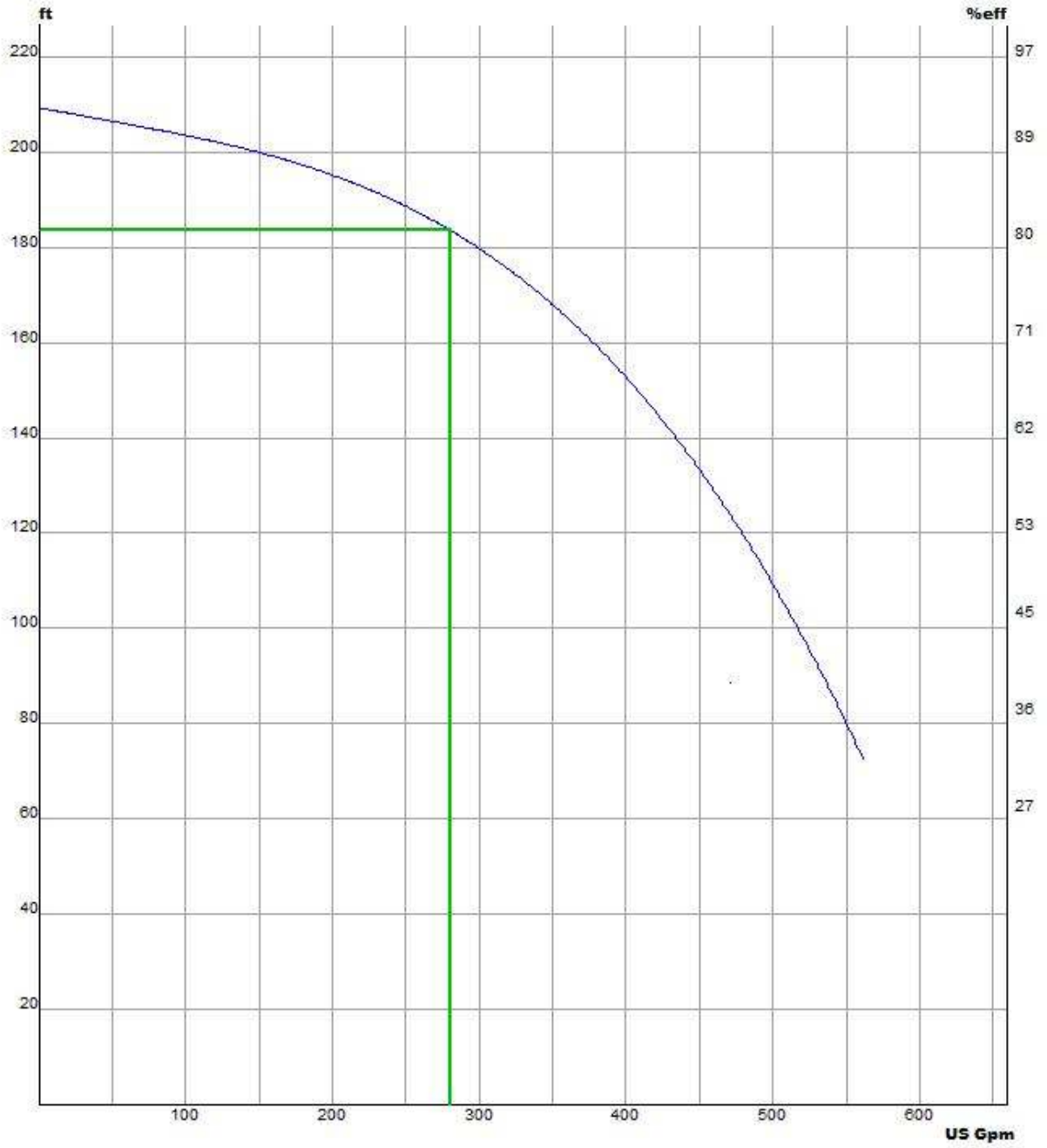
Job	Forestside Estate Brampton -Final
Client	
Engineer	
Tag	Duplex Booster Pumps

March 08, 2021

Pump data sheet (ZOOM)

Model	Type	US GPM	HEAD	IMP. DIA	BHP	NOL	NPSHR	EFF
PSM85-20-2	PSM Multi Stage Pumps	280.00	184	5.73	24.80	24.80	1.33 ft	

Performance Curve



PSM 60Hz

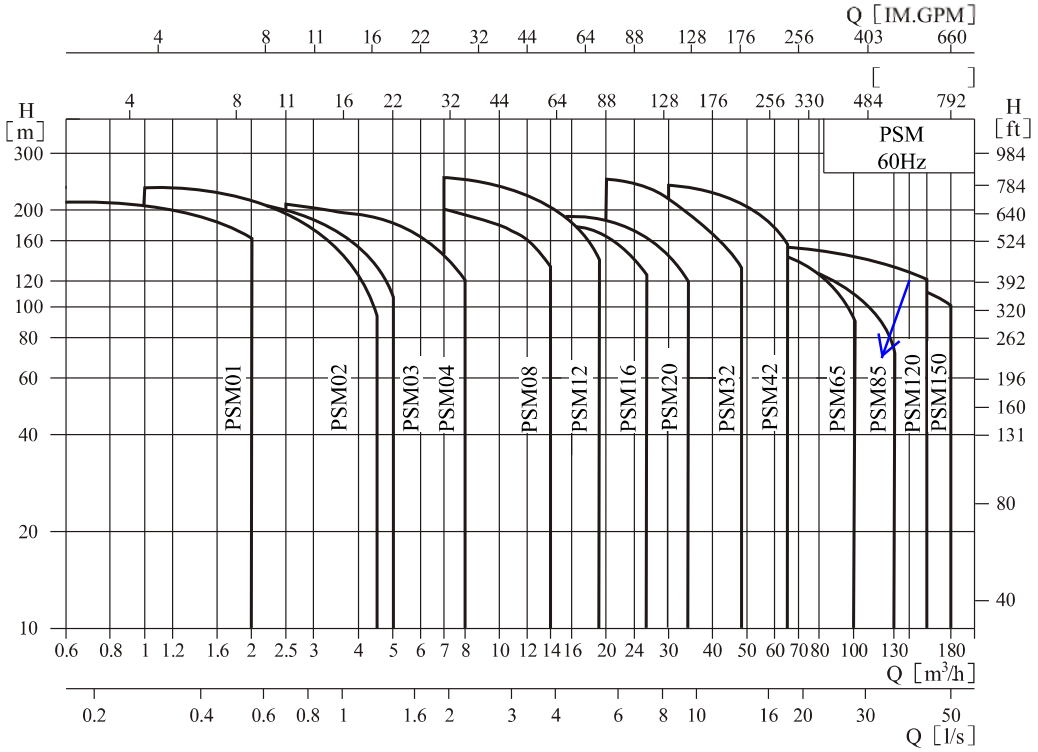
LIGHT VERTICAL MULTISTAGE CENTRIFUGAL PUMP FOR NEMA C-FRAME MOTORS

FLO FAB

www.flofab.com

General Data

Performance scope



Product range

Model	PSM01	PSM02	PSM03	PSM04	PSM08	PSM12	PSM16	PSM20	PSM32	PSM42	PSM65	PSM85	PSM120	PSM150
Rated Flow usgpm	**4,4**	**8,8**	**13,2**	**17,6**	**35,2**	**52,8**	**70,4**	**88**	**140,8**	**184,8**	**286**	**374**	**52,8**	**660**
Rated Flow (m3/h)	1	2	3	4	8	12	16	20	32	42	65	85	12	150
Rated Flow (l/s)	0,28	0,56	0,83	1,1	2,2	3,3	4,4	5,6	8,9	11,7	18	24	33	41,6
Flow Range usgpm	**2.6-8**	**6.1-22**	**6.6-22**	**11-35.**	**30-62**	**30-83**	**44-114**	**52-150**	**88-211**	**132-286**	**176-440**	**264-572**	**264-704**	**352-792**
Flow Range (m3/h)	0.6-2	1-4.5	1.5-5	2.5-8	7.14.	7,19	10.26.	12,34	20,48	30,65	40.100.	60.130.	60.160.	80.180.
Flow range (l/s)	0.17-0.56	0.28-1.25	0.42-1.4	0.7-2.2	1.9-3.9	1.9-5.3	2.8-7.2	3.3-9.4	5.5-13.3	8.3-18	11.1-27.7	16.7-36.1	16.7-44.4	22-50
Max pressure psi	**323,4**	**345,45**	**338,1**	**308,7**	**294**	**367,5**	**294**	**294**	**367,5**	**382,2**	**264,6**	**220,5**	**220,5**	**205,8**
Max pressure (bar)	22	23,5	23	21	20	25	20	20	25	26	18	15	15	14
Motor HP	**0.5-5**	**0.75-5**	**0.5-5**	**1-7.5**	**1-15.**	**1.5-20**	**3-25.**	**3-25.**	**5-40.**	**7.5-60**	**10-60.**	**15-60**	**25-100**	**20-100**
Motor power (kw)	0.37-3	0.55-4	0.37-4	0.75-5.5	0.75-11	1.1-15	2.2-18.5	2.2-18.5	3-30.	5.5-45	7.5-45	11.45.	18.5-75	15-75
Temperature F	**5 @ 248**													
Temperature (C)	-15 @ 120													
Max Efficency (%)	**44**	**46**	**54**	**59**	**64**	**63**	**66**	**69**	**76**	**78**	**80**	**81**	**74**	**73**
Flange connection ANSI	**1**	**1**	**1**	**1 1/4**	**1 1/2**	**2**	**2**	**2**	**2 1/2**	**3**	**4**	**4**	**5**	**5**
Flange connection (DIN)	**DN25**	**DN25**	**DN25**	**DN32**	**DN40**	**DN50**	**DN50**	**DN50**	**DN65**	**DN80**	**DN100**	**DN100**	**DN125**	**DN125**
Flange Oval NPT	**1**	**1**	**1**	**1 1/4**	**1 1/2**									
Flange Oval (pipe)	G1	G1	G1	G1 1/4	G1 1/2									
Flange cutting ferrule joint	**DN25**	**DN25**	**DN25**	**DN32**	**DN40**	**DN50**	**DN50**	**DN50**						
Threaded	1	1	1	1 1/4	1 1/2									

General Data

Pump

PSM is a kind of vertical non-self priming multistage centrifugal pump, which is driven by a standard electric motor. The motor output shaft directly connects with the pump shaft through a coupling. The pressure-resistant cylinder and flow passage components are fixed between pump head and inlet & outlet section with stay bolts. The inlet and outlet are located at the pump bottom at the same plane. This kind of pump can be equipped with an intelligent protector to effectively prevent it from dry-running, out-of-phase and overload.

Motor

- Full-enclosed air-blast two-pole standard motor
- Protection class: IP55
- Insulation class: F
- Standard voltage:60Hz: 3×200-230 / 346-400V
  3×220-255 / 380-440V
  3×220-277 / 380-480V

Application

PSM is a kind of multifunctional products. It can be used to convey various medium from tap water to industrial liquid at different temperature and with different flow rate and pressure. PSM is applicable to conveying non-corrosive liquid, while PSM is suitable for slightly corrosive liquid.

- Water supply: Water filter and transport in Waterworks, boosting of main pipeline, boosting in high-rise buildings.
- Industrial boosting: Process flow water system, cleaning system, high-pressure washing system, fire fighting system.
- Industrial liquid conveying: Cooling and air-conditioning system, boiler water supply and condensing system, machine-associated purpose, acids and alkali.
- Water treatment: Ultrafiltration system, reverse osmosis system, distillation system, separator, swimming pool.
- Irrigation: Farmland irrigation, spray irrigation, dripping irrigation.

Operation conditions

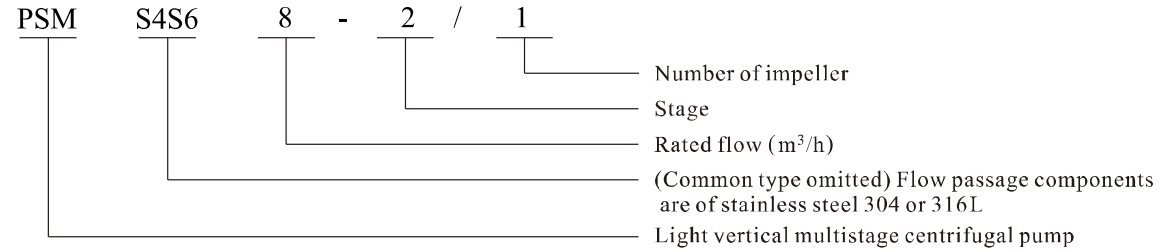
- Thin, clean, non-flammable and non-explosive liquid containing no solid granules and fibers.
- Liquid temperature:

Normal temperature type: -15℃～+70℃,
Hot water type: +70℃～+120℃

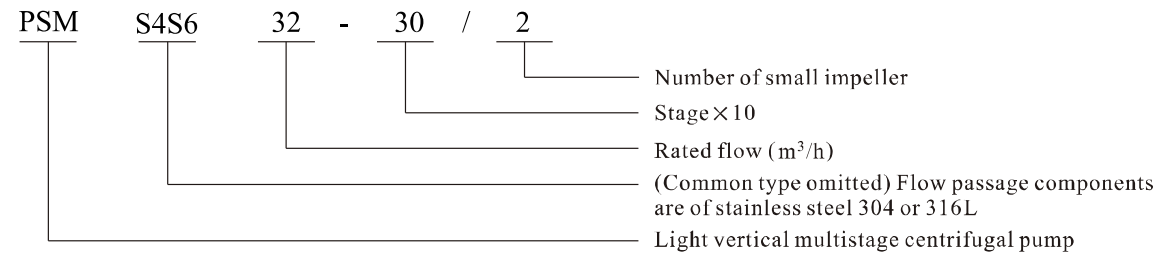
- Ambient temperature: up to +40℃
- Altitude:up to 1000m

Definition of Model

PSM01, 02, 03, 04, 08, 12, 16 and 20



PSM32, 42, 65, 85, 120 and 150



Max inlet pressure

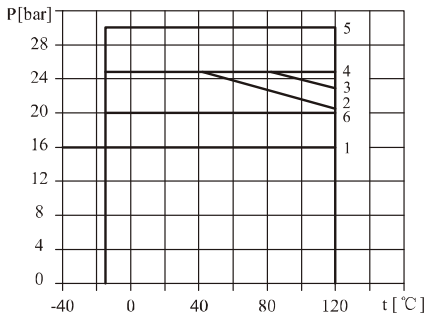
The maximum inlet pressure is shown in the table below. But the actual inlet pressure plus the valve close pressure of the pump shall be lower than the max. allowable working pressure.

