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Enerflex

Compressor

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Performance Runs

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Yoho Compressor
Run 1
22531 - YOHO VRU C-150R & C-170R Combined

John Pham
Date: **October 22, 2024**
Gauge Ref: **13.4 psi**

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	2.268 MMSCFD	Comp Ratio	8.52
Vi Range	2.2 - 5.0		Shaft Power	360.0 hp	Ideal Vi	7.26
Casing	Gray Cast Iron		Capacity %	89.4 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	96.8 %	Disc T	220.0 °F
Volumetric Eff	78.4 %		Speed	100.0 %	Disc DewT	112.3 °F
Adiabatic Eff	68.2 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	2.268 MMSCFD		Std Flow	2.268 MMSCFD		
Mass Flow	118.8 lbm/min		Mass Flow	118.8 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	21.4 psia		Pressure	163.4 psia		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	CP-1515-100		Discharge Flow	42.6 gpm	Heat Reject	365 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	19.2 gpm	Outlet T	120.0 °F
Heat Reject	374 kbtu/hr		Main Inj Flow	23.3 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	26.3 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	118.8 lbm/min
Helium-3	0.01	0.00	Suction P	20.0 psia	Discharge	118.8 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1123 cfm
Carbon Dioxide	0.51	0.78	Discharge P	170.4 psia	Discharge	171 cfm
Methane	52.94	29.68				
Ethane	20.58	21.63				
Propane	12.86	19.81				
Isobutane	2.30	4.67				
n-Butane	5.66	11.51				
Isopentane	1.42	3.58				
n-Pentane	1.80	4.53				
n-Hexane	0.75	2.27				
n-Heptane	0.27	0.94				
Water	0.80	0.51				

Yoho Compressor
Run 2
22531 - YOHO VRU C-150R & C-170R Combined

John Pham
Date: **October 22, 2024**
Gauge Ref: **13.4 psi**

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	1.506 MMSCFD	Comp Ratio	13.63
Vi Range	2.2 - 5.0		Shaft Power	330.9 hp	Ideal Vi	11.85
Casing	Gray Cast Iron		Capacity %	100.0 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	100.0 %	Disc T	220.0 °F
Volumetric Eff	83.6 %		Speed	100.0 %	Disc DewT	127.7 °F
Adiabatic Eff	62.5 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	1.506 MMSCFD		Std Flow	1.506 MMSCFD		
Mass Flow	78.7 lbm/min		Mass Flow	78.7 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	13.9 psia		Pressure	163.4 psia		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	CP-1515-100		Discharge Flow	55.2 gpm	Heat Reject	253 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	20.0 gpm	Outlet T	120.0 °F
Heat Reject	485 kbtu/hr		Main Inj Flow	35.2 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	40.7 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	78.7 lbm/min
Helium-3	0.01	0.00	Suction P	12.5 psia	Discharge	78.7 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1198 cfm
Carbon Dioxide	0.50	0.78	Discharge P	170.4 psia	Discharge	113 cfm
Methane	52.71	29.60				
Ethane	20.49	21.57				
Propane	12.80	19.76				
Isobutane	2.29	4.66				
n-Butane	5.64	11.47				
Isopentane	1.41	3.57				
n-Pentane	1.79	4.51				
n-Hexane	0.75	2.26				
n-Heptane	0.27	0.94				
Water	1.24	0.78				

Yoho Compressor

Run 3

22531 - YOHO VRU C-150R & C-170R Combined

John Pham

Date: **October 22, 2024**

Gauge Ref: 13.4 psi

COMPRESSOR

Model	SGC 2821
Vi Range	2.2 - 5.0
Casing	Gray Cast Iron
Bearings	Standard
Volumetric Eff	51.8 %
Adiabatic Eff	51.3 %

UPSTREAM

Std Flow	1.497 MMSCFD
Mass Flow	78.4 lbm/min
Temperature	50.0 °F
Pressure	21.4 psia
Line Pres Drop	1.4 psi

OIL SYSTEM

Type	CP-1515-100
Cooling Type	Glycol Cooled
Heat Reject	567 kbtu/hr
Bearing Oil T	180.0 °F
System dP	10.0 psi

MIXED GAS

By Mole By Mass

Helium-3	0.01	0.00
Nitrogen	0.10	0.10
Carbon Dioxide	0.51	0.78
Methane	52.94	29.68
Ethane	20.58	21.63
Propane	12.86	19.81
Isobutane	2.30	4.67
n-Butane	5.66	11.51
Isopentane	1.42	3.58
n-Pentane	1.80	4.53
n-Hexane	0.75	2.27
n-Heptane	0.27	0.94
Water	0.80	0.51

PERFORMANCE

Capacity	1.497	MMSCFD
Shaft Power	360.0	hp
Capacity %	61.6	%
Slide Valve Pos	85.5	%
Speed	100.0	%
Speed	1800	rpm

DOWNSTREAM

Std Flow	1.497 MMSCFD
Mass Flow	78.4 lbm/min
Temperature	120.0 °F
Pressure	213.4 psia
Line Pres Drop	7.0 psi

OIL SYSTEM

Discharge Flow	64.5 gpm
Bearing Flow	24.0 gpm
Main Inj Flow	40.5 gpm
Valve Dia	1.0 in
Valve Pos	40.5 %
Balance Piston	Std Regulator
Bal Piston dP	0.0 psi

FLANGE

Suction T	50.0 °F
Suction P	20.0 psia
Discharge T	220.0 °F
Discharge P	220.4 psia

CONDITIONS

Comp Ratio	11.02
Ideal Vi	9.30
Actual Vi	5.00
Disc T	220.0 °F
Disc DewT	121.1 °F
Disc DewT Prim	Water

AFTERCOOLER

Heat Reject	246 kbtu/hr
Outlet T	120.0 °F

FLOW

Suction	78.4 lbm/min
Discharge	78.4 lbm/min
Suction	741 cfm
Discharge	86 cfm

Yoho Compressor
Run 4
22531 - YOHO VRU C-150R & C-170R Combined

John Pham
Date: **October 22, 2024**
Gauge Ref: **13.4 psi**

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	1.107 MMSCFD	Comp Ratio	17.63
Vi Range	2.2 - 5.0		Shaft Power	360.0 hp	Ideal Vi	15.33
Casing	Gray Cast Iron		Capacity %	79.1 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	93.7 %	Disc T	220.0 °F
Volumetric Eff	61.5 %		Speed	100.0 %	Disc DewT	137.1 °F
Adiabatic Eff	47.2 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	1.107 MMSCFD		Std Flow	1.107 MMSCFD		
Mass Flow	57.9 lbm/min		Mass Flow	57.9 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	13.9 psia		Pressure	213.4 psia		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	CP-1515-100		Discharge Flow	75.1 gpm	Heat Reject	196 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	24.7 gpm	Outlet T	120.0 °F
Heat Reject	660 kbtu/hr		Main Inj Flow	50.4 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	52.3 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	57.9 lbm/min
Helium-3	0.01	0.00	Suction P	12.5 psia	Discharge	57.9 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	880 cfm
Carbon Dioxide	0.50	0.78	Discharge P	220.4 psia	Discharge	64 cfm
Methane	52.71	29.60				
Ethane	20.49	21.57				
Propane	12.80	19.76				
Isobutane	2.29	4.66				
n-Butane	5.64	11.47				
Isopentane	1.41	3.57				
n-Pentane	1.79	4.51				
n-Hexane	0.75	2.26				
n-Heptane	0.27	0.94				
Water	1.24	0.78				

Yoho Compressor
Run 1
22531 - YOHO VRU C-150R & C-170R Combined

John Pham
Date: **October 22, 2024**
Gauge Ref: **13.4 psi**

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	2.268 MMSCFD	Comp Ratio	8.52
Vi Range	2.2 - 5.0		Shaft Power	360.0 hp	Ideal Vi	7.26
Casing	Gray Cast Iron		Capacity %	89.4 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	96.8 %	Disc T	220.0 °F
Volumetric Eff	78.4 %		Speed	100.0 %	Disc DewT	112.3 °F
Adiabatic Eff	68.2 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	2.268 MMSCFD		Std Flow	2.268 MMSCFD		
Mass Flow	118.8 lbm/min		Mass Flow	118.8 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	8.0 psig		Pressure	150.0 psig		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	CP-1515-100		Discharge Flow	42.6 gpm	Heat Reject	365 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	19.2 gpm	Outlet T	120.0 °F
Heat Reject	374 kbtu/hr		Main Inj Flow	23.3 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	26.3 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	118.8 lbm/min
Helium-3	0.01	0.00	Suction P	6.6 psig	Discharge	118.8 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1123 cfm
Carbon Dioxide	0.51	0.78	Discharge P	157.0 psig	Discharge	171 cfm
Methane	52.94	29.68				
Ethane	20.58	21.63				
Propane	12.86	19.81				
Isobutane	2.30	4.67				
n-Butane	5.66	11.51				
Isopentane	1.42	3.58				
n-Pentane	1.80	4.53				
n-Hexane	0.75	2.27				
n-Heptane	0.27	0.94				
Water	0.80	0.51				

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	1.506 MMSCFD	Comp Ratio	13.63
Vi Range	2.2 - 5.0		Shaft Power	330.9 hp	Ideal Vi	11.85
Casing	Gray Cast Iron		Capacity %	100.0 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	100.0 %	Disc T	220.0 °F
Volumetric Eff	83.6 %		Speed	100.0 %	Disc DewT	127.7 °F
Adiabatic Eff	62.5 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	1.506 MMSCFD		Std Flow	1.506 MMSCFD		
Mass Flow	78.7 lbm/min		Mass Flow	78.7 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	0.5 psig		Pressure	150.0 psig		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	CP-1515-100		Discharge Flow	55.2 gpm	Heat Reject	253 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	20.0 gpm	Outlet T	120.0 °F
Heat Reject	485 kbtu/hr		Main Inj Flow	35.2 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	40.7 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	78.7 lbm/min
Helium-3	0.01	0.00	Suction P	-0.9 psig	Discharge	78.7 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1198 cfm
Carbon Dioxide	0.50	0.78	Discharge P	157.0 psig	Discharge	113 cfm
Methane	52.71	29.60				
Ethane	20.49	21.57				
Propane	12.80	19.76				
Isobutane	2.29	4.66				
n-Butane	5.64	11.47				
Isopentane	1.41	3.57				
n-Pentane	1.79	4.51				
n-Hexane	0.75	2.26				
n-Heptane	0.27	0.94				
Water	1.24	0.78				

Yoho Compressor
Run 3
22531 - YOHO VRU C-150R & C-170R Combined

John Pham
Date: **October 22, 2024**
Gauge Ref: **13.4 psi**

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	1.497 MMSCFD	Comp Ratio	11.02
Vi Range	2.2 - 5.0		Shaft Power	360.0 hp	Ideal Vi	9.30
Casing	Gray Cast Iron		Capacity %	61.6 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	85.5 %	Disc T	220.0 °F
Volumetric Eff	51.8 %		Speed	100.0 %	Disc DewT	121.1 °F
Adiabatic Eff	51.3 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	1.497 MMSCFD		Std Flow	1.497 MMSCFD		
Mass Flow	78.4 lbm/min		Mass Flow	78.4 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	8.0 psig		Pressure	200.0 psig		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	CP-1515-100		Discharge Flow	64.5 gpm	Heat Reject	246 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	24.0 gpm	Outlet T	120.0 °F
Heat Reject	567 kbtu/hr		Main Inj Flow	40.5 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	40.5 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	78.4 lbm/min
Helium-3	0.01	0.00	Suction P	6.6 psig	Discharge	78.4 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	741 cfm
Carbon Dioxide	0.51	0.78	Discharge P	207.0 psig	Discharge	86 cfm
Methane	52.94	29.68				
Ethane	20.58	21.63				
Propane	12.86	19.81				
Isobutane	2.30	4.67				
n-Butane	5.66	11.51				
Isopentane	1.42	3.58				
n-Pentane	1.80	4.53				
n-Hexane	0.75	2.27				
n-Heptane	0.27	0.94				
Water	0.80	0.51				

Yoho Compressor

Run 4

22531 - YOHO VRU C-150R & C-170R Combined

John Pham

Date: **October 22, 2024**

Gauge Ref: 13.4 psi

COMPRESSOR

Model	SGC 2821
Vi Range	2.2 - 5.0
Casing	Gray Cast Iron
Bearings	Standard
Volumetric Eff	61.5 %
Adiabatic Eff	47.2 %

UPSTREAM

Std Flow	1.107 MMSCFD
Mass Flow	57.9 lbm/min
Temperature	50.0 °F
Pressure	0.5 psig
Line Pres Drop	1.4 psi

OIL SYSTEM

Type	CP-1515-100
Cooling Type	Glycol Cooled
Heat Reject	660 kbtu/hr
Bearing Oil T	180.0 °F
System dP	10.0 psi

MIXED GAS

	By Mole	By Mass
Helium-3	0.01	0.00
Nitrogen	0.10	0.10
Carbon Dioxide	0.50	0.78
Methane	52.71	29.60
Ethane	20.49	21.57
Propane	12.80	19.76
Isobutane	2.29	4.66
n-Butane	5.64	11.47
Isopentane	1.41	3.57
n-Pentane	1.79	4.51
n-Hexane	0.75	2.26
n-Heptane	0.27	0.94
Water	1.24	0.78

PERFORMANCE

Capacity	1.107	MMSCFD
Shaft Power	360.0	hp
Capacity %	79.1	%
Slide Valve Pos	93.7	%
Speed	100.0	%
Speed	1800	rpm

DOWNSTREAM

Std Flow	1.107 MMSCFD
Mass Flow	57.9 lbm/min
Temperature	120.0 °F
Pressure	200.0 psig
Line Pres Drop	7.0 psi