MODEL	Max inlet pressure psi	Max inlet pressure Bar
PSM01		
1-2 to 1-6	88,26	6
1-7 to 1-25	147,1	10
PSM02		
2-2.	88,26	6
2-3 to 2-7	147,1	10
2-9 to 2-18	220,65	15
PSM03		
3-2 to 3-5	88,26	6
3-6 to 3-19	147,1	10
3-20 to 3-25	220,65	15
PSM04		
4-2.	88,26	6
4-3 to 4-8	147,1	10
4-10 to 4-16	220,65	15
PSM08		
8-2/1 to 8-5	88,26	6
8-6 to 8-14	147,1	10
PSM12		
12-2/1 to 12-4	88,26	6
12-5 to 12-14	147,1	10
PSM16		
16-2/1 to 16-2	88,26	6
16-3 to 16-10	147,1	10
PSM20		
20-1 to 20-2	88,26	6
20-3 to 20-10	147,1	10
PSM32		
32-10-1 to 32-30-2	58,84	4
32-30 to 32-70	147,1	10
32-80-2 to 32-100-2	220,65	15
PSM42		
42-10-1 to 42-20-2	58,84	4
42-20 to 42-40-2	147,1	10
42-40 to 42-70	220,65	15
PSM65		
65-10-1 to 65-20-2	58,84	4
65-20 to 65-30-2	147,1	10
65-30 to 65-50-2	220,65	15
PSM85		
85-10-1 to 85-10	58,84	4
85-20-2 to 85-20	147,1	10
85-30-2 to 85-40-2	220,65	15
PSM120, PSM150	220,65	**15**

Max working pressure

MODEL	curve number
PSM01	
1-2 to 1-17	1
1-19 to 1-25	2
PSM02	
2-2.to 2-11	1
2-13 to 2-18	2
PSM03	
3-2 to 3-15	1
3-17 to 3-25	2
PSM04	
4-2 to 4-10	1
4-12 to 4-16	2
PSM08	
8-2/1 to 8-8	1
8-10 to 8-14	3
PSM12	
12-2/1 to 12-7	1
12-8 to 12-14	3
PSM16	
16-2 to 16-6	1
16-7 to 16-10	3
PSM20	
20-1 to 20-4	1
20-5 to 20-10	3
PSM32	
32-10-1 to 32-50-2	1
32-50 to 32-90-2	4
32-90 to 32-100-2	5
PSM42	
42-10-1 to 42-30	1
42-40-2 to 42-60	4
42-70-2 to 42-70	5
PSM65	
65-10-1 to 65-30	1
65-40-2 to 65-50-2	4
PSM85	
85-10-1 to 85-30	1
85-40-2	4
PSM120, PSM150	6

The following figure shows the limitation of pressure and temperature, which shall be in the scope as shown in the figure.



Minimum inlet pressure NPSH

In case that the pressure in pump is lower than the steampressure used to convey liquid, the cavitations will occur. To avoid cavitations, a minimum pressure at the inlet side of the pump shall be guaranteed. The maximum suction stroke can be calculated with following formula:

H= Pb X 10.2-NPSH-Hf-Hv-Hs

Pb=atmosphere pressure [bar]

(can be set as lbar)

In a closed system, Pb means system pressure [bar]

NPSH= Net positive suction head [m]

(It can be read out from the point of possible max. flow rate shown on NPSH curve)

Hf=Pipeline loss at the inlet [m]

Hv= Steam pressure [m]

Hs= Safety margin= Minimum 0.5m delivery head

If the calculated result H is positive, the pump may run under the max. Suction stroke H.

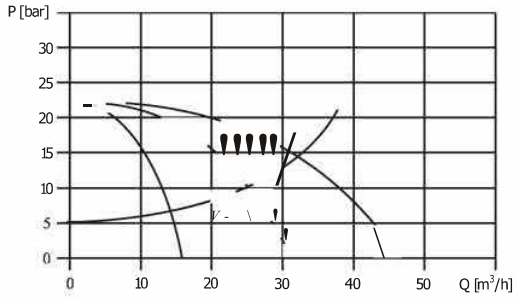
In case the calculated result H is negative, a delivery head of min. Inlet pressure is necessary.

Operation in parallel

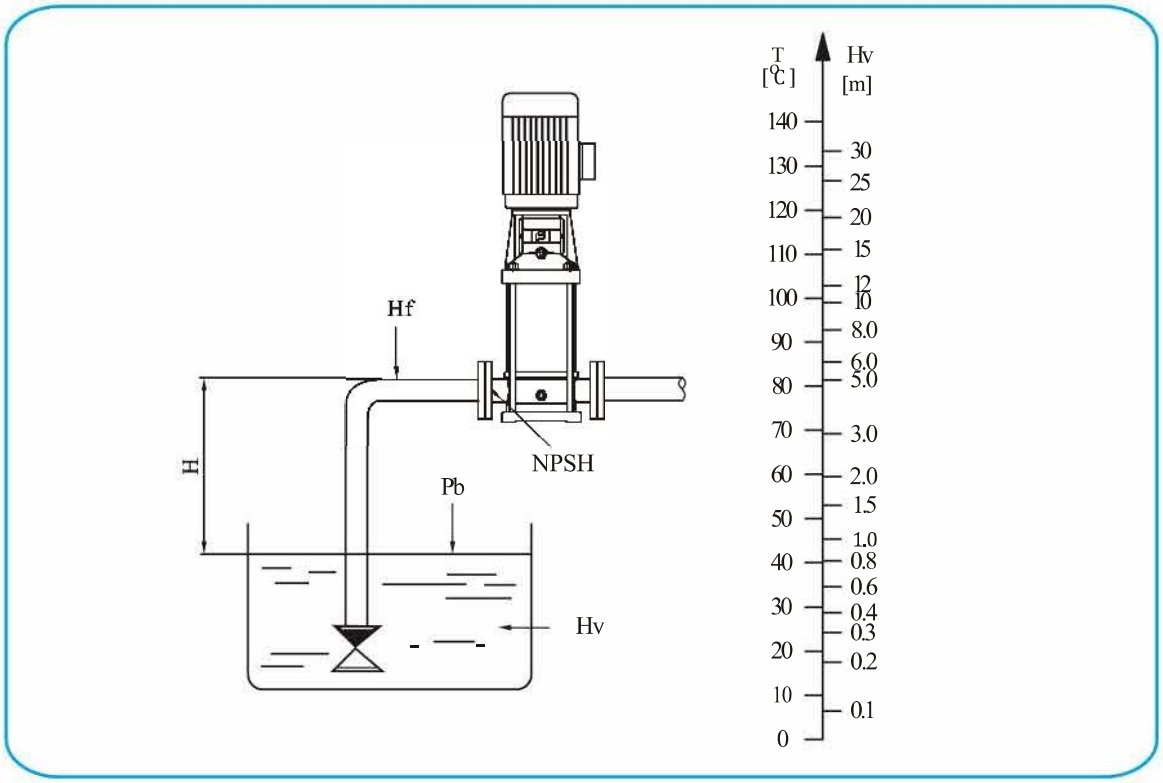
Connecting several pumps in parallel running will benefit much more than running a single large pump.

•Applicable to different working states necessary in a variable flow system.

• Increasing the possibility of water supply when the pump is in failure. Because in case of pump failure, only part of the system flow is effected.



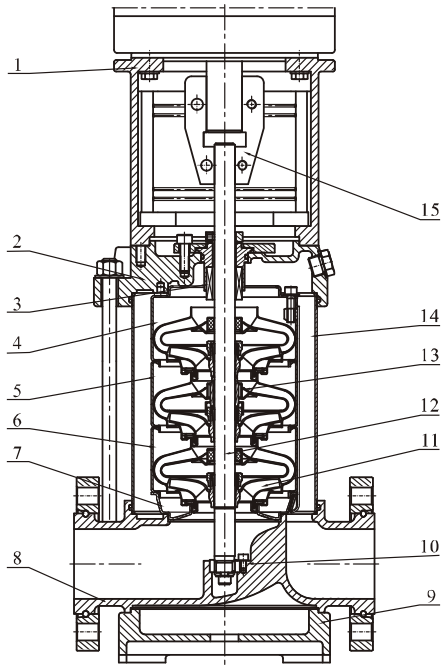
Iwo pumps or more can be connected in parallel running if necessary.



Check and ensure that the pump is not at cavitations state.

General Data

Section Drawing PSM32, 42, 65, 85



Material PSM32, 42, 65, 85

NO.	Name	Material	AISI/ASTM
1	Bracket	Cast iron	ASTM25B
3	Mechanical seal		
4	Top diffuser	Stainless steel	AISI304
5	Support diffuser	Stainless steel	AISI304
6	Diffuser	Stainless steel	AISI304
7	Inducer	Stainless steel	AISI304
9	Base plate	Cast iron	ASTM25B
10	Bottom bearing	Tungsten carbide	
11	Impeller	Stainless steel	AISI304

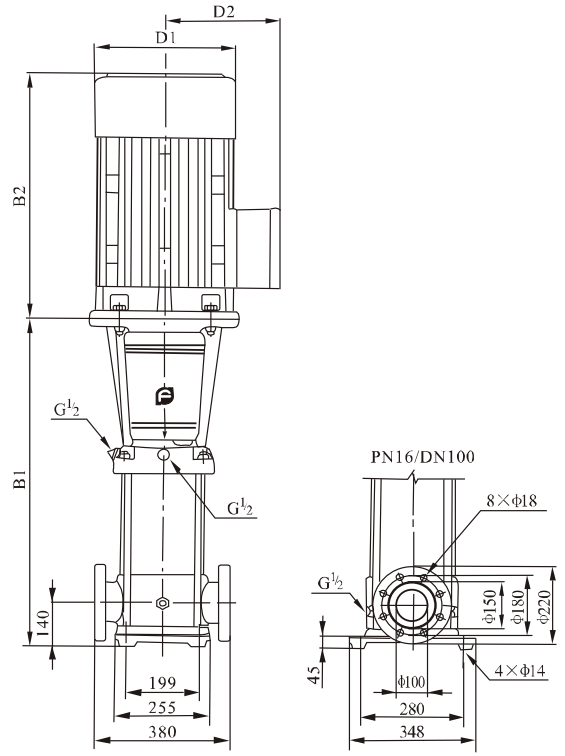
NO.	Name	Material	AISI/ASTM
12	Shaft	Stainless steel	AISI316L AISI304 AISI431
13	Intermediate bearing	Tungsten carbide	
14	Cylinder	Stainless steel	AISI304
15	Coupling	Carbon steel	
	Rubber parts	NBR	
PSM			
2	Pump head	Cast iron	ASTM25B
8	Inlet and outlet chamber	Cast iron	ASTM25B
PSMS4S6			
2	Pump head	Stainless steel	AISI304
8	Inlet and outlet chamber	Stainless steel	AISI304

Technical Data

Performance table

Model	Motor HP	Motor KW	USGPM / Q (m3h)	264 / 60	308 / 70	352 / 80	374 / 85	396 / 90	440 / 100	484 / 110	528 / 120	572 / 130
PSM85-10-1	15	11	feet head	101,68	88,56	82	78,72	75,44	68,88	59,04	45,92	29,52
			H (meter)	31	27	25	24	23	21	18	14	9
PSM85-10	20	15	feet head	118,08	114,8	108,24	101,68	98,4	95,12	85,28	75,44	59,04
			H (meter)	36	35	33	31	30	29	26	23	18
PSM85-20-2	25	18,5	feet head	193,52	186,96	177,12	167,28	157,44	144,32	127,92	104,96	72,16
			H (meter)	59	57	54	51	48	44	39	32	22
PSM85-20-1	30	22	feet head	219,76	213,2	203,36	193,52	186,96	167,28	154,16	134,48	108,24
			H (meter)	67	65	62	59	57	51	47	41	33
PSM85-20	40	30	feet head	249,28	239,44	226,32	216,48	209,92	196,8	183,68	170,56	144,32
			H (meter)	76	73	69	66	64	60	56	52	44
PSM85-30-2	50	37	feet head	321,44	308,32	288,64	278,8	268,96	246	226,32	193,52	150,88
			H (meter)	98	94	88	85	82	75	69	59	46
PSM85-30-1	50	37	feet head	354,24	341,12	321,44	308,32	295,2	272,24	255,84	226,32	183,68
			H (meter)	108	104	98	94	90	83	78	69	56
PSM85-30	60	45	feet head	380,48	364,08	344,4	334,56	318,16	305,04	288,64	259,12	226,32
			H (meter)	116	111	105	102	97	93	88	79	69
PSM85-40-2	60	45	feet head	462,48	442,8	419,84	406,72	387,04	357,52	334,56	291,92	236,16
			H (meter)	141	135	128	124	118	109	102	89	72

Installation sketch



Size and weight

Model		B1	B2	D1	D2	Weight lbs	Weight kgs
PSM85-10-1	inches	22,269	19,11	12,87	9,945	404,8	184
	mm	571	490	330	255		
PSM85-10	inches	22,269	19,11	12,87	9,945	404,8	184
	mm	571	490	330	255		
PSM85-20-2	inches	30,147	21,45	12,87	9,945	580,8	264
	mm	773	550	330	255		
PSM85-20-1	inches	30,147	23,01	14,04	11,115	580,8	264
	mm	773	590	360	285		
PSM85-20	inches	30,03	25,74	15,6	12,09	723,8	329
	mm	770	660	400	310		
PSM85-30-2	inches	33,735	25,74	15,6	12,09	798,6	363
	mm	865	660	400	310		
PSM85-30-1	inches	33,735	25,74	15,6	12,09	798,6	363
	mm	865	660	400	310		
PSM85-30	inches	33,735	27,3	17,94	13,26	798,6	363
	mm	865	700	460	340		
PSM85-40-2	inches	37,323	27,3	17,94	13,26	946	430
	mm	957	700	460	340		

The overall dimensions of the single-phase motor and explosion-proof motor are a little different. Pls contact us for details.

Technical Documentation

PDH02525C

Optim TEFC | AEHH8N-CF

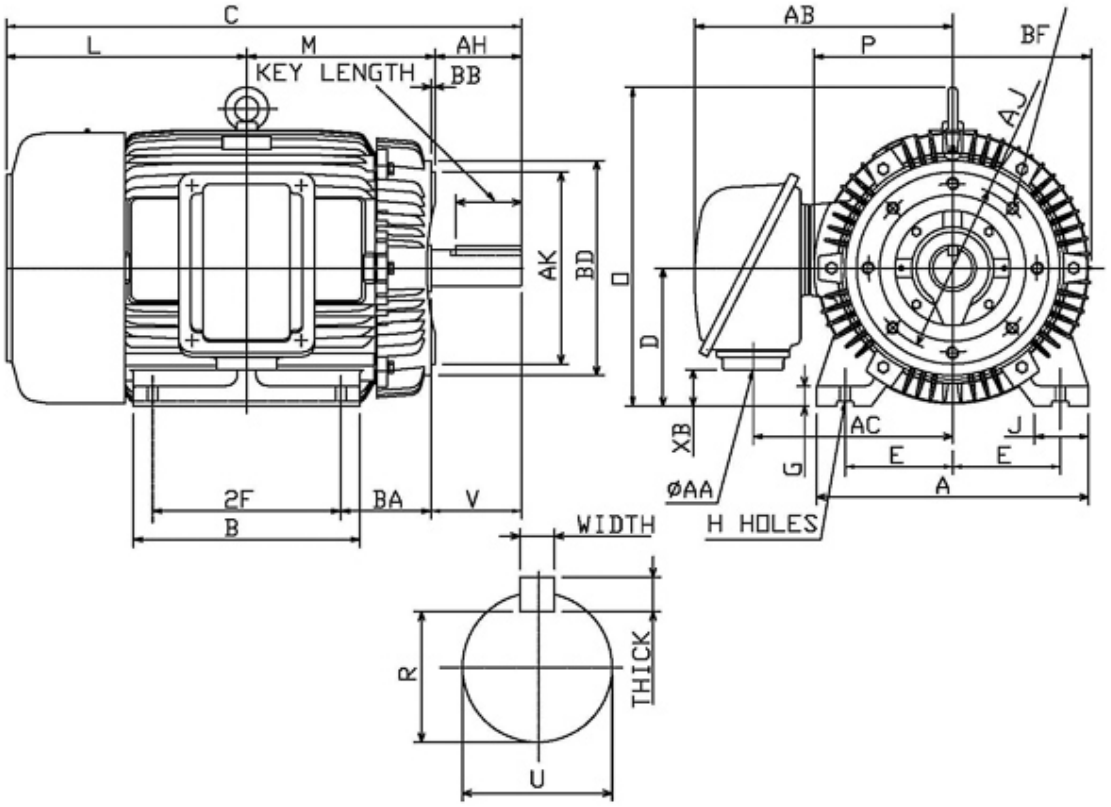
Date: March 8, 2021

TECO Westinghouse
MOTORS (CANADA) INC.

Date: March 8, 2021

Dimensional Drawing

Catalogue	Model	HP	Pole	kW	Rating	Voltage	Hz	RPM
PDH02525C	AEHH8N-CF	25	2	18.65	Continuous	575	60	3600



Frame Size	Mounting					A	B	C	CD	D
	E	2F	2F2	H	BA					
284TSC	5.5	9.5		0.53	4.75	14	11.7	25.43		7

G	J	K	L	M	O	P	T	Key			Keyseat
								Width	Thick	Length	R
0.7	2.95		12.68	9.31	14.52	15.04	1.97	0.375	0.375	1.93	1.416

Terminal Housing				Aux Box		C/D Flange					
AA	AB	AC	XB	AE	AX	BB	AH	AK	BD	AJ	BF
1.25 NPT	12.28	9.84	3.97			0.25	3	10.5	11.22	9	1/2-13UNC

Shaft Extension			Bearings		Approx. Weight Lbs	SPL dBA/3ft	Ins. Class	S.F.	Drive Method	Dimensions
N-W	U	V	DE	NDE						
3.25	1.625	3.2	6211C3	6211C3	417	76.0	F	1.15	Direct Coupling	Inches

TECO Westinghouse MOTORS (CANADA) INC.

Date: March 8, 2021

Technical Data Sheet

Motor Type: AEHH8N-CF	Catalogue No: PDH02525C

Nameplate Information

HP	Pole	RPM	Frame	Voltage	Hz	Phase
25	2	3545	284TSC	575	60	3

Enclosure	Ins. Class	Service Factor	Time Rating	NEMA Design	Rated Amb.	Rated Altitude
TEFC	F	1.15	Continuous	B	-40 to 40 °C	<1000 m

Typical Performance

Efficiency (%)				Power Factor (%)		
Full Load		3/4 Load	1/2 Load	Full Load	3/4 Load	1/2 Load
Nom.	Min.					
92.40	91.00	93.00	92.40	91.00	90.50	86.50

Torque				Current (A)		
Full Load (lb-ft)	Locked Rotor (% FLT)	Pull Up (% FLT)	Break Down (% FLT)	No Load	Full Load	Locked Rotor
37.03	175	135	250	4.5	22.3	146.40

NEMA KVA Code	Inertia (WR^2)			Safe Stall Time (s)		Noise Level Sound Press. dB(A)
	Rotor ($lb\text{-}ft^2$)	NEMA Load ($lb\text{-}ft^2$)	Max. Allowable ($lb\text{-}ft^2$)	Cold	Hot	
G	2.507	26.00	54.17	17	12	76.0

VFD Duty Information

Speed Range			VFD		S.F.
Constant Torque	Variable Torque	Constant Power	Carrier	Type	
6-60Hz	3-60Hz	60-90Hz	0	VPWM or CPWM	1.0 Only

Hazardous Locations Information

CSA Certified	
Class I, Div 2, Groups B, C & D Class I, Zone 2, Groups IIB+H2, IIB & IIA	
Temp Code (Sinewave / VFD)	T3B / T3B

Additional Certifications

Other Certification

Additional Information

Bearings		Approx. Weight
DE	NDE	lbs
6211C3	6211C3	417

TECO Westinghouse MOTORS (CANADA) INC.	
	Date: March 8, 2021

Nameplate Drawing

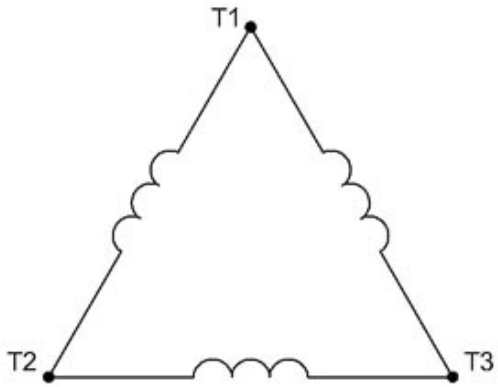
Optim TEFC

TYPE	AEHH8N-CF	CAT. NO.	PDH02525C		
OUTPUT	25 HP 18.65 kW	FRAME	284TSC	TEFC	
R.P.M.	3545	POLE	2	INS.	F
VOLTS	575	PHASE	3	Hz	60
AMPS	22.3	CODE	G	S.F.	1.15
AMBIENT	40 °C	NOM. EFF. 92.40		MIN. EFF. 91.00	
BEARINGS	6211C3 / 6211C3			RATING Cont.	

SER. NO.	TBD	DESIGN	B	WT. 417 LBS

PWM VFD DUTY	VT	CT	CP	S.F.
	3-60Hz	6-60Hz	60-90Hz	1.0 Only

Connection Diagram



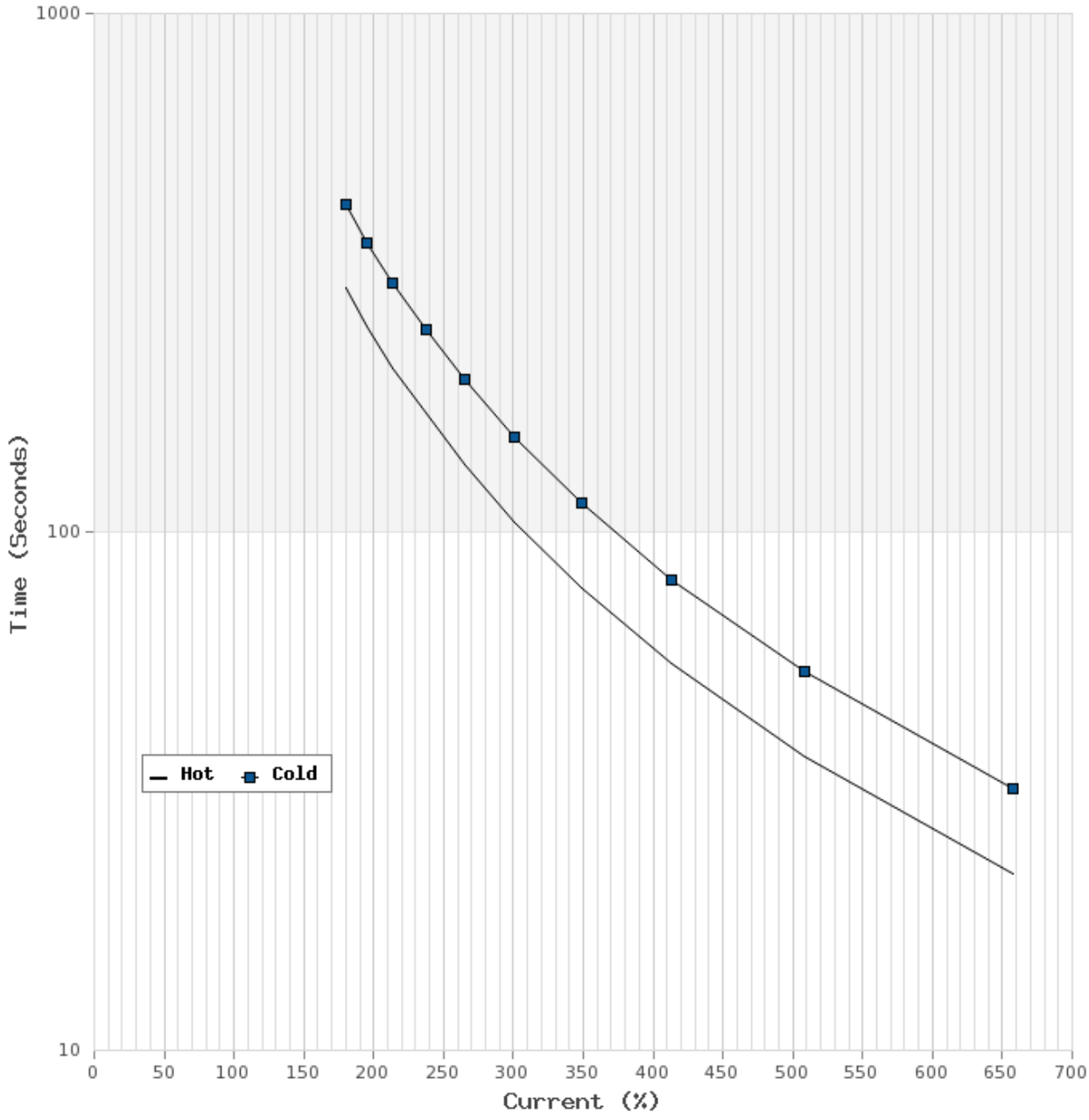
3 LEAD SINGLE VOLTAGE DELTA					
VOLTAGE	CONN.	L1	L2	L3	
-	DELTA	1	2	3	

WD_3D

TECO Westinghouse MOTORS (CANADA) INC.	
	Date: March 8, 2021

Thermal Limit Curves

Motor Type: AEHH8N-CF		Catalogue No: PDH02525C		Family: Optim TEFC	
HP	25	Safe Stall Time		Full Load A	22.3 A
Voltage	575V 60Hz	Hot	12 s	% Inrush	657 %
RPM	3600	Cold	17 s	Locked Rotor A	146.40 A