OIL SYSTEM

Discharge Flow	75.1 gpm
Bearing Flow	24.7 gpm
Main Inj Flow	50.4 gpm
Valve Dia	1.0 in
Valve Pos	52.3 %
Balance Piston	Std Regulator
Bal Piston dP	0.0 psi

FLANGE

Suction T	50.0 °F
Suction P	-0.9 psig
Discharge T	220.0 °F
Discharge P	207.0 psig

CONDITIONS

Comp Ratio	17.63
Ideal Vi	15.33
Actual Vi	5.00
Disc T	220.0 °F
Disc DewT	137.1 °F
Disc DewT Prim	Water

AFTERCOOLER

Heat Reject	196 kbtu/hr
Outlet T	120.0 °F

FLOW

Suction	57.9 lbm/min
Discharge	57.9 lbm/min
Suction	880 cfm
Discharge	64 cfm

Yoho Compressor
Run 5
22531 - YOHO VRU C-150R & C-170R Combined

John Pham
Date: **October 29, 2024**
Gauge Ref: **13.4 psi**

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	2.583 MMSCFD	Comp Ratio	7.02
Vi Range	2.2 - 5.0		Shaft Power	335.9 hp	Ideal Vi	5.93
Casing	Gray Cast Iron		Capacity %	100.0 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	100.0 %	Disc T	220.0 °F
Volumetric Eff	89.3 %		Speed	100.0 %	Disc DewT	105.8 °F
Adiabatic Eff	74.7 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	2.583 MMSCFD		Std Flow	2.583 MMSCFD		
Mass Flow	135.3 lbm/min		Mass Flow	135.3 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	8.0 psig		Pressure	120.0 psig		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	Frick NG-4		Discharge Flow	28.0 gpm	Heat Reject	413 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	19.1 gpm	Outlet T	120.0 °F
Heat Reject	228 kbtu/hr		Main Inj Flow	9.0 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	10.3 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	135.3 lbm/min
Helium-3	0.01	0.00	Suction P	6.6 psig	Discharge	135.3 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1279 cfm
Carbon Dioxide	0.51	0.78	Discharge P	127.0 psig	Discharge	238 cfm
Methane	52.94	29.68				
Ethane	20.58	21.63				
Propane	12.86	19.81				
Isobutane	2.30	4.67				
n-Butane	5.66	11.51				
Isopentane	1.42	3.58				
n-Pentane	1.80	4.53				
n-Hexane	0.75	2.27				
n-Heptane	0.27	0.94				
Water	0.80	0.51				

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	1.554 MMSCFD	Comp Ratio	11.23
Vi Range	2.2 - 5.0		Shaft Power	288.3 hp	Ideal Vi	9.61
Casing	Gray Cast Iron		Capacity %	100.0 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	100.0 %	Disc T	220.0 °F
Volumetric Eff	86.3 %		Speed	100.0 %	Disc DewT	120.8 °F
Adiabatic Eff	67.7 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	1.554 MMSCFD		Std Flow	1.554 MMSCFD		
Mass Flow	81.3 lbm/min		Mass Flow	81.3 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	0.5 psig		Pressure	120.0 psig		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	Frick NG-4		Discharge Flow	44.2 gpm	Heat Reject	249 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	20.1 gpm	Outlet T	120.0 °F
Heat Reject	359 kbtu/hr		Main Inj Flow	24.1 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	27.2 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	81.3 lbm/min
Helium-3	0.01	0.00	Suction P	-0.9 psig	Discharge	81.3 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1236 cfm
Carbon Dioxide	0.50	0.78	Discharge P	127.0 psig	Discharge	143 cfm
Methane	52.71	29.60				
Ethane	20.49	21.57				
Propane	12.80	19.76				
Isobutane	2.29	4.66				
n-Butane	5.64	11.47				
Isopentane	1.41	3.57				
n-Pentane	1.79	4.51				
n-Hexane	0.75	2.26				
n-Heptane	0.27	0.94				
Water	1.24	0.78				

Yoho Compressor
Run 7
22531 - YOHO VRU C-150R & C-170R Combined

John Pham
Date: **October 29, 2024**
Gauge Ref: **13.4 psi**

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	2.576 MMSCFD	Comp Ratio	7.52
Vi Range	2.2 - 5.0		Shaft Power	352.3 hp	Ideal Vi	6.36
Casing	Gray Cast Iron		Capacity %	100.0 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	100.0 %	Disc T	220.0 °F
Volumetric Eff	89.0 %		Speed	100.0 %	Disc DewT	108.1 °F
Adiabatic Eff	73.9 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	2.576 MMSCFD		Std Flow	2.576 MMSCFD		
Mass Flow	134.9 lbm/min		Mass Flow	134.9 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	8.0 psig		Pressure	130.0 psig		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	Frick NG-4		Discharge Flow	33.7 gpm	Heat Reject	413 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	20.3 gpm	Outlet T	120.0 °F
Heat Reject	275 kbtu/hr		Main Inj Flow	13.4 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	14.8 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	134.9 lbm/min
Helium-3	0.01	0.00	Suction P	6.6 psig	Discharge	134.9 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1275 cfm
Carbon Dioxide	0.51	0.78	Discharge P	137.0 psig	Discharge	221 cfm
Methane	52.94	29.68				
Ethane	20.58	21.63				
Propane	12.86	19.81				
Isobutane	2.30	4.67				
n-Butane	5.66	11.51				
Isopentane	1.42	3.58				
n-Pentane	1.80	4.53				
n-Hexane	0.75	2.27				
n-Heptane	0.27	0.94				
Water	0.80	0.51				

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	1.543 MMSCFD	Comp Ratio	12.03
Vi Range	2.2 - 5.0		Shaft Power	302.2 hp	Ideal Vi	10.31
Casing	Gray Cast Iron		Capacity %	100.0 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	100.0 %	Disc T	220.0 °F
Volumetric Eff	85.7 %		Speed	100.0 %	Disc DewT	123.2 °F
Adiabatic Eff	66.2 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	1.543 MMSCFD		Std Flow	1.543 MMSCFD		
Mass Flow	80.7 lbm/min		Mass Flow	80.7 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	0.5 psig		Pressure	130.0 psig		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	Frick NG-4		Discharge Flow	49.0 gpm	Heat Reject	252 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	21.3 gpm	Outlet T	120.0 °F
Heat Reject	399 kbtu/hr		Main Inj Flow	27.8 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	30.4 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	80.7 lbm/min
Helium-3	0.01	0.00	Suction P	-0.9 psig	Discharge	80.7 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1227 cfm
Carbon Dioxide	0.50	0.78	Discharge P	137.0 psig	Discharge	132 cfm
Methane	52.71	29.60				
Ethane	20.49	21.57				
Propane	12.80	19.76				
Isobutane	2.29	4.66				
n-Butane	5.64	11.47				
Isopentane	1.41	3.57				
n-Pentane	1.79	4.51				
n-Hexane	0.75	2.26				
n-Heptane	0.27	0.94				
Water	1.24	0.78				

Yoho Compressor
Run 9
22531 - YOHO VRU C-150R & C-170R Combined

John Pham
Date: **October 29, 2024**
Gauge Ref: **13.4 psi**

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	2.456 MMSCFD	Comp Ratio	8.02
Vi Range	2.2 - 5.0		Shaft Power	360.0 hp	Ideal Vi	6.80
Casing	Gray Cast Iron		Capacity %	96.1 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	98.8 %	Disc T	220.0 °F
Volumetric Eff	84.9 %		Speed	100.0 %	Disc DewT	110.2 °F
Adiabatic Eff	71.5 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	2.456 MMSCFD		Std Flow	2.456 MMSCFD		
Mass Flow	128.6 lbm/min		Mass Flow	128.6 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	8.0 psig		Pressure	140.0 psig		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	Frick NG-4		Discharge Flow	40.1 gpm	Heat Reject	395 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	21.5 gpm	Outlet T	120.0 °F
Heat Reject	326 kbtu/hr		Main Inj Flow	18.5 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	19.7 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	128.6 lbm/min
Helium-3	0.01	0.00	Suction P	6.6 psig	Discharge	128.6 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1216 cfm
Carbon Dioxide	0.51	0.78	Discharge P	147.0 psig	Discharge	197 cfm
Methane	52.94	29.68				
Ethane	20.58	21.63				
Propane	12.86	19.81				
Isobutane	2.30	4.67				
n-Butane	5.66	11.51				
Isopentane	1.42	3.58				
n-Pentane	1.80	4.53				
n-Hexane	0.75	2.27				
n-Heptane	0.27	0.94				
Water	0.80	0.51				

Yoho Compressor
Run 10
22531 - YOHO VRU C-150R & C-170R Combined

John Pham
Date: **October 29, 2024**
Gauge Ref: **13.4 psi**

COMPRESSOR			PERFORMANCE		CONDITIONS	
Model	SGC 2821		Capacity	1.525 MMSCFD	Comp Ratio	12.83
Vi Range	2.2 - 5.0		Shaft Power	316.6 hp	Ideal Vi	11.05
Casing	Gray Cast Iron		Capacity %	100.0 %	Actual Vi	5.00
Bearings	Standard		Slide Valve Pos	100.0 %	Disc T	220.0 °F
Volumetric Eff	84.7 %		Speed	100.0 %	Disc DewT	125.5 °F
Adiabatic Eff	64.4 %		Speed	1800 rpm	Disc DewT Prim	Water
UPSTREAM			DOWNSTREAM			
Std Flow	1.525 MMSCFD		Std Flow	1.525 MMSCFD		
Mass Flow	79.7 lbm/min		Mass Flow	79.7 lbm/min		
Temperature	50.0 °F		Temperature	120.0 °F		
Pressure	0.5 psig		Pressure	140.0 psig		
Line Pres Drop	1.4 psi		Line Pres Drop	7.0 psi		
OIL SYSTEM			OIL SYSTEM		AFTERCOOLER	
Type	Frick NG-4		Discharge Flow	54.3 gpm	Heat Reject	253 kbtu/hr
Cooling Type	Glycol Cooled		Bearing Flow	22.5 gpm	Outlet T	120.0 °F
Heat Reject	442 kbtu/hr		Main Inj Flow	31.8 gpm		
Bearing Oil T	180.0 °F		Valve Dia	1.0 in		
System dP	10.0 psi		Valve Pos	33.9 %		
			Balance Piston	Std Regulator		
			Bal Piston dP	0.0 psi		
MIXED GAS			FLANGE		FLOW	
	By Mole	By Mass	Suction T	50.0 °F	Suction	79.7 lbm/min
Helium-3	0.01	0.00	Suction P	-0.9 psig	Discharge	79.7 lbm/min
Nitrogen	0.10	0.10	Discharge T	220.0 °F	Suction	1213 cfm
Carbon Dioxide	0.50	0.78	Discharge P	147.0 psig	Discharge	122 cfm
Methane	52.71	29.60				
Ethane	20.49	21.57				
Propane	12.80	19.76				
Isobutane	2.29	4.66				
n-Butane	5.64	11.47				
Isopentane	1.41	3.57				
n-Pentane	1.79	4.51				
n-Hexane	0.75	2.26				
n-Heptane	0.27	0.94				
Water	1.24	0.78				



Section 2

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Enerflex

Driver / Cooler

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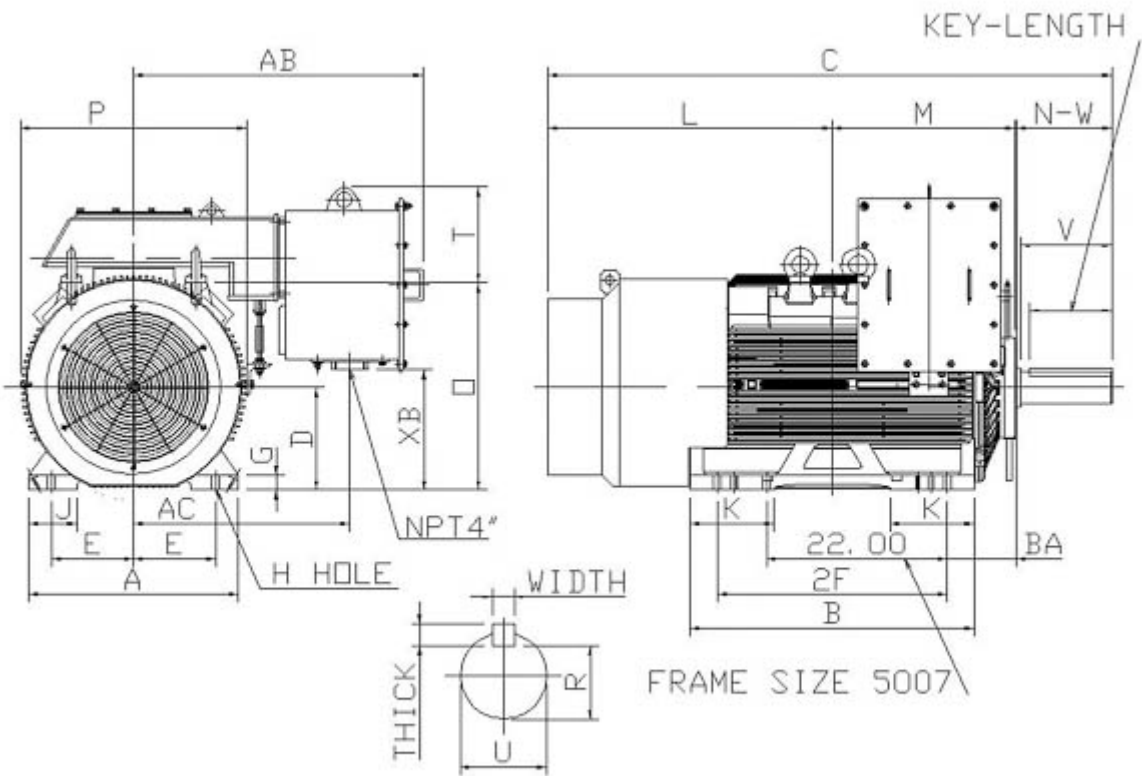
Vendor Data Packages

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	Date: October 18, 2024

Dimensional Drawing

Catalogue	Type	HP	RPM	Voltage	Hz	Frame Size
PF4004	AFHH	400	1800	460	60	5009B



Mounting				A	B	C	D	G	J	K	KL
E	2F	H	BA								
10	28	0.94	8.5	25.6	34.65	68.83	12.5	1.85	5.9	10.24	
L	M	O	P	T		Terminal Housing					
						AA	AB	AC	XB		
								25.3	27.6	19.96	
Shaft Extension			Key			Keyseat					
N-W	U	V	Width	Thick	Length	R					
11.62	3.875	11.12	1	1	10	3.309					
Bearings				Weight Lbs		Drive Method				Dimensions	
DE		NDE									
6324C3		6320C3-INS		3800		Direct Coupling / Belt Drive				Inches	

	
	Date: October 18, 2024

Technical Data Sheet

Motor Type: AFHH	Catalogue No: PF4004
------------------	----------------------

Nameplate Information

HP	Pole	RPM	Frame	Voltage	Hz	Phase
400	4	1790	5009B	460	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.					
96.20	95.40	95.80	95.40	88.00	87.00	81.00
Torque				Current (A)		
Full Load (lb-ft)	Locked Rotor (% FLT)	Pull Up (% FLT)	Break Down (% FLT)	No Load	Full Load	Locked Rotor
1173.90	140	126	200	118.8	442.0	2900.00
NEMA KVA Code	Inertia (WR ²)			Safe Stall Time (s)		Noise Level Sound Press. dB(A)
	Rotor (lb-ft ²)	NEMA Load (lb-ft ²)	Max. Allowable (lb-ft ²)	Cold	Hot	
G	155.000	1546.00	2089.00	12	9	80.0

VFD Duty Information

MAX HP	Current (A)	Speed Range			VFD		S.F.
		CT	VT	CHP	Carrier Hz	Type	
400	442.00	20-60Hz	6-60Hz	60-60Hz	3-6kHz	VPWM or CPWM	1.0

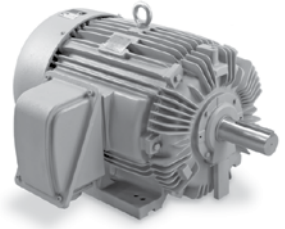
Hazardous Locations Information

Additional Certifications

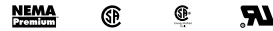
CSA Certified	Other Certification
Class I, Div 2, Groups B, C & D Class I, Zone 2, Groups IIB+H2, IIB & IIA	Class II, Div 2, Groups F & G
Temp Code (Sinewave / VFD)	T3 / T3

Additional Information

Bearings		Approx. Weight
DE	NDE	lbs
6324C3	6320C3-INS	3800



MODEL: OPTIM® TEFC
TYPE: AEHH8N, AFHH



Effective 02-09-23
Supercedes All Previous

APPLICATIONS

- Fans & Blowers
- Crushers
- Mixers
- Pumps
- Compressor
- Conveyors

PRODUCT OVERVIEW

- 1-800 HP
- 60Hz, 230/460V, 460V or 575V
- 3600, 1800, 1200 & 900 RPM
- Totally Enclosed Fan Cooled IP54 Design, IP55 for 5000 Frames and Larger
- Horizontal F1 Mount
- NEMA Premium Efficiency

DESIGN FEATURES

- 1.15 S.F. Sine Wave Power; 1.0 S.F. VFD Power
- Class F Insulation
- Max Elevation 3300ft
- Continuous Duty
- NEMA Design B or C
- 40°C Ambient

MECHANICAL FEATURES

- Shielded Bearings Frames 140T-280T and Open Bearings with Regreaseable Provisions Frames 280TS, 320T and Larger
- Polyrex EM Grease in all Regreaseable Bearings, Multemp SRL Grease in Shielded Bearings
- Aluminum Rotor up to 440T Frames; Copper/Copper Alloy or Aluminum Rotor 5000 and Larger
- Cast-Iron Frame and End Brackets
- Cast-Iron Conduit Box up to 449T Frames; Fabricated Steel Conduit Box 5000 Frames and Larger
- Non-Sparking Plastic Fan up to 449T 4,6 & 8 Pole Motors; Bronze Fan 440TS 2 Pole Motors; Aluminum Fan 5000 Frames and Larger
- Number of Leads 230/460V: 9 Leads 1-5 HP; 12 Leads 7.5-125 HP; 6 Leads 150 and Above
- Number of Leads 575V: 3 Leads up to 449T; 6 Leads 5000 Frames and Larger
- Solderless Lug Terminals on All Leads
- Grounding Terminal Inside Main Terminal Box, Additional Grounding Terminal on Frame for 5000 Frames and Larger
- Interchangeable F1 and F2 Mounting up to 449T Except 449TX/TSX, F3 Available 5000 Frames and Larger
- Dual Drilled Feet for Longer Frames (i.e. 145T also Drilled for 143T) 449T and Below Except 449TX/TSX
- Paint System: Phenolic Rust Proof Base with Lacquer Top Coat
- Insulated NDE Bearing Standard for 5000 Frames and Larger
- Rubber Flinger on DE up to 280T; Brass Flinger on Both Ends 280TS to 449T; Steel Flinger on Both Ends Interchangeable with Inpro Seals 5000 Frames and Larger
- *HPE™ High Pulse Endurance Spike Resistant Wire
- 2 Dips Phenolic Alkyd Resin Varnish 140T-440T, 2 Dips Epoxy Resin 5000 Frames and Larger; Spray Enamel Top Coat on all Frames
- Bi-Directional Rotation Except 3600RPM Motors 5000 Frames and Larger Which are CCW From NDE
- Winding RTD's, Space Heaters and Provisions for Bearing RTD's Standard 5000 Frames and Larger

OTHER FEATURES

- CSA Certified for Class I, Division 2, Groups B, C & D (Class I, Zone 2, Groups IIB+H2, IIB and IIA)
- CSA Certified Class II, Division 2 (Class II, Zone 22) available for 440 Frames and larger upon request
- *Speed Ranges up to 10:1 CT, and 20:1 VT. Refer to data sheet for rating specific turn down ratios
- *Meets NEMA MG1 Part 31.4.4.2

* Precautions should be taken to eliminate or reduce voltage spikes and shaft currents that may be imposed on the motor by the VFD as stated per NEMA MG1, Part 31.4.4.



Instructions For Three Phase Induction Motors

**Large Cast Iron Frame Type
IEC Frame 280 (NEMA Frame 444) and above**



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1. INTRODUCTION

1.1 General

This and the following instructions address the more common situations encountered in motor installation, operation and maintenance. For the TECO motor warranty to be and to remain in effect, the motor must be installed and operated in strict accordance with the outline drawing, motor nameplates and these instructions, and must not be altered or modified in any unauthorized manner.

During the installation and operation of motors in heavy industrial applications there is a danger of contact with live electrical and rotating parts. Therefore to prevent injury and/or damage the basic planning work for installation, transport, assembly, operation, etc... needs to be done and checked by authorized and competent personnel only.

Since these instructions cannot cover every eventuality of installation, operation and maintenance, the following points should however be considered and checked.

- Technical data and information on permissible use such as assembly, connection, ambient and operating conditions given in the related catalogue, operating instructions, nameplates and other production documentation.
- General erection and safety regulations.
- Local (job site) and plant-specific specifications and requirements.
- Proper use of transport, lifting devices and tools.
- Use of personal protective equipment.

The following safety indications should be observed when reading these instructions:



Electric Hazard.



Danger.

ATTENTION !

Warning of possible damage to the motor or installation.

This instruction manual is for **TECHNICAL USE ONLY, NOT FOR COMMERCIAL PURPOSE**. The warranty is limited to coverage expressed in your sales contract. Documentation of storage, transportation, installation and examination, if required, shall be obtained from TECO-Westinghouse service centers before start and maintenance.

1.2 Serial number of the machine

Each electric motor is identified with a serial number. It has been stamped on a main name plate which is attached on the frame by rivets. This serial number is very important as an index for tracking this motor's history.

1.3 Mounting

In this instruction manual, the arrangements for most of the electric motor are as follows:

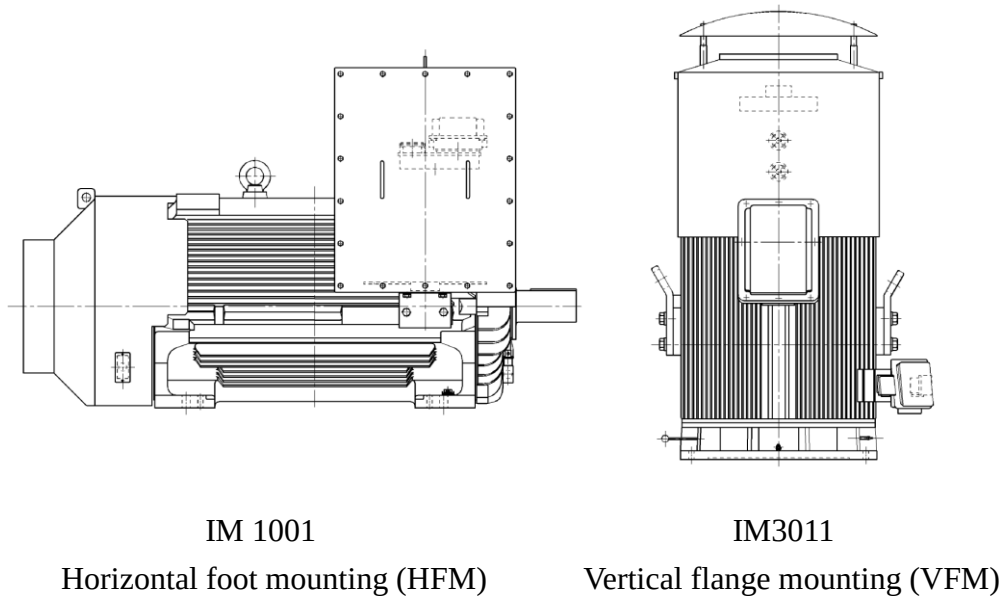


Fig. 1 Mounting arrangement

1.4 Direction of rotation

The arrow on the direction nameplate indicates the direction of the rotation of the Rotor, looking in front of the DE-Shaft-end.

The motor must be operated just on the plate shown direction.

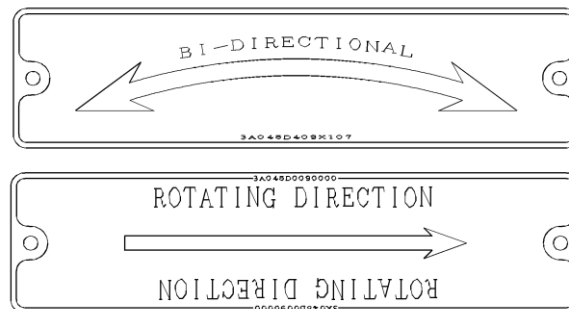


Fig. 2 Direction nameplate

ATTENTION !

Operating the motor in the incorrect direction may cause serious damage to both the motor and driven equipment.

2. ACCEPTING, INSPECTION, STORAGE, TRANSPORTATION

2.1 Inspection upon receipt

Check the following points upon receipt :

- Is there any visible damage to the motor or case? Any damage should be photographed, documented and reported to the carrier and TECO-Westinghouse immediately.
- Are the nameplate ratings identical with your confirmed order ?
- Are dimensions and color in compliance with your specifications ?
- Are the nameplate ratings for heater, thermal protector, temperature detector, etc. identical with your confirmed order ?
- Are all accessories and accompanying instruction manuals in good order ?
- Does the arrow head indicate the correct direction of rotation?
- If there are any specific requirements, please ensure they are in conformity with your specification.

2.2 Storage

2.2.1 General

When motors are not in operation, the following precautionary measures must be taken to insure the motors do not suffer deterioration or damage from moisture, dust and dirt, or careless handling. The climate, length of time the equipment is to be stored, and the adequacy of the storage facilities will determine the storage precautions required.

Any deterioration or damage of the motors due to customer's incorrect storage of the motors is not covered by the warranty. This includes all periods of time when the motor is installed on site but has not been placed into operation.

The following procedures must be followed and a maintenance log must be kept to keep from voiding factory warranty. The records are also useful to decide if a motor is suitable or not to be put into service.

2.2.2 Location

The ideal storage area is a clean, heated, and well-ventilated building.

- (a) High and dry, well-ventilated indoor, without exposure to direct sun lights, free from dust, corrosive gas (such as chlorine, sulfur, dioxide, and nitrous oxides) and fumes, and infestation by vermin or insects.
 - (b) The ideal storage temperature range is from 10°C to 50°C (50°F to 125°F)
 - (c) Not close to a boiler or freezer.
 - (d) Entirely free from vibration. Vibration levels above 2.5 mm/s (0.1 in/sec) velocity could damage the bearings and cause “brinelling” of the bearing races.
 - (e) Motors should be put on pallets to prevent moisture from accumulating underneath.
 - (f) Motors should be stored in a heated building, outdoor storage is not suitable for motors. If motors have to be stored outdoors for some reasons, they should be well covered with a tarpaulin and protected from contamination and the elements. Motors should be well shielded from dust, but under well-ventilated circumstances. This should be for a very short period of time (say less than one month) only and the risk of deterioration is the responsibility of the users.
-

2.2.3 Moisture prevention

Since moisture can be very detrimental to electrical components, the motor temperature should be maintained about 3°C above the dew point temperature by providing either external or internal heat. If the motor is equipped with space heaters, they should be energized at the voltage shown by the space heater nameplate attached to the motor. Check weekly that the space heaters are operating. Incandescent light bulbs can be placed within the motor to provide heat, if the anti-condensation space heaters are not fitted. However, if used, incandescent bulbs must not be allowed to come in contact with any parts of the motor because of the concentrated hot spot that could result.