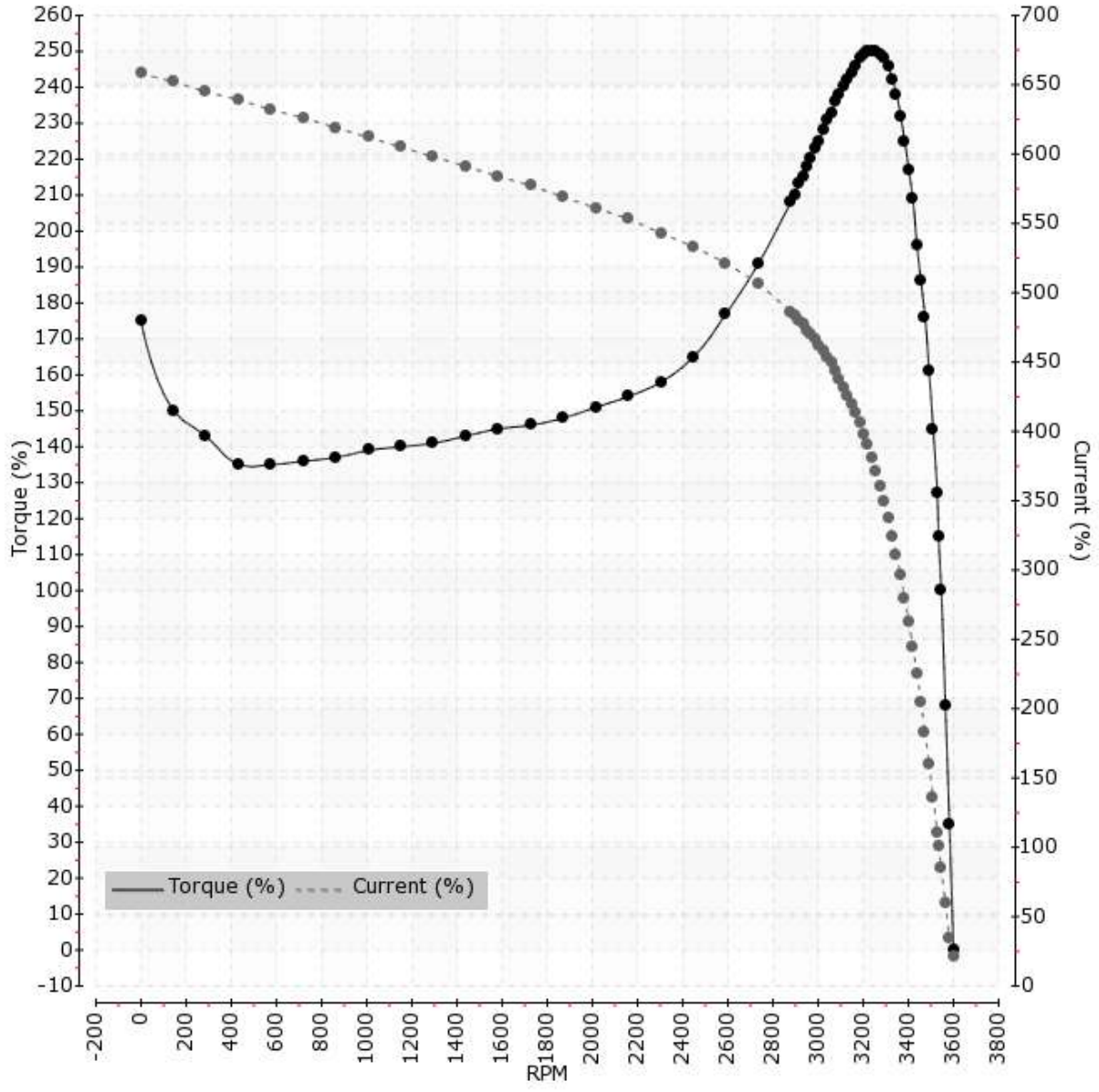
TECO Westinghouse
MOTORS (CANADA) INC.

Date: March 8, 2021

T-N and I-N Curves

Motor Type: AEHH8N-CF	Catalogue No: PDH02525C	Family: Optim TEFC

HP	25	Full Load T	37.03 lb-ft	Full Load A	22.3 A
Voltage	575V 60Hz	Locked Rotor T	175 %	Locked Rotor A	146.4 A
RPM	3600	Pull Up T	135 %	Break Down T	250 %



ENGINEERING
TOMORROW

Danfoss Drives

Danfoss Drives is a world leader in variable speed control of electric motors. We aim to prove to you that a better tomorrow is driven by drives. It is as simple and as ambitious as that.

We offer you unparalleled competitive edge through quality, application-optimized products targeting your needs – and a comprehensive range of product lifecycle services.

You can rely on us to share your goals. Striving for the best possible performance in your applications is our focus. We achieve this by providing the innovative products and application know-how required to optimize efficiency, enhance usability, and reduce complexity.

From supplying individual drive components to planning and delivering complete drive systems; our experts are ready to support you all the way.

We draw on decades of experience within industries that include:

- Chemical
- Cranes and Hoists
- Food and Beverage
- HVAC
- Lifts and Escalators
- Marine and Offshore
- Material Handling
- Mining and Minerals
- Oil and Gas
- Packaging
- Pulp and Paper
- Refrigeration
- Water and Wastewater
- Wind

You will find it easy to do business with us. Online, and locally in more than 50 countries, our experts are never far away, reacting fast when you need them.

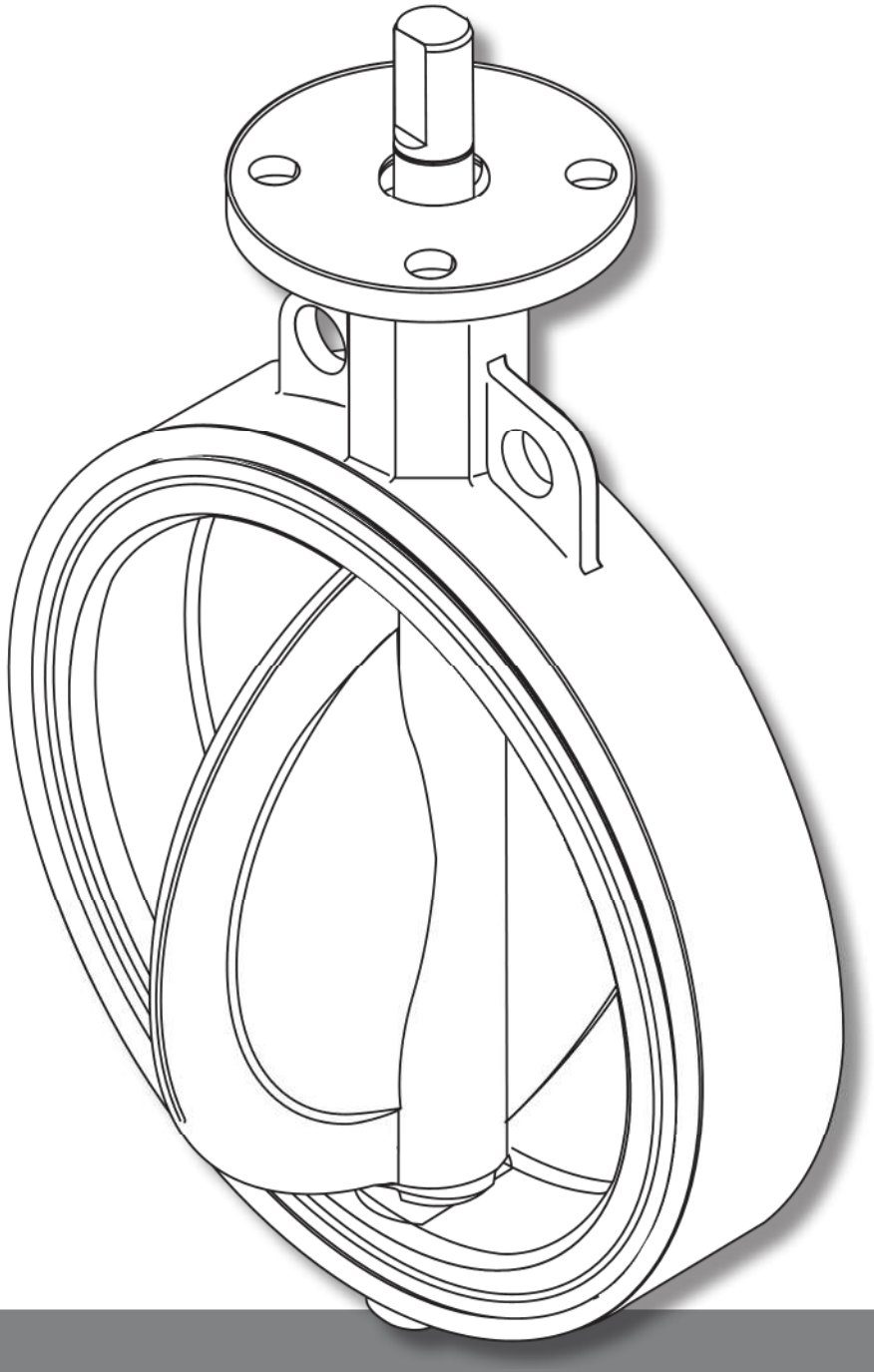
Since 1968, we have been pioneers in the drives business. In 2014, Vacon and Danfoss merged, forming one of the largest companies in the industry. Our AC drives can adapt to any motor technology and we supply products in a power range from 0.18 kW to 5.3 MW.