2.2.4 Prevent Corrosion and frost damage

When motors are shipped from the factory, the shaft extension and bearing journals on sleeve bearing motors, are covered with a protective coating. This coating should be examined to see that it has not been accidentally removed. The coating should be renewed if there are any signs of corrosion or if the coating has been removed. Care should be taken to keep parts such as fitted surface, key, shaft extension, mounting feet or face, and axial central hole from any collision with foreign matters, and to have rust preventative in place. It is a good practice to seal any shaft openings with silicone, rubber caulking, or tape. If any rust is observed, measures should be taken to remove the rust and protect against it. Grease or anti-corrosion agent should also be generously applied to prevent rusting.

Water-cooled motors or motors using bearings with water-cooling coils, please make sure the water is dried off to prevent tube corrosion or frost damage.

TECO-Westinghouse reserves the right to void warranties based upon evidence of rust or other indications of moisture inside the motor that indicate that the motor was improperly stored.

2.2.5 Insulation resistance test

Even during storage, the insulation resistance should be kept above the specified values.

- (a) For measurement of insulation resistance and acceptable standard values, please refer to measures stated in 4.1.2 "Measurement of insulation resistance".
- (b) Insulation resistance test should be performed once every three months.
- (c) Resistance measurement of each temperature detector (ex. PT 100Ω/°C) is necessary once every three months.

2.2.6 Long period of idle (storage)

If the motor is not in operation for a long period of time (one week and above) after installation or has been in operation but stopped for a period of time, the following precautions must be taken.

- (a) Protect the motor as measures stated in 2.2.3 and 2.2.4.
 - (b) Insulation resistance test should be performed as stated in 2.2.5.
 - (c) Bearing Protection per 2.2.7.
 - (d) Operation test should be performed once every three (3) months.
-

- (e) If external vibration is present, the shaft coupling should be opened.
- (f) If motors are mounted shaft up, a solid protective plate or shield shall be mounted above the installation if needed.
- (g) If motors are mounted shaft down, drip covers are to be mounted to give satisfactory protection if needed.
- (h) If motors are equipped with drain plugs, they should be removed.
- (i) When motors equipped with brushes, the brushes should be lifted in the brush holder, if there is no protective strip (such as MYLAR) between the brushes and collector rings.
- (j) Water-cooled motors or motors using bearings with water-cooled coils, ensure the water is dried off to prevent tube corrosion or frost damage.
- (k) Storage maintenance must be documented for warranty and reference purposes.

2.2.7 Bearing protection

- (a) If the motor has been provided with a shaft shipping brace to prevent shaft movement during transit, it must be removed before operating the motor.

It is very important that this brace be reinstalled exactly as it was originally, before the motor is moved from storage or any time when the motor is being transported. This prevents axial rotor movement that might damage the bearings.

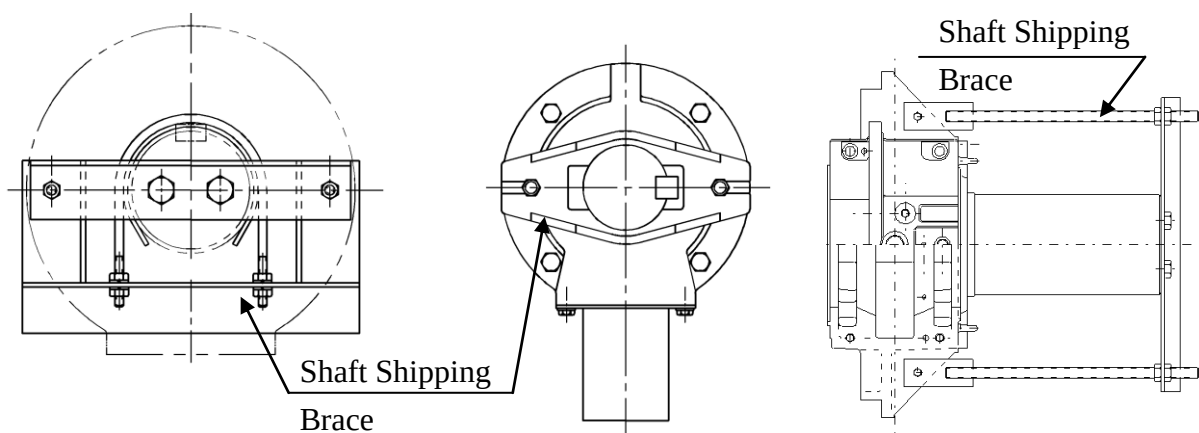


Fig. 3 Shaft shipping brace

- (b) Motors equipped with sleeve bearings are shipped from the factory with the bearing oil reservoirs drained. In storage, the oil reservoirs should be properly filled to the center of the oil level gauge with a good grade of rust inhibiting oil. To keep the bearing journals well oiled and prevent rusting, the motor shaft should be rotated several revolutions every month ensuring the shaft does not come to rest in its original position. While the shaft is rotating, it should be pushed to both extremes of the endplay. If the motor is not in operation for over six months, dismount the upper cover of the sleeve bearing housing and check the anti-corrosion protection.

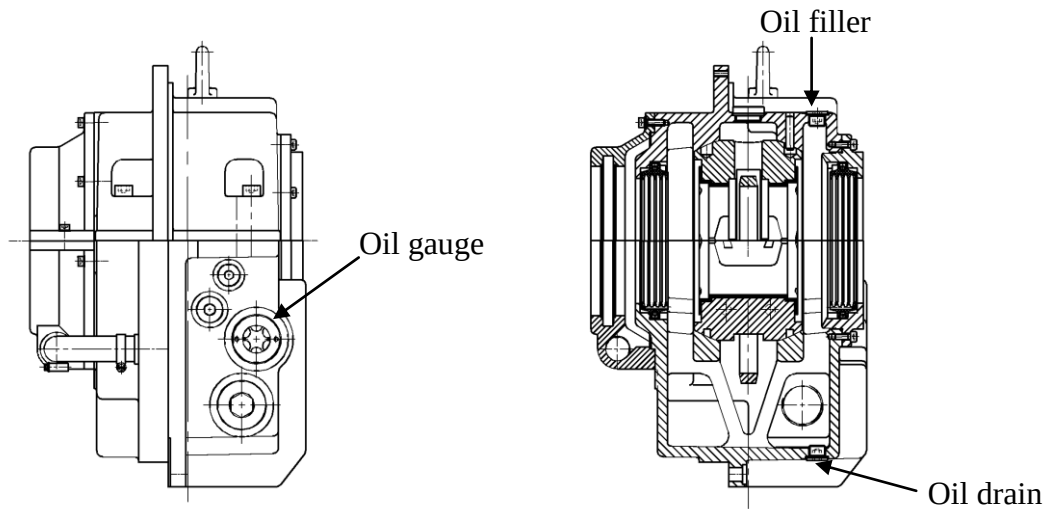


Fig. 4 Sleeve bearing

- (c) Motors with anti-friction bearings are properly lubricated with the correct grade of grease at the factory and no further greasing is required in storage. If the motor is not in operation for over three months, add grease to each bearing per lubrication nameplate. The shaft should be rotated several revolutions every month to maintain proper distribution of the grease within the bearings.
- (d) Tilt-pad bearings are a type of sleeve bearing used in special design applications. Due to the nature of this bearing, a loose oil ring for delivering lubricant cannot be provided. Therefore, during the storage interval, oil must be manually introduced periodically into the pads and housing to prevent the occurrence of oxidation of the precision machined components.
- (1) Remove the pipe plug from the bearing cap located above the tilt-bearing shell.
 - (2) Pour in approximately one cup of oil every month and rotate the shaft a few revolutions every two (2) weeks.
- For long periods of storage, the oil that accumulates in the housing should be removed.
- (e) The bearing assembly parts of motors with oil mist lubrication are put on with anti-rust oil, so they can be preserved for several months in good condition. The motor should be stored indoor and well-ventilated environment and prevent contact with contaminated or corrosive air. The following points should be noted :

- (1) During preservation, the Inpro seal can not prevent moisture from going through into the bearings. Please use the oil mist to lubricate the bearings every two (2) weeks.
- (2) If the color of flow out oil is changed, the bearing should be rusted or have contamination in it. Please contact TECO-Westinghouse.
- (3) Avoid using grease as it will plug the vent/drain.
- (4) All assembly surfaces are painted with seal bonds, do not disassemble them at anytime.
- (5) Do not remove the plugs in vent/drain to prevent the moisture.
- (6) Do not apply any force on the Inpro seal to prevent damage.
- (7) The Inpro seal is a labyrinth type seal. Therefore it can not contain a pressure differential.
- (f) If the storage is over two (2) years, it is recommended that the bearing assembly is dismantled and the bearing parts are inspected before commissioning. Any corrosion has to be removed with fine emery cloth.
- (g) Motors with anti-friction bearings with provisions for oil mist are shipped from factory with the correct grade of grease in the bearings and therefore it is not necessary to hook up the motors to the oil mist system. The shaft should be rotated several revolutions every month to maintain proper distribution of the grease within the bearings. If customers choose to hook up to the oil mist system, all grease must be removed from the bearings.

2.2.8 Removal from storage

After long period of idle or storage, and, prior to energizing the motor, a thorough inspection and megger test of windings is required. The bearings should be inspected for corrosion, brinelling and deformation.

If any of the following conditions pertain, then re-conditioning may be required before putting a motor into service.

- (a) Winding resistance is less than recommended.
- (b) Evidence of rust or other indications of moisture inside the motor.
- (c) Corrosion or brinelling or deformation occurred in bearings.
- (d) Idle or storage longer than the warranty period.
- (e) Idle or storage in dirty or damp surroundings.
- (f) Storage in unheated area where the temperature and humidity fluctuate.
- (g) Idle or storage where it has been subject to vibration, such as from nearby machinery or passing traffic.
- (h) Outdoor storage.
- (i) No maintenance records showing that the storage procedures have been followed.

Any reconditioning required, as noted by the inspections after removal from storage, should be performed prior to putting the motor into service. Such inspection and testing or re-conditioning are available from local TECO-Westinghouse service/facilities. Reconditioning after idle or storage is not covered by factory warranty. Any parts that must be replaced due to damage or deterioration will be at customer's cost.

2.3 Transportation

ATTENTION !

To keep the rotating parts of motors from moving, thus preventing damage and scratching during transportation, they should be held securely with a locking device. Remove all transit clamps before operating the motor. It is very important that this device be reinstalled, exactly as it was originally, before the motor is moved from storage or any time when the motor is being transported.

Vertical mount type motors should be transported in the vertical position only.



Do not use the hoisting hook/eyebolts to lift more than the motor itself. They are designed to support the motor only.

Make sure the hoisting hook is correctly attached to the eyebolt(s) or lug(s) of the motor and that the eyebolt(s)/lug(s) are fully threaded in before hoisting. Also note such parts as fan cover, ventilation box, bracket, slip-ring covers, etc. may have their own hoisting lugs which can only carry their own weight. Nothing extra should be attached while hoisting.

Do not twist or cross the steel cables. Make sure the eyebolts have been securely threaded with the shoulder flush and the sling angle is correct.

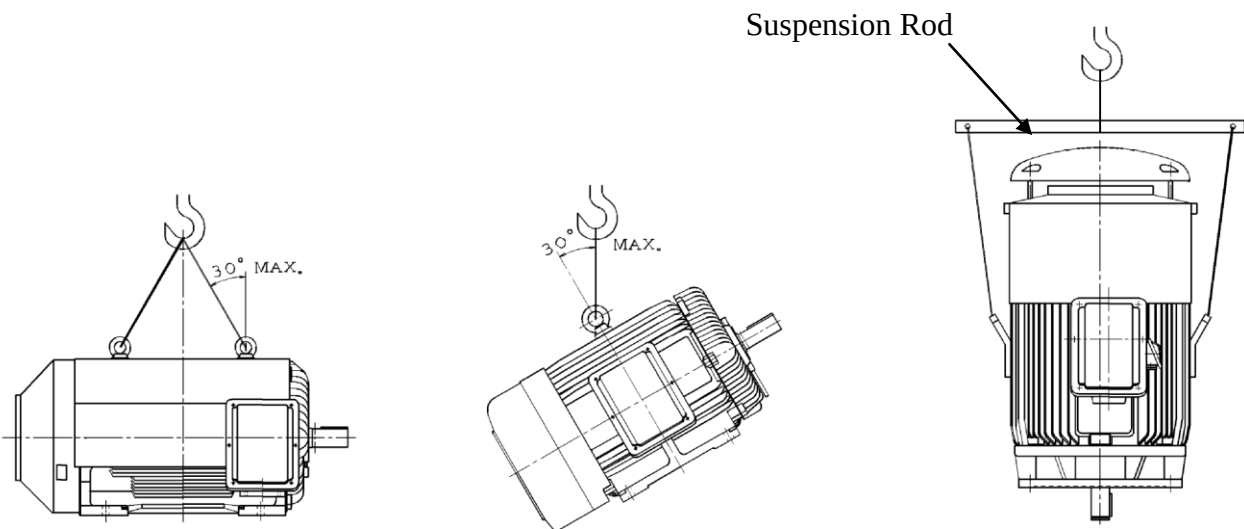


Fig. 5

3. INSTALLATION

3.1 Site and environment for motor installation

3.1.1 General

Standard environment and site conditions for the installation of motors are usually set as follows :

- (a) Ambient temperature : $-20 \sim +40^{\circ}\text{C}$
- (b) Humidity : Relative humidity shall be below 95%RH for totally-enclosed types, and below 80%RH for semi-enclosed types.
- (c) Elevation : Below 1000 meters.
- (d) Harmful gases, liquids, dusts and high moisture levels should be absent.
- (e) Foundations should be strong and free of vibration.

For water-cooled motors or motors using bearings with water-cooling coils, the ambient temperature must not drop below 5°C (41°F) to prevent frost damage. If there are any special environmental conditions, please inform us at time of order.

3.1.2 Ventilation and space

- (a) Installation area should be well-ventilated.
- (b) The installation space should be large enough to facilitate heat dissipation and maintenance.

3.2 Foundation

Motor manufacturer is not responsible for the foundation design. Motor weight, thrust load, twisting moments, seismic forces and other external applied loads must be considered in foundation design.

3.2.1 Reactions of horizontal motor

For a horizontal motor with four hold down bolts, the reactions necessary for foundation design are as follows – kgs per bolt at centerline of hold down bolt holes :

- (a) Static weight = motor weight / bolt number
- (b) Rated motor torque (T_R) , reactions = motor weight/bolt number $\pm T_R/2L$
- (c) Maximum motor torque ($T_{\max}$) ,
Reactions = motor weight/bolt number $\pm T_{\max}/2L$

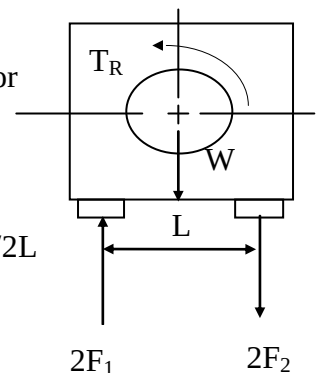


Fig. 6

3.2.2 Soleplate & common bed

Use rigid and solid soleplate or common bed as foundation.

ATTENTION !

For best motor performance, it is advisable to use a sole plate or common bed, particularly when using direct coupling.

If the sole plate or common bed does not have enough stiffness, the critical speed of motors or equipment will then be affected. This change may cause a large vibration (resonance) and decrease the life of the machines.

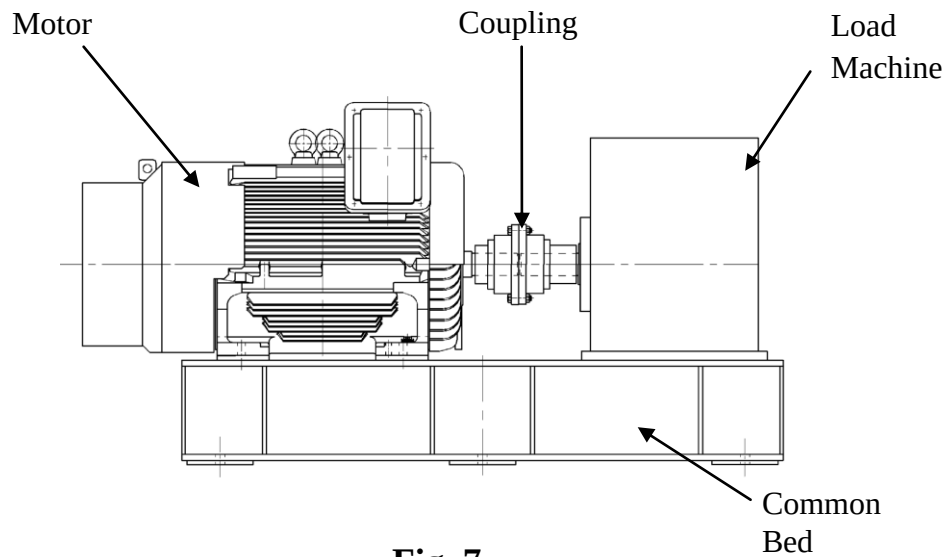


Fig. 7

3.2.3 Installation

- (a) Select an appropriate foundation surface for the soleplate or common bed which will be considered the ultimate level.
- (b) Align the position of the common bed with reference to that level at a minimum of four points. The accuracy should be within 0.04mm (1.5mil).
- (c) Sole plate or common bed should be embedded in concrete foundation as illustrated in Fig.8. Stiff pads should also be installed beneath the wedges which are welded together at various spots about 400-500mm (15-20inches) apart to enable the foundation to evenly carry the weight of the whole motor.
- (d) The base should be sturdy and rigid to keep it flat and level.
- (e) Make sure the mortar and concrete are completely dry and the precision of the level is acceptable, then set the motor on the mounting foundation.
- (f) After accurately install shaft couplings, weld the wedges to prevent soleplate or common bed moving.

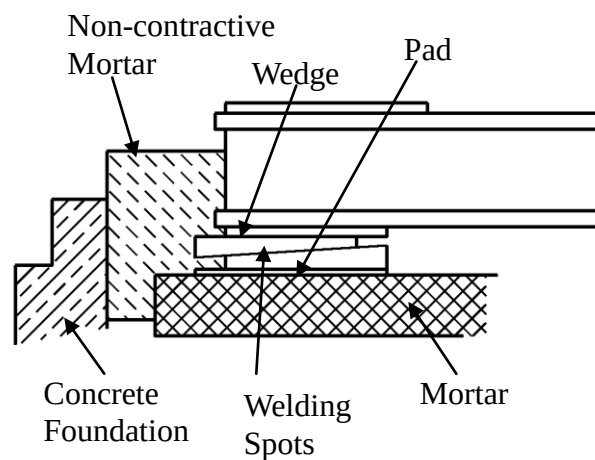


Fig. 8

3.2.4 The foundation of vertical induction motor (Also the foundation of pump)

- (a) Foundation of motor/pump must be rigid and secure to provide adequate support. There must be no vibration, twisting, misalignment etc. due to inadequate foundations.
- (b) A massive concrete foundation is preferred in order to minimize vibration. Rigidity and stability are enhanced by prop plate and foundation bolt. As shown in Fig.9 and Fig.10.

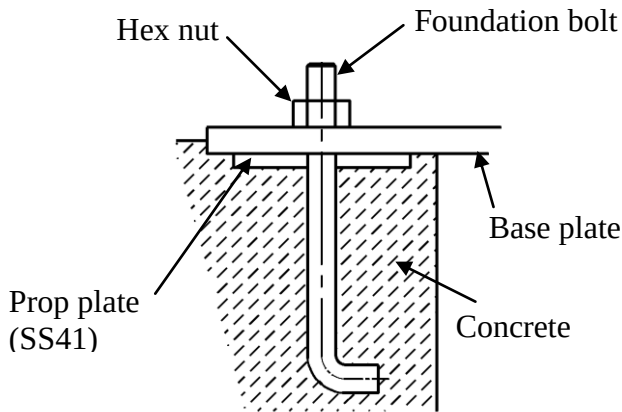


Fig. 9

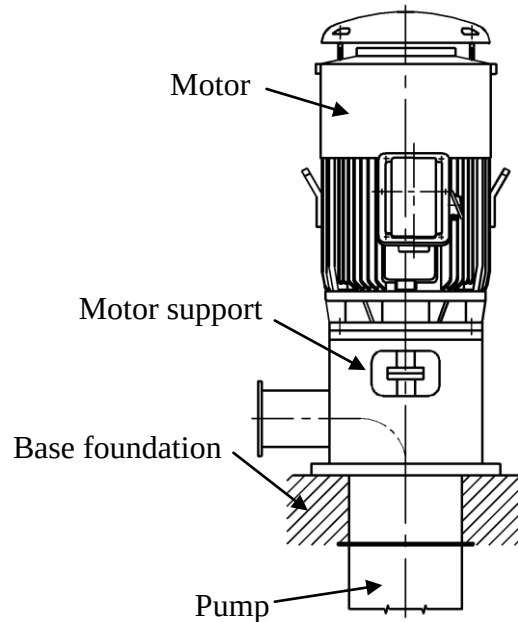


Fig. 10

3.2.5 Installation of vertical motor

- (a) All mounting surfaces must be planished and clean.
- (b) Foundation must be leveled at least at 4 points and guaranteed to be below 0.04mm flat and level.
- (c) Make sure the mortar and concrete are completely dry, and the precision of the level is acceptable, then set the motor on the mounting foundation.
- (d) Accurately install shaft couplings.

3.3 Installation of shaft coupling

3.3.1 General

ATTENTION !

Motors must always be accurately aligned, and this applies especially where they are directly coupled.

Incorrect alignment can lead to bearing failure, vibration and even shaft fracture. As soon as bearing failure or vibration is detected, the alignment should be checked.

3.3.2 Mounting procedure

Field application of a coupling to the motor shaft should follow the procedures recommended by the coupling manufacturer. The motor shaft extension must not be subjected to either extreme heat or cold during coupling installation.

3.3.3 End-play

Although the sleeve bearings are equipped with thrust faces, these are intended only to provide momentary axial restraint of rotor movement either during start-up or when operating the motor disconnected from the driven equipment. They must not be operated under a constant thrust load unless they were originally designed for this condition.

Motors with either sleeve or anti-friction bearings are suitable for connection to the driven load through a flexible coupling. Coupling solidly to the load is not acceptable. With sleeve bearings, the flexible coupling should be of the limited end float type to prevent the possibility of any end thrust from the load being transmitted to the motor bearings, which could cause bearing damage.

The recommended limits of end float for couplings are as follows :

- (a) When the motor is in operation after installation, be sure that the end-play indicator is within the 6mm of the groove on the shaft or aligned to the shaft shoulder immediately outboard of the drive-end bearing to assure there is low friction between shaft and bearing.
 - (b) Unless otherwise specified, the designed end-play value X of the groove for TECO-Westinghouse motors in general is within 7mm (0.276") as illustrated in Fig. 11. In essence, the end-play indicator is adjusted to point at the center of the groove or the drive-end shaft shoulder; thus X equals to $7 \pm 1\text{mm}$ ($0.276'' \pm 0.039''$) or so, and the end-play value (Y) of the couplings should equal or be smaller than 2.4mm (0.094").
 - (c) If the desired value Y is greater than 3mm (0.118") caused for instance by a thrust load and/or load machine with large end-play, please inform us at time of order.
-

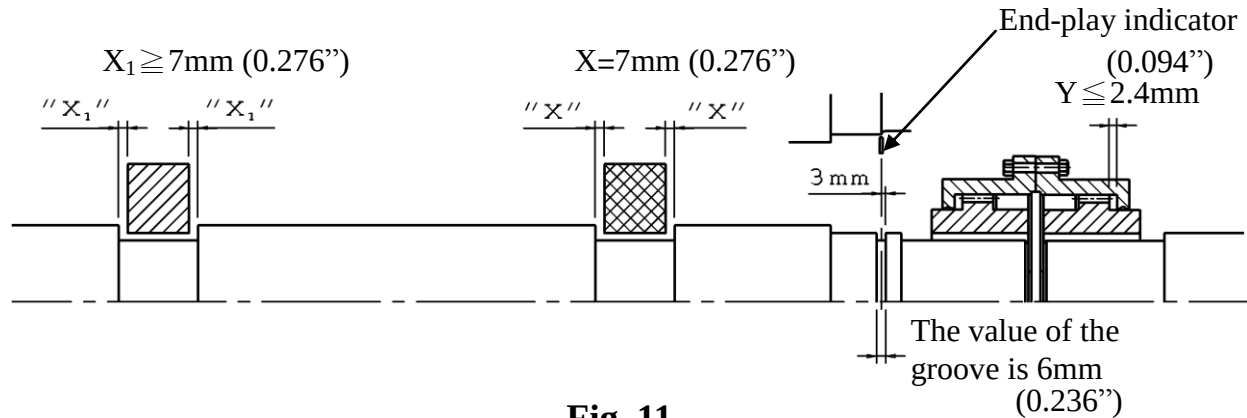


Fig. 11

3.3.4 Thermal growth

In aligning the motor (and rotor) axially with the driven equipment, consideration should be given not only to the end-play indicator position but also to axial shaft expansion and increase in shaft centerline height due to thermal effects. In general, the axial shaft growth for motors can be disregarded since neither bearing fixed nor any shaft growth due to temperature increase will produce an elongation away from the coupling.

Shaft height growth (change in shaft centerline elevation) for TEFC machines can be calculated as follows :

$$\Delta = (0.0005) \times (\text{motor foot to shaft centerline dimension})$$

For non-TEFC machines, divide this number by 2.

3.3.5 Alignment

It is desirable, in normal operation, that the motor operate on its magnetic center, so that no axial force is exerted on the coupling.

The motor shaft and the driven shaft should be aligned within the following tolerances in both angular and parallel alignment :

Unit : mm

TIR	Range of rotating speed	Solid coupling	Flexible coupling
C	2500rpm and above	0.03	0.03
	Below 2500rpm	0.04	0.05
A	2500rpm and above	0.03	0.03
	Below 2500rpm	0.03	0.04

Angular misalignment is the amount by which the centerlines of driver and driven shaft are skewed. It can be measured using a dial indicator set up as shown in Fig.12. The couplings are rotated together through 360 degrees so that the indicator does not measure run out of the coupling hub face. The shafts should be forced against either the in or out extreme of their end float while being rotated.

Parallel misalignment is the amount by which the centerlines of the driver and driven shafts are out of parallel. It can be measured using a dial indicator set up as shown in Fig.13. Again, the couplings are rotated together through 360 degrees so that the indicator does not measure runout of the coupling hub outside diameter.