VLT® | VACON®

DKDD.PB.906.A3.02

SALES REFERENCE DRAWINGS

Resilient Seated Butterfly Valves



Bray®

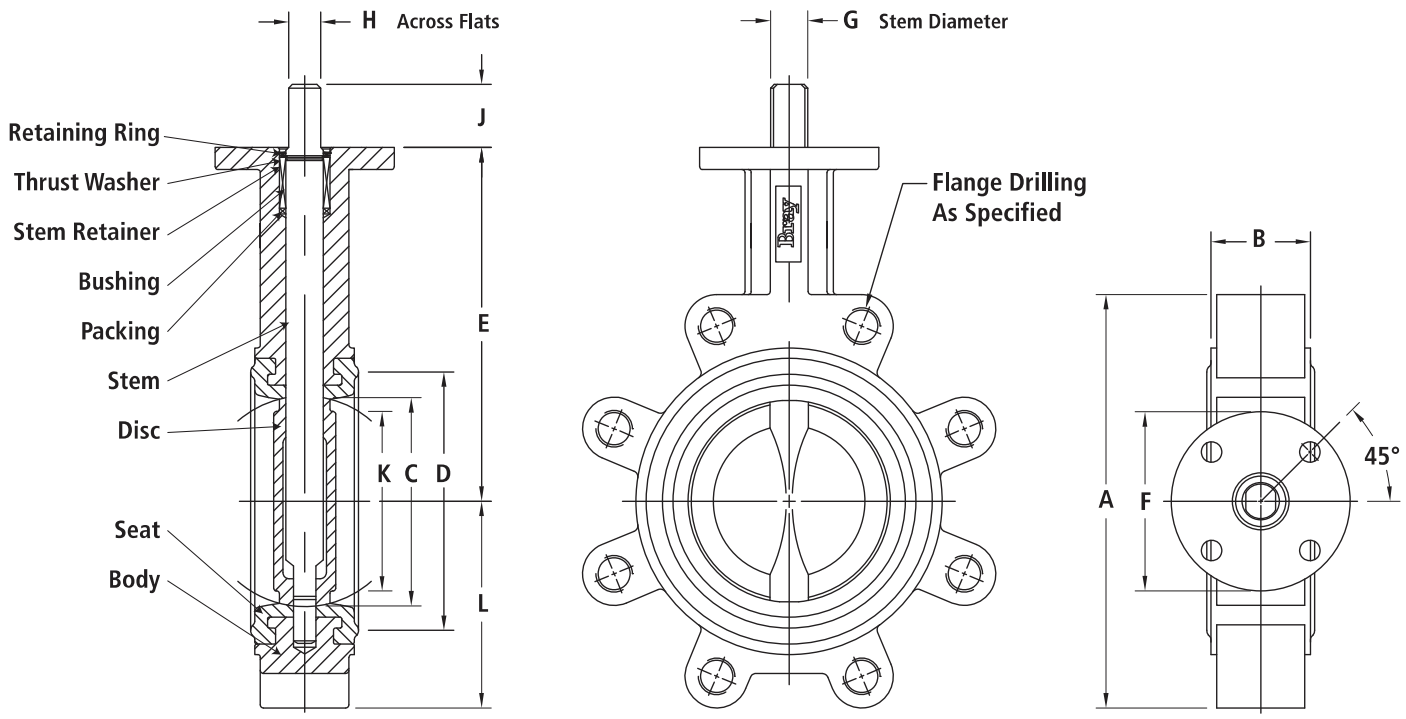
BRAY.COM

THE HIGH PERFORMANCE COMPANY

RESILIENT SEATED BUTTERFLY VALVE
SALES REFERENCE DRAWINGS

Table of Contents

Series 31H Lug



IMPERIAL DIMENSIONS: Inches																	Lug Bolting Data		
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 (lbs)	Bolt Circle	No of Holes	Threads ISO Coarse
2	3.69	1.62	2.00	2.84	5.50	3.54	2.76	4	.39	.55	39	1.25	1.32	2.30	A	7.0	4.75	4	5/8-11
2 1/2	4.19	1.75	2.50	3.34	6.00	3.54	2.76	4	.39	.55	.39	1.25	1.91	2.57	A	8.0	5.50	4	5/8-11
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	9.0	6.00	4	5/8-11
4	6.06	2.00	4.00	5.16	7.00	3.54	2.76	4	.39	.63	.43	1.25	3.57	4.09	B	15.0	7.50	8	5/8-11
5	7.12	2.12	5.00	6.16	7.50	3.54	2.76	4	.39	.75	.51	1.25	4.63	4.61	C	20.0	8.50	8	3/4-10
6	8.12	2.12	5.75	7.02	8.00	3.54	2.76	4	.39	.75	.51	1.25	5.45	5.06	C	23.0	9.50	8	3/4-10
8	10.50	2.50	7.75	9.47	9.50	5.91	4.92	4	.57	.87	.63	1.25	7.45	6.05	D	42.0	11.75	8	3/4-10
10	12.75	2.50	9.75	11.47	10.72	5.91	4.92	4	.57	1.18	.87	2.00	9.53	7.69	E	66.0	14.25	12	7/8-9
12	14.88	3.00	11.75	13.47	12.25	5.91	4.92	4	.57	1.18	.87	2.00	11.47	9.02	E	88.0	17.00	12	7/8-9

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

METRIC DIMENSIONS: Millimeters																	Lug Bolting Data		
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 (Kg)	Bolt Circle	No of Holes	Threads ISO Coarse
50	94	41.2	51	72	140	90	70	4	10	14	10	32	34	58	A	3	121	4	5/8-11
65	106	44.5	64	85	152	90	70	4	10	14	10	32	49	65	A	3.6	140	4	5/8-11
80	124	44.5	76	102	159	90	70	4	10	14	10	32	65	71	A	4.1	152	4	5/8-11
100	154	50.8	102	131	178	90	70	4	10	16	11	32	91	104	B	7	191	8	5/8-11
125	181	54.0	127	156	191	90	70	4	10	19	13	32	118	117	C	9	216	8	3/4-10
150	206	54.0	146	178	203	90	70	4	10	19	13	32	138	129	C	10	241	8	3/4-10
200	267	63.5	197	241	241	150	125	4	14	22	16	32	189	154	D	19	298	8	3/4-10
250	324	63.5	248	291	272	150	125	4	14	30	22	51	242	195	E	30	362	12	7/8-9
300	378	76.2	298	342	311	150	125	4	14	30	22	51	291	229	E	40	432	12	7/8-9

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

Drawings are for reference only. Please refer to Bray ES drawings on the Bray website, www.bray.com. Bray reserves the right to change product dimensions without notice.

SR Drawing #31H-2/12-in

Inquire/P.O. No.:_____

Customer/Project: _____

Bray Order No.: _____

DOUBLE DOOR CHECK VALVES

2” (50mm) – 12” (300mm)

Certified to NSF/ANSI 61-G

Bray/Rite®

BRAY.COM/BRAY-RITE

BRAY/RITE
Double Door Check Valve

The Bray/Rite double door check valve is designed for energy efficient protection against flow reversal.

Featuring dual lightweight discs, responsive independent springs and a durable resilient seat for reliable flow-activated operation with tight sealing and reduced water hammer potential.

COST EFFICIENT DESIGN

> Low weight and short laying length saves initial cost, requires less space, and is easier to install.

QUICK CLOSE

> Independent springs provide quick-closing, non-slam shutoff for reduced water hammer potential.

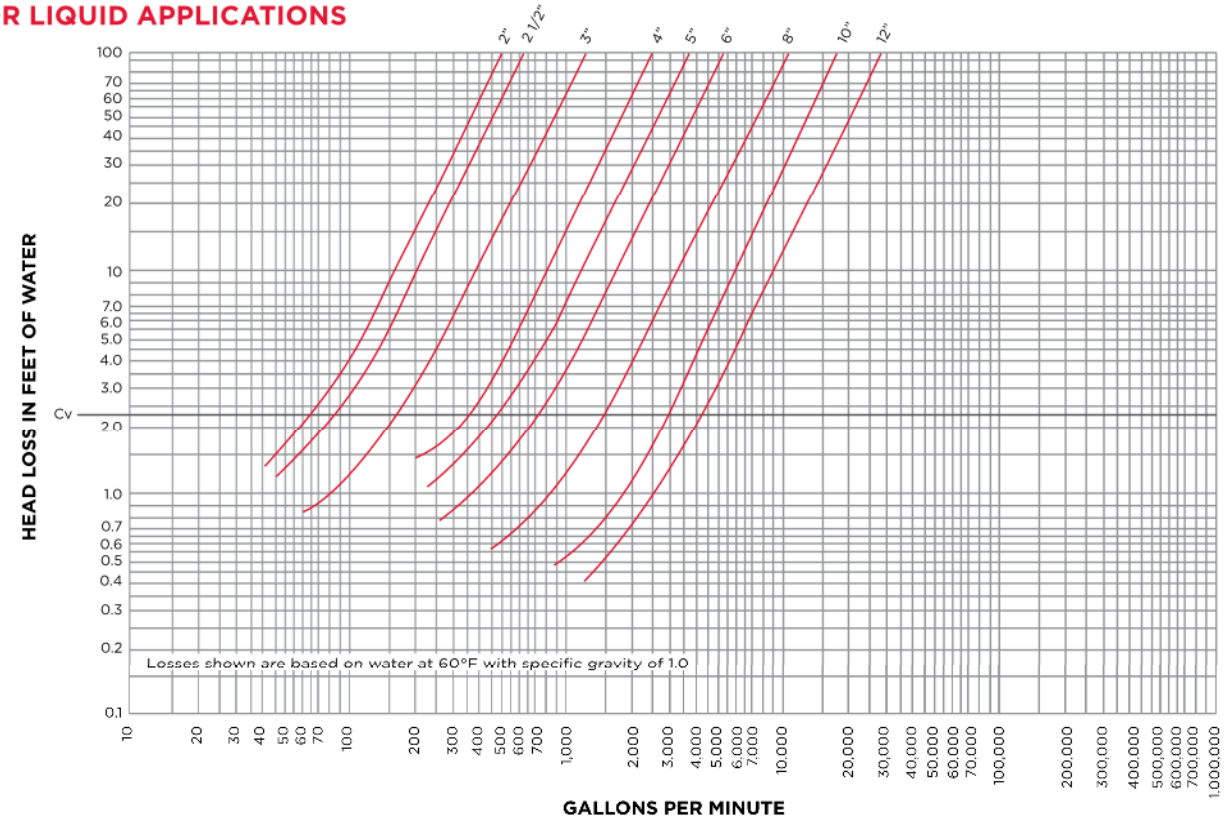
LOW CRACKING PRESSURE

> Lightweight, spring-loaded discs have low cracking pressure for energy efficient operation.

MINIMAL HEAD LOSS

> Contoured body provides a short and straight flow path with minimal turbulence.

FOR LIQUID APPLICATIONS



FOR GAS APPLICATIONS

$$\Delta P = \frac{GT}{P}\left(\frac{Q}{1360Cv}\right)^2$$

Cv = Flow Coefficient
G = Specific Gravity of Gas
P = Inlet Pressure in psia (psig + 14.7)
ΔP = Pressure Drop Across Valve in psi

$$SCFH = ACFH\left(\frac{P}{14.7}\right)\left(\frac{520}{T}\right)$$

Q = Gas Flow Rate in SCFH
T = Absolute Temperature (°F + 460)
ACFH = Actual Cubic Feet per Hour
SCFH = Standard Cubic Feet per Hour

ALL VALVES ARE REGISTERED TO A CANADIAN REGISTRATION NUMBER (CRN) CANADA WIDE

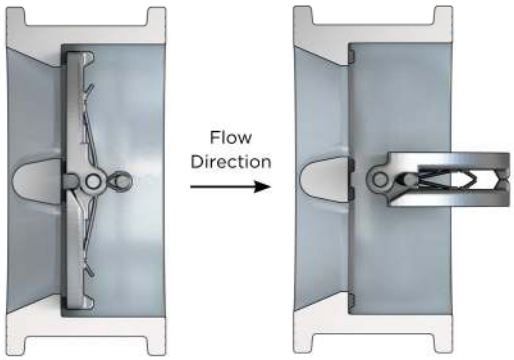
> ASME B16.5 Class 150 flange connection.
> Designed according to API 594 and tested according to API 598.
> All valves are 'CE' marked in accordance to PED 2014/68/EU.

DUAL INDEPENDENT SPRINGS

> Increased disc responsiveness over a single spring for reduced water hammer potential.

EXTENDED SPRING LEGS

> Prevent seat scrubbing for reduced wear and increased service life.



PRESSURE TEMPERATURE RATINGS

Pressure Class	Class 150
Testing Pressure	Shell: 450 PSI Seat: 325 PSI
Working Temperature	-50F to 300F EPDM -40F to 250F Buna

MATERIAL CONFIGURATIONS

Additional material configurations available upon request. XX = size of valve in inches (example: D**04**15XEZNSF designates a 4" valve).

Part Number	**DXX15DEZNSF**	**DXX15DBZ**	**DXX15XEZ**
Body Material	Ductile Iron ASTM A536 Gr. 65-45-12	Ductile Iron ASTM A536 Gr. 65-45-12	Stainless Steel ASTM A351 CF8M
Discs	Stainless Steel ASTM A351 CF8M	Stainless Steel ASTM A351 CF8M	Stainless Steel ASTM A351 CF8M
Pins	SS316	SS316	SS316
Springs	SS316	SS316	SS316
Plugs	SS316	SS316	SS316
Spacers	PTFE	PTFE	PTFE
Seats	EPDM	Buna	EPDM
Marked	NSF-G, CE	CE	CE

Certified to NSF/ANSI 61-G

DIMENSIONS

DN	**(mm)**	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**	**300**
	(in)	2	2-1/2	3	4	5	6	8	10	12
Face-to-face	**(mm)**	**54**	**60**	**67**	**67**	**83**	**95**	**127**	**140**	**181**
API594	**(in)**	2.126	2.362	2.638	2.638	3.668	3.740	5	5.512	7.126
Flange diameter	**(mm)**	**104**	**123**	**135**	**162**	**192**	**218**	**273**	**328**	**378**
	(in)	4.094	4.843	5.315	6.378	7.559	8.583	10.748	12.913	14.882

Bray/Rite®

10200 Parkway, Montreal, Quebec, Canada H1J 2K4
Tél 514.324.8900 Fax 514.324.9525

LEAD FREE LIQUID FILLED PRESSURE GAUGE

Model FFBRLF201L

MODEL FFBRLF200

FEATURES:

The Model FFBRLF200 Lead Free Liquid Filled Pressure Gauge from Flo Fab Inc. is an accurate, bottom connected, liquid-filled pressure gauge. Its lead free construction allows it to be specified within drinking water pump, pipeline and filtration system installations, or anywhere that the mitigation of lead contamination risk is a concern.

SPECIFICATIONS:

- Lead Free Brass Internals and Connection
- Lead Free Phosphor Bronze Bourdon Tube
- Dial Sizes: 1½", 2", 2½", 4", and 6"
- Glycerine fill standard
- Accuracy:
  1½" and 2" Dial Sizes: 2%
  2½" Dial: 1.6%
  4" and 6" Dial Sizes: = 1%
- Connection Sizes:
  ⅛" (M) NPT on 1½" and 2"
  ¼" (M) NPT on 2", 2½", and 4"
  ½" (M) NPT on 4" and 6"
- Dual Scale: PSI & BAR
- Ambient Temperature:
  Filled: 0 °F to +150 °F
  Dry: -30 °F to +150 °F
- Enclosure: IP65

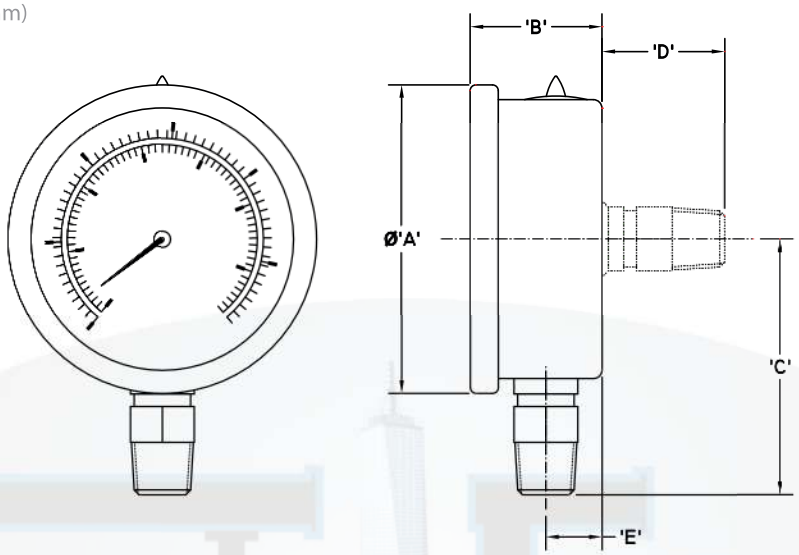
FIELD OPTIONS:

- Single Scale (PSI)
- Available in Dry
- Front Flange (FF), Back Flange (BF), and U-Clamp (UC) mount
- Alternate fills available

RANGE	RANGE CODES	MAJOR, INC.	MINOR, INC.
30/0" VAC	A	5	0.5
30/0/15	CB	5	0.5
30/0/30	CC	10	1
30/0/60	CD	10	1
30/0/100	CE	20	2
30/0/150	CF	20	2
30/0/300	CH	50	10
0/15	B	2	0.2
0/30	C	5	0.5
0/60	D	10	1
0/100	E	20	2
0/160	F	20	2
0/200	G	40	4
0/300	H	50	5
0/400	I	50	5
0/500	J	100	10
0/600	K	100	10
0/800	L	100	10
0/1000	M	200	20
0/1500	N	200	20
0/2000	O	400	50
0/3000	P	500	50
0/4000	Q	500	50
0/5000	R	1000	100
0/6000	S	2000	200
0/10,000	U	2000	200
0/15,000	V	2000	200

DIMENSIONAL DRAWING

All dimensions are in inches (mm)



BR200
FILLABLE GAUGE

DIAL SIZE	'A'	'B'	'C'	'D'	'E'
Ø1.50	1.85	1.08	1.58	0.74	0.9
Ø2.00 (1/8)	2.25	1.155	2.15	0.91	0.585
Ø2.00 (1/4)	2.25	1.155	2.165	0.935	0.585
Ø2.50	2.675	1.16	1.00	1.22	0.458
Ø4.00 (1/4)	4.29	1.4	3.2	1.256	0.703
Ø4.00 (1/2)	4.29	1.4	3.24	1.293	0.703
Ø6.00	6.40	1.93	4.10	1.15	0.56

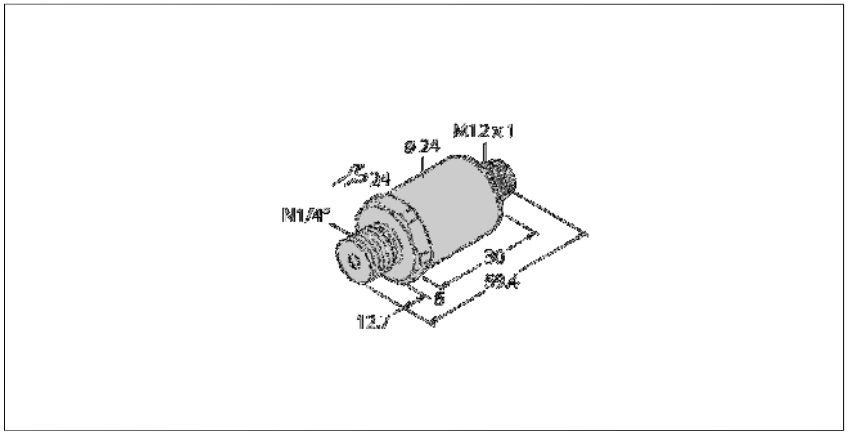
ORDERING GUIDE

Example: FFBRLF201L204F

FFBRLF201	L	20	2	F
Model Number		**Dial Size**	**Connector Size**	**Pressure Range**
201 - bottom connect		1.5" - 15	8 - ⅛" NPT	See chart on page 1
202 - back connect		2.0" - 20	4 - ¼" NPT	
Fill Type		2.5" - 25	2 - ½" NPT	
D - dry, non-filled		4" - 40		
L - Liquid, glycerine filled		6" - 60		

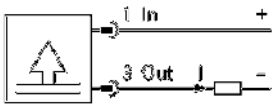
Available in Back Flange (BF), Front Flange (FF), and U-Clamp (UC) mount

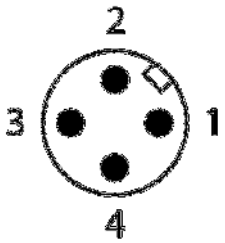
Pressure Transmitter
With Current Output (2-wire)
PT300PSIG-2003-I2-H1143



- **Completely welded measuring cell**
- **Compact and robust design**
- **Excellent EMC properties**
- **Pressure range 0…300 psi rel.**

Wiring Diagram





Type designation	PT300PSIG-2003-I2-H1143
Ident-No.	6837058
Relative pressure	
Operating range	0…20.68 bar rel.
Operating range	0…300psi
Operating range	0…2.07MPa
Admissible overpressure	≤ 62.05 bar
Burst pressure	≥ 124.11 bar
Response time	< 2 ms, typ. 1 ms
Power supply	
Operating voltage	7…33 VDC
Current consumption	≤ 23 mA
Short-circuit/reverse polarity protection	yes/ yes
Protection type and class	IP67/ III
Outputs	
Output 1	Analog output
Analogue output	
Current output	4…20mA
Load	≤ (Supply voltage -7) / 20 kΩ
Accuracy LHR analog output	± 0.3 % of final value BSL
Temperature behaviour	
Medium temperature	-40…+135 °C
Temperature coefficient	± 0.2 % of full scale/10 K
Ambient conditions	
Ambient temperature	-30…++85 °C
Storage temperature	-50…+100°C
Vibration resistance	20 g, 15…2000 Hz, 15…25 Hz with amplitude +/-15 mm acc. to IEC 68-2-6
Shock resistance	100 g, 11 ms, half sinusoidal curve, all 6 directions, free fall from 1 m onto concrete (6x) , according to IEC 61508
Housing	
Housing material	Stainless-steel/Plastic, Stainless steel V4A (1.4404)/ Polyarylamide 50% GF UL 94 V-0
Pressure connection material	Stainless steel V4A (1.4404)/AISI 316L
Pressure transducer material	Stainless steel V4A (1.4404) / AISI 316L
Process connection	NPT¼"-18 male thread
Electrical connection	Connector, M12 × 1
Max. tightening torque housing nut	20 Nm

Functional principle

The pressure transmitters of the PT …-2000 series operate with a fully welded metal measuring cell. Depending on the sensor version, the processed signal is converted into an analog output of either (4…20mA (2-wire) or 0…10V (3-wire).

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Pressure Transmitter
With Current Output (2-wire)
PT300PSIG-2003-I2-H1143

Reference conditions acc. to IEC 61298-1	
Temperature	15…+25 °C
Atmospheric pressure	860…160 hPa abs.
Humidity	45…75 % rel.
Auxiliary power	24 VDC

Approval	cULus
MTTF	1189 acc. to SN 29500 (Ed. 99) 40 °C

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CALEFACTIO

POTABLE

BFA SERIES

- Fixed bladder
- Top connection

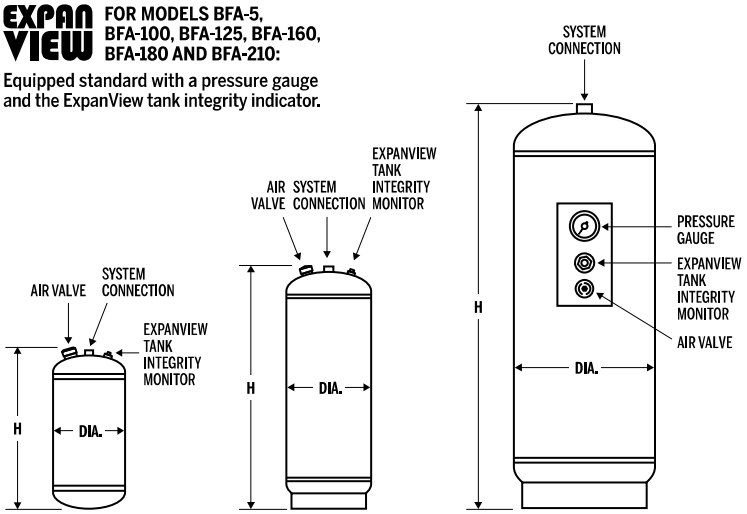
- Construction conforms to ASME, chapter VIII
- Fixed EPDM bladder ultra resistant CSA approved conforms to the NSF61 standard
- Water remains permanently separated from air
- Air precharged at factory; pressure adjustable on site

TECHNICAL SPECIFICATIONS

- Stainless steel connection
- Exterior finish in painted primer
- Maximum temperature of 240°F (115°C)
- Air precharged at factory at 40 PSI (275 kPa)
- Service pressure 150 PSI (1034 kPa)
- Maximum pressure of 175, 250 and 300 PSI also available

To obtain a tank of higher capacity and greater pressure, contact the manufacturer.

EXPANVIEW FOR MODELS BFA-5, BFA-100, BFA-125, BFA-160, BFA-180 AND BFA-210:
Equipped standard with a pressure gauge and the ExpanView tank integrity indicator.



Model#	Tank Volume		Acceptance Volume		NPT Connection		Max. Oper. Pressure	Dimensions				Approx. weight	
								Diameter		Height			
	gal	L	gal	L	in	mm	psi	in	mm	in	mm	lb	kg
BFA-5	3.5	13	2.3	9	¾	19	150	10	254	14	356	22	10
BFA-12	5	19	3.3	12	¾	19	150	12	305	14	356	28	13
BFA-20	8	30	5.3	20	¾	19	150	12	305	20	508	34	15
BFA-30	15	57	10	38	1	25	150	16	406	24	610	64	29
BFA-42	22	83	14.5	55	1	25	150	16	406	31	787	88	40
BFA-60	26	98	17.5	66	1	25	150	16	406	34	864	93	42
BFA-80	35	132	23.5	89	1	25	150	16	406	45	1183	109	49
BFA-100	45	170	30	114	1	25	150	20	508	39	914	148	67
BFA-125	60	227	40	151	1	25	150	20	508	50	1270	175	79
BFA-160	70	265	47	178	1½	38	150	24	610	47	1194	259	117
BFA-180	80	303	53	201	1½	38	150	24	610	50	1270	268	122
BFA-210	90	341	60	227	1½	38	150	24	610	53	1346	283	128

QUANTITY: _____ **MODEL: BFA-** _____ **OPTION :** ☐ Seismic bracket – Suffix "VB" (Fits models BFA-20 to BFA-210)

MAXIMUM PRESSURE: ☐ 125 PSI / 861 kPa ☐ 150 PSI / 1034 kPa ☐ 175 PSI / 1207 kPa ☐ Other* : _____

Notes: _____

Project: _____ Representative: _____

Location: _____ Date submitted: _____

Engineer: _____ Approved by: _____

Contractor: _____ Date of approval: _____

*Subject to the manufacturer's approval.