TIR = Total indicator reading (by dial indicator)

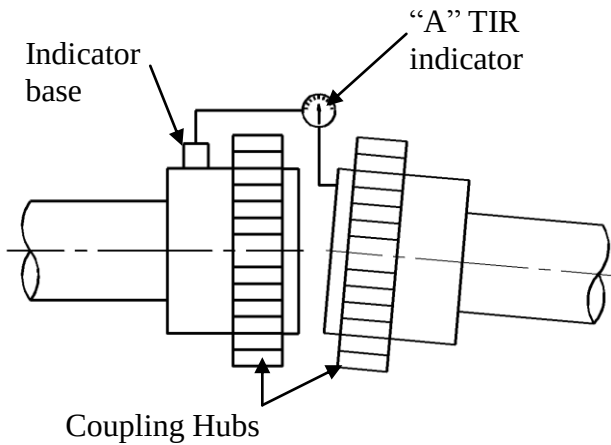


Fig. 12

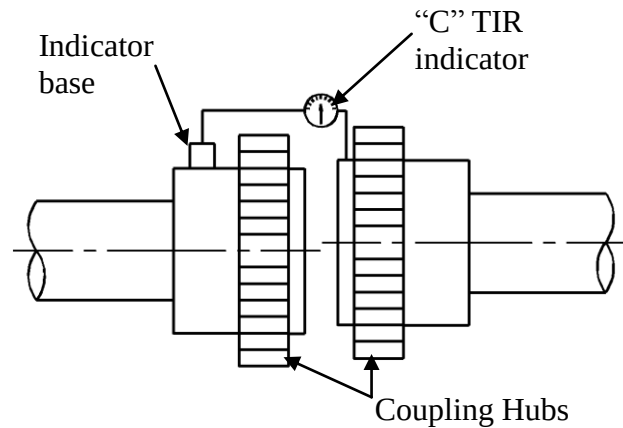


Fig. 13

ATTENTION !

Measurements should be made only after shimming and with hold-down bolts properly tightened.

3.3.6 Shims for horizontal motor

During alignment, the motor is adjusted vertically by shimming between the mounting surface and the motor feet. The shims (furnished only if part of the motor order) should be as large as the projected area of the motor foot pad and should either partially or completely encircle the hold-down bolts. Shimming must be done carefully to prevent any uneven support of the frame feet that could result in frame distortion due to hold-down bolt tension. When properly shimmed, it should be possible to insert 0.05mm thick feeler gauge between the top shim and the bottom of any frame foot.

3.3.7 Dowel for horizontal motor

After the motor has been properly aligned with the driven equipment and the hold-down bolts have been installed and tightened, for motors with fabricated frame, at least two dowel pins should be installed in two diagonally opposite motor feet.

For motors with fabricated frame, pilot holes are provided to facilitate final field drilling and reaming of the required dowel holes. Since the dowel pilot hole in the frame foot is set at a 45° angle from the vertical, it may first be necessary to spot face the motor mounting surface. This can be accomplished with a flat bottom drill utilizing the pilot hole as a guide.

3.3.8 Installation of shaft coupling (Vertical hollow shaft motor only)

Bolted coupling as Fig.14

- (a) Bearings are provided to absorb some upward shaft thrust when the coupling is fitted.
- (b) The coupling is fastened with bolts.
- (c) This coupling type is not auto-release type.

Note : Standard high thrust motors can absorb momentary upthrust load up to 30% of the standard downthrust load. If the upthrust is long duration (over 10 seconds) and/or exceeds 30% of the standard high thrust rating, special design arrangements are required and a standard motor is not suitable.

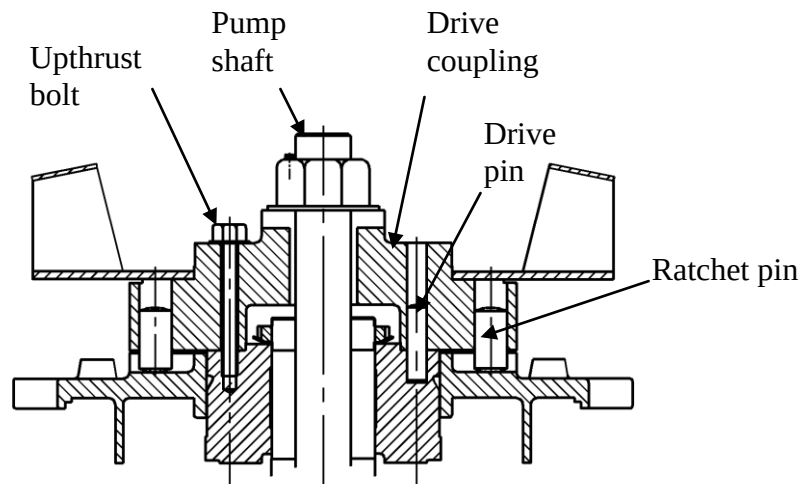


Fig. 14

3.3.9 Non-reverse ratchet/coupling, as Fig. 14 (If fitted)

The non-reverse coupling is also a bolted type and,

- (a) It prevents the pump and motor from rotating in the reverse direction.
- (b) It also prevents damage from over speeding and damage to pump shaft and bearings.
- (c) The ratchet pins are lifted by the ratchet teeth and are held clear by centrifugal force and friction as the motor comes up to speed.
- (d) When power is removed, speed decreases, and the pins fall. At the instant of reversal, a pin will catch in a ratchet tooth and prevent backward rotation.
- (e) When installing the non-reverse coupling, do not use lubricant. Lubrication will interfere with proper operation. The top half of the coupling should seat solidly on the lower half and the pins should touch the bottom of the pockets between the teeth in the plate.
- (f) As with the bolted coupling, the upthrust capabilities are 30% of the standard high thrust rating for downthrust.

ATTENTION !

Do not apply non-reverse ratchets on applications in which the pump reversal time from shutdown (the instant the stop button is pressed) to zero speed is less than one second.

3.3.10 Manual rotation of large vertical rotor with sleeve bearing during alignment (Vertical motor only)

- (a) If there is a thread in the non-drive end shaft center, the breakaway torque can be overcome by the use of torque wrench provided there is no ratchet. Remove the top cover, insert a bolt in the threaded shaft center and use a torque wrench to apply the rotating force. The breakaway torque is decided if a torque wrench is feasible.

$$\text{Torque [kg-mm]} = \text{Rotor Wt [kg]} * \text{Thrust Pad Center Radius [mm]} * 0.4$$

0.4 = coefficient of friction for dry lubrication

- (b) An alternate is to use a long bar bolted to the coupling to apply the torque.
- (c) If the rotor can be lifted either from above using a crane attached to the top of the rotor or from below using a jack, then the rotor weight is reduced and the torque needed to breakaway is much less. This does not always work, as sometimes the pads adhere to the thrust collar face due to cohesion.

There is no danger of Babbitt damage due to breakaway because it only takes a small revolution of the rotor to lubricate all shoe surfaces.

3.3.11 Removal of redundant shaft key

When the length of coupling hub is different from the length of shaft key, the motor may have a high vibration level due to this unbalance condition. The removal of redundant shaft key is necessary, shown as Fig.15.

Method (1) :

After installing the coupling, use a grinding wheel to remove the redundant key (hatch area).

Method (2) :

Before installing the coupling, calculate the different length between coupling hub and shaft key, then cut the half of this different value (hatch area) to achieve approximate-balance condition.

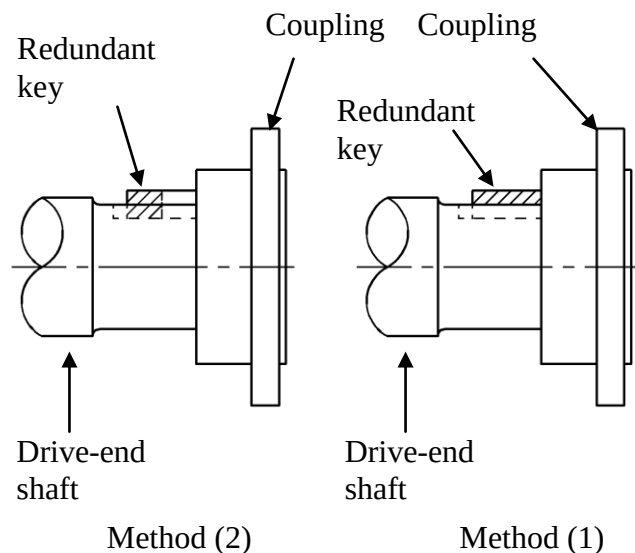


Fig. 15

3.4 Installation for belt drive

3.4.1 General

In general, power transmission through direct flexible coupling is appropriate for large motors. Such motors are not suitable for belt, chain or gear connection unless specially designed for such service. However, for small and medium motors of which outputs within the ranges shown on table below, it is acceptable to use belt transmission as indicated. Beyond these ranges, do not apply belt sheaves unless specially designed.

3.4.2 Diameter of sheaves

The diameter ratio between conveyance sheaves should not be greater than 5 to 1 for flat belts, and 8 to 1 for V-belt. It is also advisable to limit the belt velocity to under 35 m/sec to limit belt abrasion and vibration. The smaller the outer diameter of the V-belt sheave, the greater the shaft bending stress will be. If the bending stress is in excess of the shaft fatigue stress, the shaft may break. Therefore, please inform us when you have decided the size of the sheaves and the length of the belts upon ordering.

ATTENTION !

Place the sheave and belt as close as possible to the motor body (it is advisable to make x as shown in Fig.16 equal to 0) to reduce the bending moment and improve shaft life.

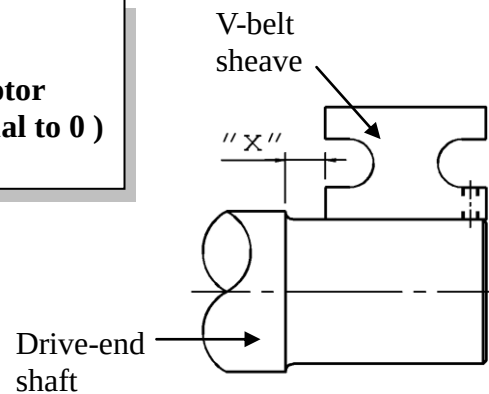


Fig. 16

3.4.3 Table of belt-sheave application for general electric motors

Output (kW)			V-Belt Sheave							
			Conventional V-Belt				Narrow V-Belt			
4P	6P	8P	V-Belt Type	Number of Belts	Min. PCD (mm)	Max. Width (mm)	V-Belt Type	Number of Belts	Min. PCD (mm)	Max. Width (mm)
45	--	--	C	6	265	162	5V	4	224	78
--	45	--	C	7	280	187	5V	5	224	95
--	--	45	C	7	315	187	5V	6	250	113
55	--	--	C	7	265	187	5V	5	224	95
--	55	--	C	8	300	213	5V	6	250	113
--	--	55	D	5	355	196	5V	6	280	113
75	--	--	C	8	315	213	5V	6	250	113
--	75	--	D	6	355	233	5V	6	315	113
--	--	75	D	6	400	233	5V	6	355	113
--	90	--	D	6	400	233	5V	6	355	113
--	--	90	D	6	425	233	8V	4	355	124
--	110	--	D	7	400	270	8V	4	355	124
--	132	110	D	7	450	270	8V	4	400	124
--	160	132	D	9	450	344	8V	4	450	124

3.5 Conveyance with chain or gear

3.5.1 Loading capacity

Make sure the loading capacity of shaft and bearings is appropriate for the size and installation position (overhung) of chain and gear. If necessary, please contact us to ensure the shaft and bearings will meet your requirements.

3.5.2

Pay close attention to ensure the parallelism of shafts.

3.5.3

The teeth of couplings should be correctly and precisely matched; the force conveyance centers should lie on the same line.

3.5.4

There should be no skip, jumping, vibration or unusual noises.

ATTENTION !

Do not hammer the conveyance devices such as couplings, belt sheaves, chain wheels, gears etc. onto the shaft. Those shaft fitments should be fitted and removed only by means of suitable devices. Heat shrinking may be a better alternative to avoid damaging bearings and other components



The exposed rotating parts should be covered to prevent accidents.

3.6 Electrical connections

All interconnecting wiring for controls and grounding should be in strict accordance with local requirements such as the USA National Electrical Code and UK IEE wiring regulations.

Wiring of motor and control, overload protection and grounding should follow the instructions of connection diagrams where provided.

3.6.1 Power

The rated conditions of operation for the motor are as shown on the nameplate. Within the limits, given below, of voltage and frequency variation from the nameplate values, the motor will continue to operate but with performance characteristics that may differ from those at the rated conditions :

+/- 10% of rated voltage

+/- 5% of rated frequency

+/- 10% combined voltage and frequency variation so long as frequency variation is no more than +/- 5% of rated

ATTENTION !

Operating the motor at voltages and frequencies outside of the above limits can result in both unsatisfactory motor performance and damage to or failure of the motor.

3.6.2 Main lead box

The main lead box furnished with the motor has been sized to provide adequate space for the make-up of the connections between the motor lead cables and the incoming power cables.



The bolted joints between the motor lead and the power cables must be made and insulated in accordance with the best industry practices.

3.6.3 Grounding

Both fabricated steel motors and fan cooled cast frame motors are provided with grounding pads or bolts.



The motor must be grounded by a proper connection to the electrical grounding system.

3.6.4 Rotation direction

The rotation direction of the motor will be as shown by either a nameplate on the motor or the outline drawing. The required phase rotation of the incoming power for this motor rotation may also be stated. If either is unknown, the correct sequence can be determined in the following manner :

While the motor is uncoupled from the load, start the motor and observe the direction of rotation. Allow the motor to achieve full speed before disconnecting it from the power source. Refer to the operation section of these instructions for information concerning initial start-up. If resulting rotation is incorrect, it can be reversed by interchanging any two (2) incoming cables.