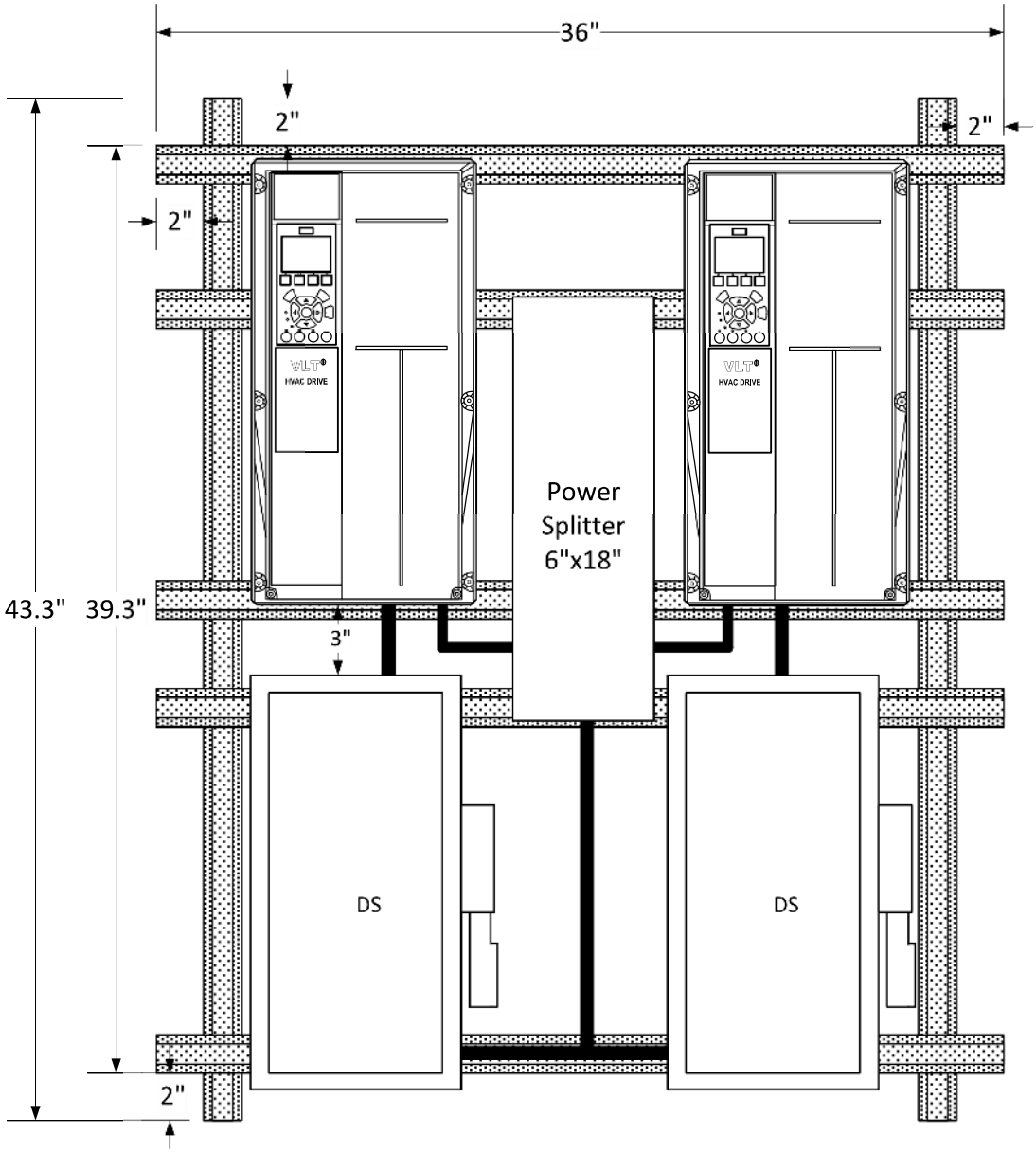
TYPICAL SPECIFICATIONS: Furnish and install as shown on plans a _____ gallons/liters _____ in/mm diameter × _____ in/mm (high) air precharged steel thermal expansion tank with a _____ in/mm diameter system connection and a replaceable EPDM bladder, approved by CSA for the NSF61 norm. The tank must be equipped with a tank integrity indicator (ExpanVIEW), have a NPT stainless steel system connection and a 0.302"-32 charging valve connection (standard tire valve) to facilitate on-site charging of the tank to meet system requirements. The tank must be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code and stamped _____ psi working pressure. Each tank shall be Expanflex model number BFA- _____ or approved equal.

VFD's

VFD's							
Qty.	Tag Numbers	HP	Frame Size NEMA1	VLT Model	Voltage	Amps	Electrical Drawing #
2	P-1	25	B1	FC102P18KT6	575	27	174N3179

Included Features for VFD's

5% Input DC Link reactors	Standard
Johnson Controls Metasys N2	Standard
Modbus RTU Communication	Standard
UL, CUL Certification	Standard
Bacnet Communication	Standard
USB Connection	Standard
NEMA 1 enclosures	Standard
Disconnect Switch	Included



NOTES:
- VFD SIZE B1 15-25 HP
- OVERALL DIMENSIONS: 43.3"x36"x13.5"
- UNISTRUT: 1 5/8"

Kildonan Energy
We've Always Been Green

Frame Size B1			
VFD UNISTRUT DIMENSIONAL			
DUPLEX LAYOUT			
DRAWN: LZ	DATE: 02/24/14	DWG# KE-DM-109	

DRIVE FEATURES – OPERATOR INTERFACE

The VLT®HVAC Drive

The VLT HVAC Drive Series is a microprocessor-based, high frequency IGBT-based, PWM AC drive with control functions and software designed solely for the unique needs of HVAC systems. The VLT HVAC Drive uses state-of-the-art Voltage Vector Control to supply full rated motor voltage at rated load and frequency, full motor performance without derating, high efficiency for both drive and motor, and a nearly perfect output sine wave. The diode-bridge rectifier and DC-link reactor provide a high displacement power factor at all speeds and loads and minimize power line harmonics. The VLT HVAC Drive utilizes a common user interface for all units.

Fully Graphic, Multilingual Display

The VLT HVAC Drive uses a large, bright, backlit graphic display to provide complete drive information at a glance. The logical arrangement of all elements simplifies the setup, operation and monitoring of the drive. Choose from 25 different items to display, including input reference, motor current, hours run, output frequency, horsepower, kW or kWh. Or select from custom units, such as GPM or HP and calibrate the maximum value to the maximum frequency of the unit. After programming one drive, the keypad can be used to transfer the same settings to all other drives. Drive can run without the keypad in place to assure tamper-proof operation. Drive status is shown even with the keypad removed.

LED Indication

Three LEDs are provided on the VLT HVAC Drive for indication of power applied, warning and fault. Upon power up, all LEDs will briefly light as a lamp test.

Alarm – Will flash red when the drive has registered a fault condition which has caused the drive to shut down.

Warning – Will flash yellow to indicate a situation exists that exceeds the normal drive/system parameters, and if that condition continues, a trip may be imminent.

On – Will glow green to indicate that the VFD is connected to AC power (line voltage is present).

Operating Keys

Hand On – Starts the drive regardless of remote start/stop contact (assuming safety interlock is closed). The speed of the drive will generally be controlled manually via the keypad "+" and "–" buttons.

Off – Shuts the drive down regardless of other commands.

Auto/On – The drive will start and stop via the external contact closure (building automation time clock). The speed is generally controlled via the building automation signal (4 to 20 mA, 0 to 10 V DC, etc.).

Reset – Will reset any trip level fault (not trip lock) if the drive is not set for infinite automatic fault resets.

Directional Keys

Right / Left / Up / Down arrows – Used as the electronic potentiometer to manually control the speed in the Hand/Start mode. All four keys are active during operation as well as programming. They provide the ability to move the cursor around the display, or sequence through display values.

Programming Keys

Status – Used to display operational data and status.

Cancel – Used to cancel the last programming command so the change is not carried out.

OK – Used to confirm that the last programming change should be saved to memory.

Back – Used to exit present display or menu to the previous display or menu.

Quick Menu – Used for programming the VLT HVAC Drive for the most typical applications.

Main Menu – Used to access all parameters for programming. It can switch directly from this mode to quick menu.

Alarm Menu – Used to access all fault and warning data.

Info Key – Accesses an on-board manual that gives detailed explanation of a parameter.

PROGRAM OPTIONS

Application-Specific Software

The VLT HVAC Drive was designed specifically for the HVAC market. This specialization has allowed Danfoss to factory program and configure the VLT HVAC Drive to make it ready to use, out of the box. This eliminates the time-consuming and often confusing job of selecting the correct parameters in the field. For the advanced user, the parameters are logically grouped, making modifications simple. Customized text fields are available to show user-specific data. Four independent setups are available for unmatched flexibility.

Menu Structure

Quick Setup Menu – Contains the 14 required setup parameters to easily start the application.

HVAC Application Menu – Easy access to the most relevant parameters for each of the most common HVAC applications.

Personal Menu – Contains up to 20 user-selectable parameters for customized access.

Changes Made Menu – Provides easy access to previously modified parameters

Keypad Features

- Hot-pluggable with upload and download capabilities
- On-screen scroll bars and graphs
- Up to five separate meters displayed simultaneously
- Two-level password protection
- Plain language alarms and warnings
- Remote keypad mounting kits available

USB Connectivity

The VLT HVAC Drive can be remotely commissioned and monitored through a standard USB connection and MCT 10 PC software.

Agency listing:

All drives and option packages are factory built and carry UL and C–UL listings.

All drives and option packages are built in ISO 9000 and 14001 certified facilities.

DRIVE FEATURES – MOTOR AND DRIVE INTERACTION

Constant-Torque Start

The VLT HVAC Drive's constant-torque start mode provides full torque to accelerate different loads until the drive reaches the setpoint. Breakaway current can be set up to 160% for up to 0.5 seconds for starting high friction loads.

Current Limit Circuit

Adjustable from 0 to 110% of the VLT HVAC Drive's rated current (factory set at 110%). If during acceleration the current required to accelerate the load exceeds the current limit, the VLT HVAC Drive will stop accelerating until the motor current is reduced to normal levels, at which time the load will continue to accelerate at the rate set by the acceleration time.

Three-Phase Output Current Measurement

The VLT HVAC Drive's software measures output current on all three phases. Phase grounding is detected instantly. Output contactors may be repeatedly used with no damage to the drive. Multiple motors may be run from one drive.

Advanced Motor Protection

The VLT HVAC Drive features integrated electronic, thermal motor protection. The VFD calculates the motor temperature based on current, frequency, and time. This system allows for changing cooling conditions as speed and load vary. The drive can predict motor overheating and reports a % of thermal load.

Motor Preheat Circuit

This preheat function can be activated to avoid condensation on the motor windings when it is stopped.

Stall Protection

The VLT HVAC Drive provides protection against a stalled motor. When activated, this function can provide a warning or a fault condition caused by excessive motor current at low speeds.

DRIVE FEATURES

DC-Link Reactor

A dual, 5% DC-link reactor on the positive and negative rails of the DC bus is standard equipment on the VLT HVAC Drive. This reactor reduces the level of harmonics reflected back into the building power system without causing a voltage loss at the drive's input and reducing efficiency as an external AC line reactor would. This reactor also improves input power factor. The reactor is non-saturating (linear) to provide full harmonic filtering throughout the entire load range. In performance, the DC-link reactor is equivalent to a 5% AC line reactor.

Power Line Protection

Power line voltage surge protection is provided by means of input Metal Oxide Varistors (MOVs). This protects the diodes in the VLT HVAC Drive's 3-phase full wave diode bridge. The DC-link reactor also acts to reduce input current caused by power line disturbances.

Sleep Mode

Automatically stops the drive when speed drops below set "sleep" level for specified time. Automatically restarts when speed command exceeds set "wake" level. Saves energy and reduces wear on driven equipment.

Run Permissive Circuit

Ability to accept a "system ready" signal assures that dampers or other auxiliary equipment are in the proper state for drive operation. This feature also provides the ability for the drive to send a "start signal applied" signal to the system to notify the auxiliary equipment of the drive's request to start.

Firefighter's Override Mode

Overrides all other commands to provide desired operation. Ignores most alarms including overload, overcurrent, overtemperature, and phase loss. When used with bypass, selectable to run from drive, from bypass, or switch from drive to bypass in the event of a drive failure.

Acceleration / Deceleration Rates

The VLT HVAC Drive can provide four individually controlled sets of acceleration/deceleration rates each from 1 to 3600 seconds. The shape of these curves may be automatically contoured to prevent tripping.

Plenum Rated

The VLT HVAC NEMA 1 or NEMA 12 drive is recognized by UL for installation in air handling compartments.

Auto Restarts

The VLT HVAC Drive can be automatically restarted up to 20 times or infinitely at 0 to 600 second intervals. If the application causes the drive to trip more than the number of trials set, the drive will stop operating and display the fault on the display screen. A manual reset will be required by means of the reset key, a digital input, or EIA–485 command. In cases of severe trips, as a safety feature, the drive's input power may have to be cycled to restart a fault.

Carrier Frequency

By using IGBTs, the VLT HVAC Drive can employ high switching frequencies, so the motor current is practically sinusoidal. Audible motor noise can also be minimized by adjusting the switching frequency. These frequencies can be set or adjust themselves automatically to fit the application.

Input Power

The VLT HVAC Drive is equipped with an automatic sustained power or phase loss circuit. The VLT HVAC Drive will provide a full rated output with an input voltage as low as 90% of the nominal. The drive will continue to operate with reduced output with an input voltage as low as 164 volts for 208/230 volt units, 313 volts for 460 volt units, and 394 volts for 600 volt units.

Automatic Motor Adaptation (AMA)

Knowing motor stator resistance, the drive automatically optimizes performance and efficiency. The motor does not have to be run or decoupled from the load for the AMA setup to be performed.

Automated Frequency Avoidance / Critical Frequency Lockouts

For applications where it may be necessary to avoid specific frequencies due to mechanical resonance problems in the driven equipment, the VLT HVAC Drive, with its Critical Frequency Lockout Function, makes it possible to set up to four different frequency ranges which will be avoided during operation of the drive. This feature can be programmed by simply activating the feature and pushing OK at the top and bottom points that you wish to avoid.

- Each critical frequency setting can avoid a frequency band which is from 1 to 100 Hz wide. If the reference signal defines that the VLT HVAC Drive is to operate within this critical frequency range, the critical frequency lockout function will keep the drive operating continuously within this range.
- When the frequency reference signal rises above the critical frequency maximum limit, the VLT HVAC Drive will allow the motor to accelerate through the critical frequency at the rate set by the acceleration rate.

Automatic Energy Optimization Circuitry

The Automatic Energy Optimization (AEO) function adapts the output of the drive to the specific motor and load connected. This circuit optimizes the system efficiency as system loads change. The AEO function regulates the output voltage on the basis of the reactive current and the effective current. A savings of 3 to 10% in power consumption can be obtained with this function.

Preset Speeds

The VLT HVAC Drive allows for a maximum of 16 programmable preset speeds to be selected from the digital inputs.

Energy Monitoring

Real energy savings are always available without the additional expense of external equipment.

Real-Time Clock

Adds sophisticated performance to basic control schemes for increased comfort and energy savings.