3.6.5 Auxiliary devices

Auxiliary devices such as resistance temperature detectors, thermocouples, thermoguards, etc., will generally terminate on terminal blocks located in the auxiliary terminal box on the motor. Other devices may terminate in their own enclosures elsewhere on the motor. Such information can be obtained by referring to the outline drawing. Information regarding terminal designation and the connection of auxiliary devices can be obtained from auxiliary drawings or attached nameplates.

If the motor is provided with internal space heaters, the incoming voltage supplied to them must be exactly as shown by either a nameplate on the motor or the outline drawing for proper heater operation.

ATTENTION !

Caution must be exercised anytime contact is made with the incoming space heater circuit as space heater voltage is often automatically applied when the motor is shutdown.

4. OPERATION

4.1 Examination before start

4.1.1 Wiring check

When motors are installed in good manner, ensure the wiring is according to the diagram. Also, the following points should be noted :

- (a) Make sure all wiring is correct.
- (b) Ensure the sizes of cable wires are appropriate and all connections are well made for the currents they will carry.
- (c) Ensure all connections are properly insulated for the voltage and temperature they will experience.
- (d) Ensure the capacity of fuse, switches, magnetic switches and thermo relays etc. are appropriate and the contactors are in good condition.
- (e) Make sure that frame and terminal box are grounded.
- (f) Make sure that the starting method is correct.
- (g) Make sure switches and starters are set at their right positions.
- (h) Motor heaters must be switched off when the motor is running.

4.1.2 Measurement of insulation resistance



During and immediately after measuring, the terminals must not be touched as they may carry dangerous residual voltages. Furthermore, if power cables are connected, make sure that the power supplies are clearly disconnected and there are no moving parts.

- (a) For rated voltage below 1000V, measured with a 500VDC megger.
For rated voltage above 1000V, measured with a 1000VDC megger.
- (b) In accordance with IEEE 43-2000, there are three recommendation minimum insulation resistance values. These values corrected to 40°C are :
 - (1) kV+1 in Megohms for most windings made before 1970, all field windings and windings not otherwise described.
 - (2) 100 Megohms for most DC armatures and AC windings built after about 1970 with form wound coils.
 - (3) 5 Megohms for machines with random wound stator coils and for form wound coils rated below 1kV.

ATTENTION !

After measurement the winding must be grounded or shunted to discharge residual voltages.

- (c) On a new winding, where the contaminant causing low insulation resistance is generally moisture, drying the winding through the proper application of heat will normally increase the insulation resistance to an acceptable level. The following are several accepted methods for applying heat to a winding :

- (1) If the motor is equipped with space heaters, they can be energized to heat the winding.
- (2) Direct current (as from a welding equipment) can be passed through the winding. The total current should not exceed approximately 20% of rated full load current. If the motor has only three leads, two must be connected together to form one circuit through the winding. In this case, one phase will carry the full applied current and each of the others, one-half each. If the motor has six leads (3 mains and 3 neutrals), the three phases should be connected into one series circuit.



Ensure there is adequate guarding so live parts cannot be touched.

- (3) Heated air can be either blown directly into the motor or into a temporary enclosure surrounding the motor. The source of heated air should preferably be electrical as opposed to fueled (such as kerosene) where a malfunction of the fuel burner could result in carbon entering the motor.

ATTENTION !

Caution must be exercised, when heating the motor with any source of heat other than self contained space heaters, to raise the winding temperature at a gradual rate to allow any entrapped moisture to vaporize and escape without rupturing the insulation. The entire heating cycle should extend over 15-20 hours.

Insulation resistance measurements can be made while the winding is being heated. However, they must be corrected to 40°C for evaluation since the actual insulation resistance will decrease with increasing temperature. As an approximation for a new winding, the insulation resistance will be approximately halved for each 10°C increase in insulation temperature above the dew point temperature.

- (d) Should the resistance fail to attain the specified value even after drying, careful examination should be undertaken to eliminate all other possible causes, if any.

4.1.3 Power source

- (a) Ensure the capacity of the power source is sufficient.
 - (b) Ensure the supply voltage and frequency ratings are identical to those on the nameplate.
 - (c) Voltage variation should be confined to $\pm 10\%$ of the rated value and the phase to phase voltages should be balanced.
-

4.1.4 Bearing lubrication

- (a) For sleeve bearing motors, the oil reservoir must be filled with oil to the correct level. On self-lubricated bearings, the standstill oil level will be at the center of the oil gauge. The proper oil is a rust and oxidation inhibiting, turbine grade oil. Refer to the lubrication nameplate for the recommended viscosity.
- (b) Motors which are supplied with provision for flood lubrication have an inlet orifice to meter the oil flow to the bearing. Refer to the outline drawing for these values. If the supply pressure does not match that stated on the outline, the orifice size must be adjusted to produce the specified flow rate. In line with operation conditions (degree of contamination of the oil) filters must be cleaned according to the instructions of the manufacturer. The recommendation mesh size of the filters is 15~20 μ m.

The drain adapter (also provided) has a weir plate fixed to the inside of the pipe to permit the establishment of the proper oil level. This weir plate must be located at the bottom of the pipe and must be parallel to the plane of the motor feet. To ensure optimum flow, the drain line should be vented to the atmosphere.

Oil inlet temperature :

Normal	20°C (70°F) ~ 49°C (120°F)
Alarm	60°C (140°F)
Trip	65°C (150°F)

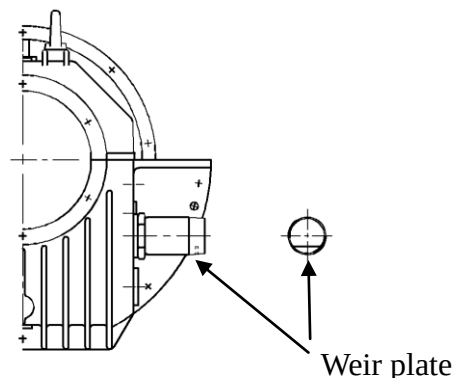


Fig. 17

- (c) If the motor is in storage for over three (3) months, refilling of some new oil should be undertaken before operation to prevent bearing damage due to dry friction. The oil level should be kept at the center of the oil gauge. If necessary, drain some oil after refilling.
- (d) Grease lubricant type
- (1) The bearings have been well greased at factory before delivery. However, regreasing is required if a significant period has elapsed between manufacture and use or in storage. Fill new grease until it overflows and the old grease is entirely replaced.
 - (2) Unless otherwise specified and shown on nameplate, ExxonMobil Polyrex EM is the standard applied to TECO-Westinghouse motors.
 - (3) If roller bearing is used, add a small amount of grease if abnormal sound occurs in the bearings. If this sound, disappears temporarily after regreasing, it is a normal condition and can operate as it is, as long as the temperature rise of the bearing is normal.

4.1.5 Oil-mist lubrication motors

Unless otherwise specified, Inpro seals are used as TECO-Westinghouse standard.

(a) Before operation :

Please check the rotor & stator parts of the Inpro seal, and make sure that they don't contact each other. A 0.03mm feeler gauge is suggested to inspect the gap between rotor and stator as shown in Fig.15. If they are touching on one side, it means that this seal is in the wrong position. You can use a wooden or rubber hammer to adjust this seal gently. If this can't be done, this seal may be damaged and have to be checked. Please contact with our service department.

(b) Lubricant :

Please use ISO VG68 or equal viscosity oil..

(c) About the oil mist lubrication generation system :

The users have to prepare an oil mist lubrication system and apply suitable inlet oil quantity and pressure. Please follow the instruction for the oil mist lubrication system that you used. Avoid high oil pressure to prevent oil from going into the inside of the motor damaging the insulation or causing oil leakage.

(d) Operation :

Before first operation or after a long time without running, please turn on the oil mist lubrication system for at least 5 hours to lubricate the bearings. If you use the central control system, the mist system shall operate continuously for a minimum of 48 hours. After making sure the pressure is stable and flow out oil is in good condition, you can operate this motor.

(e) Appendix :

Fitting or reclassifier of oil-mist lubrication system :

Reclassifiers or fittings are devices which convert small particle-size dry mist to larger particle sizes which can lubricate bearings. Please use correct fittings or reclassifiers.

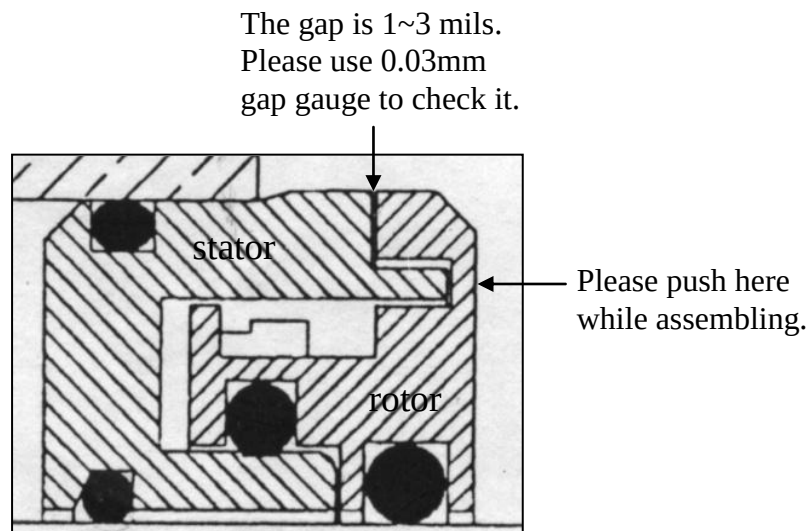


Fig. 18

4.1.6 Cooling water for the motors with water jacket (TEWC)

Make sure the quality, volume and inlet temperature of cooling water for the motors are normal before the machine is in operation.

Water : General tower water or industrial water, the suspended solid shall be below 20 μ m/l

Volume : Please see outline drawing

Inlet temperature : Normal below 30°C (86°F) ; above 5°C (41°F)

Alarm 35°C (95°F)

Trip 40°C (104°F)

Special temperature settings will be noted in outline drawings.

4.1.7 For motors equipped with independent force-ventilating blower unit

- (a) Ensure the voltage and frequency of the power source are identical to the ratings shown on blower motor name plate.
- (b) Ensure the wiring to blower motor is according to the connection diagram.
- (c) Test run the blower motor to ensure the phase currents are within the tolerance limits.
- (d) Ensure the cooling air flow direction is correct. Refer to motor outline for cooling air flow direction.
- (e) Blower motor should be started prior to operating the main motor.
- (f) Do not switch off the blower motor immediately after the main motor is shut off. It must be left running for 15 minutes after the main motor is shut down.
- (g) For small blower motor, double shield and pre-lubricated ball bearings are used and re-lubrication is not necessary.

4.1.8 Remove all locks

ATTENTION !

Make sure all locks which fasten the movable parts of the motor during transportation are dismantled and the shaft can rotate freely.

4.1.9 Transmission system check

Make sure the transmission system, including belts, screws, bolts, nuts and set pins are in good condition.



The keys fitted to the shaft extensions are held by plastic tape only to prevent them from falling out during transportation or handling. The shaft key shall be removed to prevent it from flying out, when the motor is operated prior to the couplings etc. being fitted to the shaft extension.

4.1.10 Test run

Make sure the items above are examined. Test the motor running with or without load. Record and check according to the statement of 5.11 "Records of operation and maintenance" at 15 minute intervals during the first three hours of operation. Then regular examinations should take place at longer intervals. If everything goes well, the motor can be classified as "in good order".

ATTENTION !

To avoid the abnormal bearing temperature and vibration level increase, we suggest do not run a vertical high thrust motor continuously without load.

4.2 Starting operation

4.2.1 Starting load

Initially run the motor unloaded prior to coupling to other machines. Unless otherwise specified, a motor usually starts with light load which is then gradually increased proportional to the square of speed and at last reach 100% load at full load speed.

4.2.2 Starting

Too frequent starts can harm the motors. The following restrictions should be observed :

- (a) Motor can be restarted should the initial start fail. Two starts are generally permissible when the motor is cold.
- (b) Motor can be started only once when it is at normal running temperature.
- (c) Should additional starts be necessary beyond the conditions stated above, the following restrictions should be noted :
 - (1) Let the motor cool down for 60 minutes before restarting, fully loaded.
 - (2) Let the motor cool down for 30 minutes before restarting, unloaded.
 - (3) Two inching starts can be regarded as one normal start.

ATTENTION !

If the motor rotor fails to start turning within one or two seconds, shut off the power supply immediately.

Investigate thoroughly and take corrective action before attempting a restart.

Possible reasons for not starting are :

- (1) Voltage drop at the motor terminals is more than allowed (check against motor data sheet).
- (2) The counter torque is too large to accelerate the rotor.
- (3) The driven machine is stuck, jammed or blocked.
- (4) The electrical connections have not been made correct to drawings and standards.
- (5) One phase is missing or single phase power has been applied.
- (6) Any combination of the above.

4.2.3 Rotating direction

- (a) Most TECO-Westinghouse motors can be operated in bi-directional rotation. However, when some special types, such as high speed 2P, certain large capacity motors, those with a non-reverse ratchet etc. should rotate in one direction, please ensure the rotation is in conformity with the directional arrow-mark shown on the attached nameplate.
 - (b) To reverse a bi-directional motor, cut the power and wait until the motor stops. Then interchange any two of the three phases.
-

4.2.4 Power source, voltage, current

- (a) Ensure the voltage and frequency of the power source are identical to the ratings shown on the nameplate.
- (b) Voltage variation should be confined to $\pm 10\%$ of the rating and the three phase voltages should be in full balance.
- (c) Ensure the motor phase currents in no-load condition are within $\pm 5\%$ of the average values.

4.2.5 Power source, frequency

The variation of the frequency should be confined to $\pm 5\%$ of the rating. The aggregate variation of voltage and frequency should be confined to $\pm 10\%$ of the absolute value of the ratings.