Automatic High Ambient Derate

If the ambient temperature exceeds the normal limit, the drive can be set to warn of its overtemperature and continue to run, keeping the HVAC system functional. To control its temperature, the drive will reduce the output carrier frequency and then, if necessary, reduce the output current.

Preventive Maintenance Scheduling

The VLT HVAC Drive can monitor system usage and notify the operator when preventive maintenance is required.

Intelligent HVAC Controller

Four auto-tuning PIDs control the drive and up to three other devices, eliminating external controllers and reducing cost.

- Proportional: The proportional gain dictates the rate at which the deviation between actual and desired feedback signal is corrected. The higher the gain, the faster the response, but too high a gain can cause hunting and a large overshoot.
- Integral Time: The integral time continually compares the feedback value with the desired setpoint over time to make sure the setpoint is reached. The greater the integral time, the longer it takes to actually achieve the setpoint, but improves the system stability.
- Derivative: The derivative function monitors the rate at which the feedback is closing on the desired setpoint and slows the rate of approach to prevent overshooting. This function allows rapid accurate system control.

Built-in Communications

The VLT HVAC Drive is fully equipped for serial communication (EIA–485). Up to 31 drives can be connected to one serial bus up to 5,000 feet long.

Communicates directly with *Johnson Controls Metasys (N2), Siemens Building Technologies System 600 (FLN), and Modbus RTU* systems with no hardware changes or additional costs.

Optional communications include *BACnet MS/TP* and *LonWorks* with the addition of an Option A card.

Broken Belt, Loss of Load

A minimum motor current value can be set to indicate the motor is not using any more current than to run at idle. This can be used to indicate a broken belt or coupler. This feature can also be used to detect when a motor is disconnected from the drive.

WARRANTY

The VLT HVAC Drive packages for this project carry a 18 Month on-site warranty from the date shipment. This warranty includes parts, labor, travel, and expenses.

STARTUP

Danfoss authorized service technician will perform a professional startup service.

SPECIFICATIONS

Drive Input Power

Input voltage, 3 phase	200–240, or 380–460, or 525–600 VAC
Input voltage range for full output	Nominal ±10%
Undervoltage trip point	164, 313 VAC, or 394 VAC
Overvoltage trip point	299, 538, or 690 (792 for 100 HP and above) VAC
Input frequency	50 or 60 Hz, ± 2 Hz
Displacement Power factor	0.98 or greater at all speeds and loads
Total Power factor	0.90 or greater at full load and nominal motor speed

Drive Output Power

Output frequency	Selectable 0 to 120 Hz
Motor voltages	200, 208, 220, 230; 380, 400, 415, 440, 460; 550 or 575 VAC
Continuous output current	100% rated current
Output current limit setting	Adjustable to 110% of drive rating
Current limit timer	0 to 60 seconds or infinite
Adjustable maximum speed	From minimum speed setting to 120 Hz
Adjustable minimum speed	From maximum speed setting to 0 Hz
Acceleration time	To 3,600 seconds to base speed
Deceleration time	To 3,600 seconds from base speed
Breakaway torque time	0.0 to 0.5 seconds (1.6 times motor nameplate current)
Start voltage	0 to 10%
DC braking time	0 to 60 seconds
DC braking start	0 to maximum frequency
DC braking current	0 to 50% of rated motor current

Environmental limits:

Efficiency	97% or greater at full load and nominal motor speed
Ambient operating temperature	14°F to 113°F (−10°C to 45°C) frames A2–C2; 14°F to 104°F (−10°C to 40°C) frames D1–E1
Humidity	< 95%, non-condensing
Altitude: maximum without derating	3,300 ft. (1,000 m)
Drive and options enclosure(s)	NEMA/UL Types 1 and 12; as noted

Software

Lost speed reference action	Selectable to go to a preset speed, go to maximum speed, stay at last speed, stop, turn off, or stop and trip
Time delay for lost speed reference action	1 to 99 seconds
Adjustable auto restart time delay	0 to 600 seconds
Automatic restart attempts	0 to 20 or infinite
Automatic restart time delay	0 to 600 seconds between each attempt
Relay ON delay and relay OFF delay	0 to 600 seconds
Maximum number of preset speeds	16
Maximum number of frequency stepovers	4
Maximum stepover width	100 Hz
Maximum number of accel rates	4
Maximum number of decel rates	4
Delayed Start	0 to 120 seconds

Protections:

Low frequency and high frequency warnings	0 to 120 Hz
Low current and high current warnings	0 to maximum current
Low reference and high reference warnings	−999,999 to 999,999
Low feedback and high feedback warnings	−999,999 to 999,999
Ground fault	Protected
Motor stall	Protected
Motor overtemperature	Protected (Predictive motor temperature)
Motor Condensation	Protected (Motor pre-heat circuit)
Pump No-Flow	Protected
Pump end-of-curve	Protected
Dry pump	Protected
Short-cycle	Protected
Motor overload	Protected (Programmable action)
Vibration protection	Protected (Programming automated)

Control Connections

Follower signal, analog input	2; selectable voltage or current, direct and inverse acting
Programmable digital inputs	6 (2 can be used as digital outputs)
Programmable analog outputs	1; 0/4 to 20 mA
Programmable relay outputs	2 standard Form C 240 V AC, 2 A; 1 or 3 additional optional
Auxiliary voltage	+24 V DC, maximum 200 mA

Control Optional

MCB 101 General Purpose I/O.....3 DI, 2 DO, 2 AI (voltage), and 1 AO (current)

MCB 105 Relay Card.....3 standard Form C 240 V AC, 2 A

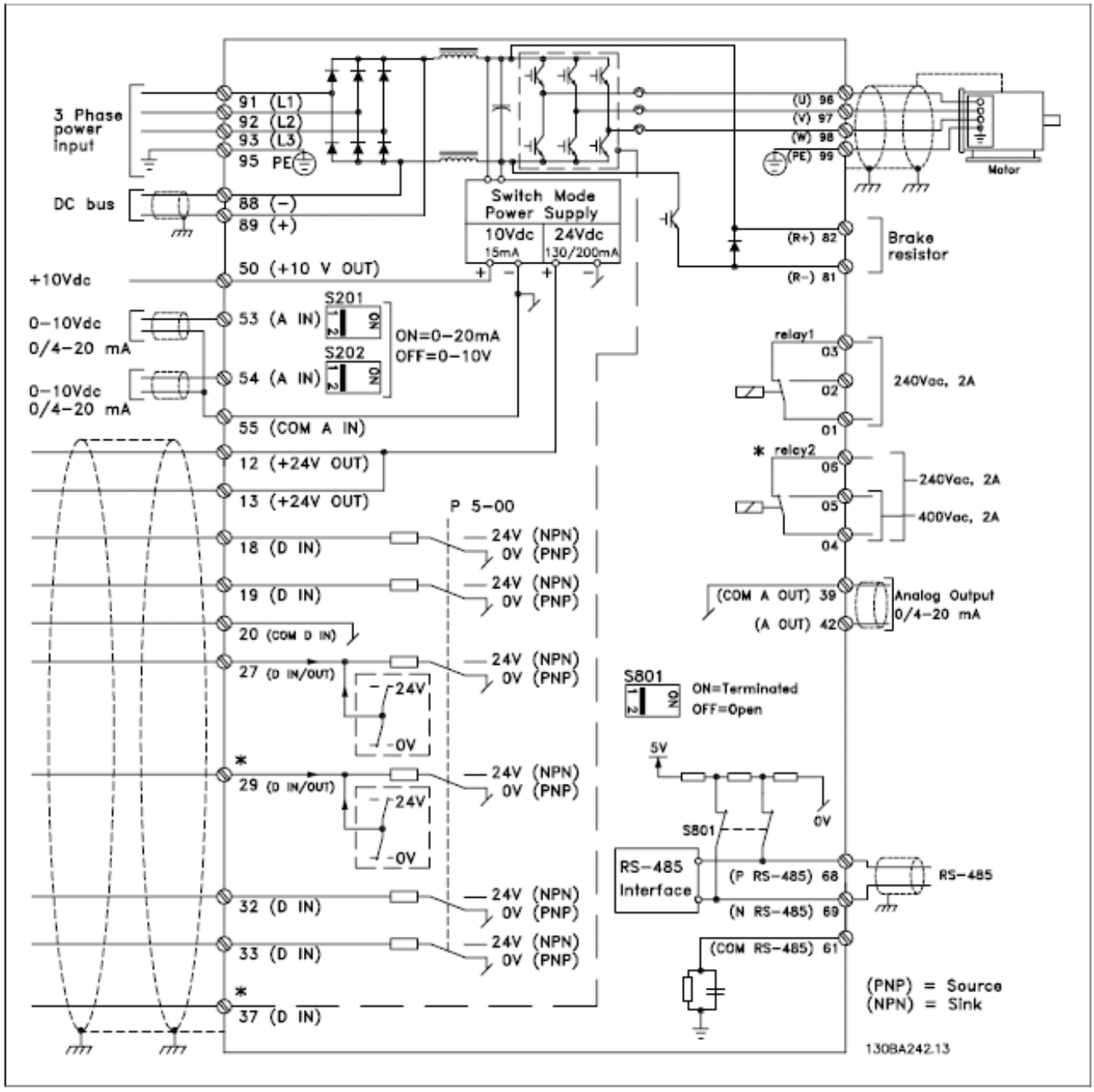
MCB 107 24V DC Supply.....Allows external 24 V DC power to be connected to the VLT HVAC Drive

MCB 109 Analog I/O.....3 AO(voltage), 3 AI(voltage or PT1000 or NI1000), Battery backup

MCB 110 Battery backup.....Battery backup for real-time clock

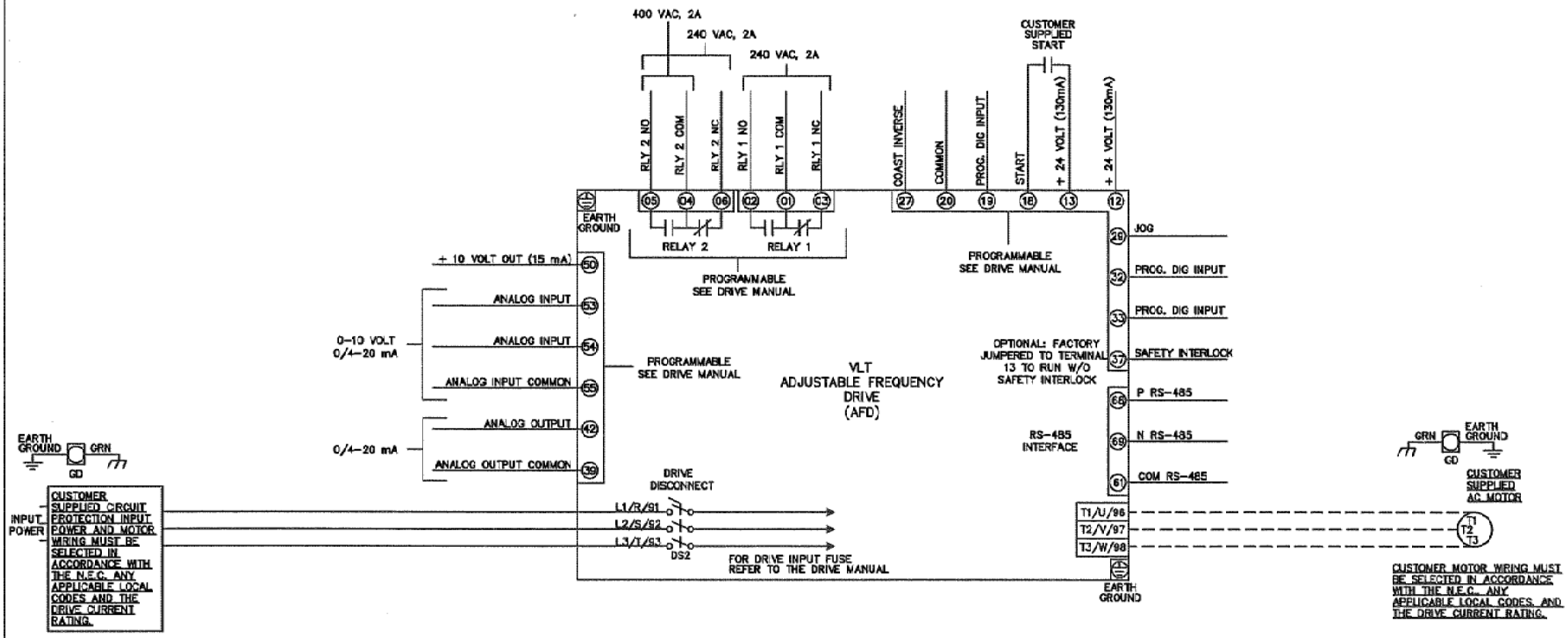
Typical Control Connections

Base VLT HVAC Drive I/O



Included Features for VFD's

5% Input DC Link reactors	Standard
Johnson Controls Metasys N2	Standard
Modbus RTU Communication	Standard
UL, CUL Certification	Standard
Bacnet Communication	Standard
USB Connection	Standard
NEMA 1 enclosures	Standard
Disconnect Switch	Included



REV	ECN	DATE

DRN JNW 9/05/08

APR 9/sc/08

NAME SCHEMATIC DIAGRAM, DRIVE WITH DRIVE DISCONNECT

MODEL VLT

PAGE 1 OF 1

SIZE A

DWG NO. 174N3179