4.2.6 Starting time and unusual noises

ATTENTION !

Starting time is longer for the motors with large inertia. However, if starting time is longer than usual or if there is difficulty in starting, or there is abnormal noise, do not run the motor and refer to TECO-Westinghouse.

4.2.7 Sleeve bearing oil rings (sleeve bearing types only)

As the oil ring is used to carry lubricant to sleeve bearings, frequently check to ensure the oil ring is in motion.

4.2.8 Bearing temperature rise

Following the initial start-up, the bearing temperatures should be closely monitored. The rise rate of bearing temperature is more indicative of impending trouble than is the actual temperature.

ATTENTION !

If the rise rate of the temperature is excessive, the motor exhibits excessive vibration or unusual noise, shut down the motor immediately. Before start up the motor again, a thorough investigation has been made to figure out the cause.

If the bearing temperature rise and motor operation appear to be normal, operation should continue until the bearing temperature is stabilized.

Recommended limits on bearing temperature are as follows :

	Alarm Temperature setting	Trip temperature setting
Sleeve Bearings By permanently installed detector	90°C (194°F)	95°C (203°F)
Anti-friction Bearings By permanently installed detector	95°C (203°F)	100°C (212°F)

ATTENTION ! (For sleeve bearing)

- (1) Flood lubrication sleeve bearings without external lubrication supply, the bearing temperature must not be allowed to exceed 85°C in total.
- (2) Self-lube bearing, the rate of temperature rise should be from 11K to 14K for the first ten (10) minutes after starting up and approximately 22K at thirty (30) minutes. The rate of bearing temperature rise is a function of the natural ventilation and operating conditions.
- (3) When the rate of bearing temperature rise is less than $\pm 1K$ per (30) minutes, the bearing temperature is considered to steady conditions.
- (4) If the total bearing temperature exceeds 95°C, the motor should be shut down immediately and a thorough investigation has been made to figure out the cause.

ATTENTION !

If the rise rate of the temperature is excessive, the motor exhibits excessive vibration or unusual noise, shut down the motor immediately. Before start up the motor again, a thorough investigation has been made to figure out the cause.

4.2.9 Noise and Vibration

ATTENTION !

Any abnormal noise or vibration should be immediately investigated and corrected. Increased vibration can be indicative of a change in balance due to mechanical failure of a rotor part, a stator winding problem or a change in motor alignment.

(a) NEMA MG1, vibration limits at no load

Unfiltered Vibration Limits		
Speed, rpm	Rotational Frequency, Hz	Velocity, in./s peak (mm/s)
3600	60	0.15 (3.8)
1800	30	0.15 (3.8)
1200	20	0.15 (3.8)
900	15	0.12 (3.0)
720	12	0.09 (2.3)
600	10	0.08 (2.0)

(b) ISO 10816, overall vibration severity chart for customer's reference

Machine		Class I Small machine	Class II Medium machine	Class III Large rigid foundation	Class IV Large soft foundation
in/s	mm/s				
Vibration Velocity (r.m.s.)	0.01	Good	Good	Good	Good
	0.02				
	0.03				
	0.04				
	0.07	Satisfactory	Satisfactory	Satisfactory	Satisfactory
	0.11				
	0.18	Unsatisfactory	Unsatisfactory	Unsatisfactory	Unsatisfactory
	0.28				
	0.44				
	0.70				
	0.71				
	1.10	Unacceptable	Unacceptable	Unacceptable	Unacceptable
	45.0				

4.2.10 Recommended winding temperature settings

An electric motor normally has built in “over temperature protection devices” such as thermistors and RTD’s. They are set to trip at levels dependent upon the Class of Insulation of the motor windings. Motors designated Class F insulation have an allowable total temperature of 155°C in total. For those motors, the recommended alarm and trip settings are as below:

Alarm	Trip
140°C (284°F)	155°C (311°F)

4.2.11 Additional points to note

- (a) The motor characteristic data includes values for the acceleration and safe stall times, when specified by the customer. If the motor fails to reach full speed, shut off the power immediately. Investigate thoroughly and take corrective action before attempting to restart.
- (b) Each start of an induction motor subjects the motor to full inrush current with resulting heating of the stator and rotor windings. Each acceleration and repeated start can produce more heat than that produced and dissipated by the motor under full load.

The starting duty for which the motor is designed is shown by a nameplate mounted on the motor and must not be exceeded, if long motor life is expected. Abnormally terminal voltage drop and/or excessive load torque during motor start-up can cause extended acceleration time during which rotor speed is reduced and ventilation is minimized. This can cause rotor damage or can lead to extreme shorten of rotor life.

- (c) The temperature rating of the motor is shown on the main nameplate as a temperature rise above an ambient temperature. If there is a service factor, it is also shown.

If the motor does not have stator winding temperature detectors and abnormal winding temperatures (as might be indicated by high discharge air temperature, odor, etc.) are suspected, the motor should be shut down immediately and an investigation made before further operation is attempted.

5. MAINTENANCE

5.1 Major points in regular inspection and maintenance



Maintenance and repairs must only be carried out by properly trained personnel.



Some testing, such as insulation resistance, usually requires the motor to be stopped and isolated from power supply(ies).

Routine inspection and maintenance are usually performed visually, audibly, by odor, and by means of simple meters.



High temperature may arise under operating conditions on the motor surfaces, so touching should be prevented or avoided.

Keep away from moving and live parts.

Unless deemed necessary, do not remove guards while assessing the motor.

Timely replacement of worn parts can assure longevity and prevent breakdown.

Routine and regular inspection and maintenance are important in preventing breakdown and lengthening service life.

Owing to the varied time and circumstances motors are used, it is difficult to set the items and periods for regular inspection and maintenance. However, as a guide it is recommended to be performed periodically according to factory maintenance program. Generally, the inspection scope is determined by the following factors :

- (a) Ambient temperature and ambient conditions (dust, humidity, other contamination).
 - (b) Starting and stop frequency.
 - (c) Troublesome parts usually affect motor dysfunctions.
 - (d) Easily abraded parts (slipring, brushes, earthing brushes).
 - (e) The important position of motor in the operational system should be duly recognized.
Therefore, its life time should be intact and fully protected, especially when it is operating in severe conditions.
-

5.2 Motor windings

- (a) Measurement of insulation resistance and standards to determine quality of insulation resistance, please refer to measures stated in 4.1.2 "Measurement of insulation resistance".
- (b) Inspection of coil-ends :
 - (1) Grease and dust accumulated on coils may cause insulation deterioration and poor cooling effect.
 - (2) Moisture must not accumulate. Keep coils warm when motor is not in use (use space heater, if it's installed).
 - (3) Discoloring. This is mainly caused by overheating.
- (c) Ensure no untoward change of wedges from original position occurs.
- (d) Ensure the binding at the coil end is in its normal position.

5.3 Clean the interior of the motor

- (a) After a motor has been in operation for some time, accumulation of dust, carbon powder and grease etc., on the inside is unavoidable, and may cause damage. Regular cleaning and examination is necessary to assure top performance.
- (b) Points to note during cleaning :
 - (1) If using compressed air or a blower :
 - a) Compressed air should be free of moisture. Be sure, that the dust and other materials can come out of motor housing, iron core and windings.
 - b) Maintain air pressure below 4 kg/cm^2 , since high pressure can cause damage to coils.
 - (2) Vacuum

Vacuum cleaning can be used before and after other methods of cleaning, to remove loose dirt and debris. It is a very effective way to remove loose surface contamination from the winding without scattering. Vacuum cleaning tools should be non-metallic to avoid any damage to the winding insulation.
 - (3) Wiping

Surface contamination on the winding can be removed by wiping using a soft, lint-free wiping material. If the contamination is oily, the wiping material can be moistened (not dripping wet) with a safety type petroleum solvent.

In hazardous locations, a solvent such as inhibited methyl chloroform may be used, but must be used sparingly and immediately removed. While this solvent is non-flammable under ordinary conditions, it is toxic and proper health and safety precautions should be followed while using it.

ATTENTION !

Solvents of any type should never be used on windings provided with abrasion protection. Abrasion protection is a gray, rubber-like coating applied to the winding end-turns.



Adequate ventilation must always be provided in any area where solvents are being used to avoid the danger of fire, explosion or health hazards. In confined areas (such as pits) each operator should be provided with an air line respirator, a hose mask or a self-contained breathing apparatus. Operators should wear goggles, aprons and suitable gloves. Solvents and their vapors should never be exposed to open flames or sparks and should always be stored in approved safety containers.

- (4) Keep core ducts completely clean. The difference in temperature rise could be around 10°C before and after cleaning.

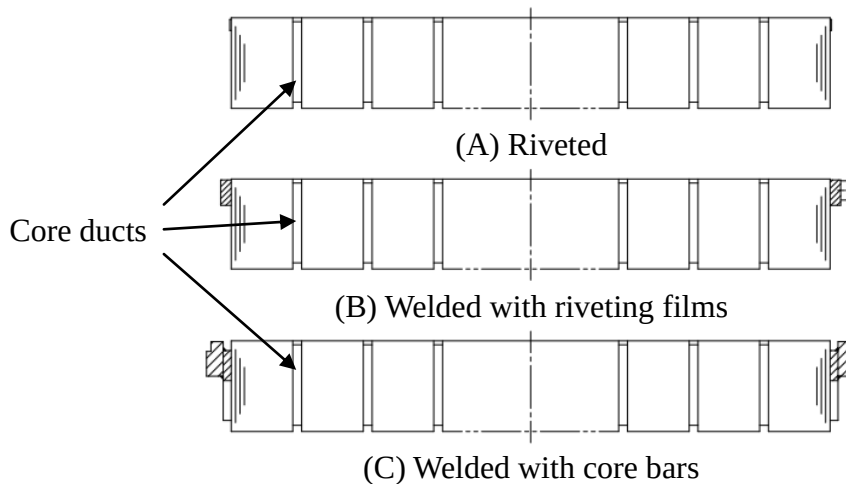


Fig. 19

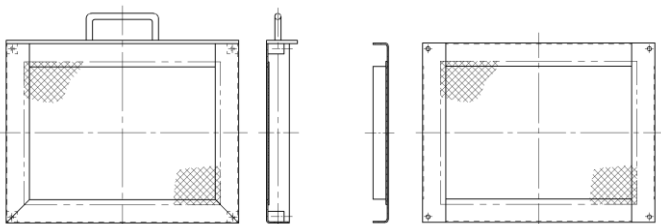
5.4 Clean the exterior of the motor

- (a) On open ventilated motors, screens and louvers over the inlet air openings should not be allowed to accumulate any build-up of dirt, lint, etc. that could restrict free air movement.

ATTENTION !

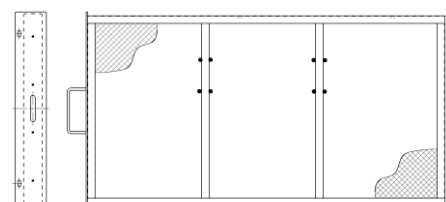
Screens and louvers should never be cleaned or disturbed while the motor is in operation because any dislodged dirt or debris can be drawn directly into the motor.

- (b) If the motor is equipped with air filters, they should be replaced (disposable type) or cleaned and reconditioned (permanent type) at a frequency that is dictated by conditions. It is better to replace or recondition filters too often than not often enough. The Permanent type air filters can be cleaned with fresh water, make sure to let them dry before reinstalling.



Disposable type filter fitted into two filter supports.

Fig. 20



Permanent type filter.

Fig. 21

-
- (c) Totally enclosed air-to-air cooled and totally enclosed fan cooled motors require special cleaning considerations. The external fan must be cleaned thoroughly since any dirt build-up not removed can lead to unbalance and vibration. All of the tubes of the air-to-air heat exchanger should be cleaned using a suitable tube brush having synthetic fiber bristles (not wire of any type).
 - (d) It is important to keep the external surfaces of any motor clean and free from buildup of dirt and debris as this can function as an insulating blanket causing the motor to overheat drastically and could reducing the life of the motor. Methods of cleaning external surfaces are: Scraping, brushing, dry ice blasting etc.
-

5.5 Maintenance of anti-friction bearing

5.5.1 Frequency of relubrication

The life of grease varies greatly as a result of types of model, revolution speed, temperature, operational conditions etc. It is, therefore, impossible to be precise about replenishment intervals. However, for normal direct coupling transmission, the periods shown in Table 1 may be used as a guide.

Remarks :

- (a) The periods shown in Table 1 should be halved where bearings are used for belt drive and/or in dirty, high ambient temperature or high humidity environments.
- (b) Please refer to the lubrication nameplate, if attached to the motor.
- (c) For bearing numbers outside the range of Table 1, please contact TECO-Westinghouse.
- (d) If the periods referred to Table 1 for drive-end bearing and opposite drive-end bearing are different, for the convenience of maintenance operation, one could take the shorter one for re-greasing schedule.

5.5.2 Kinds of grease

ExxonMobil Polyrex EM grease is standard for TECO-Westinghouse motors except some special models for which special grease will be shown on the lubrication nameplate. Please use identical grease or its equivalents when maintaining.

ATTENTION !

Do not mix different kinds of grease.

Mixing grease with different types of thickeners may destroy its composition and physical properties. Even if the thickeners are of the same type, possible differences in the additive may cause detrimental effects.

Table 1

Bearing number		600 RPM	720 RPM	750 RPM	900 RPM	1000 RPM	1200 RPM	1500 RPM	1800 RPM	3000 RPM	3600 RPM
62XX	6210										
63XX	12									2000Hrs	
72XX	13										
73XX	14									1000Hrs	
	15										
	16									720 Hrs	
	17							2000Hrs			
	18	3000Hrs								500 Hrs	
	20										
	22										
	24							1500Hrs			
	26										
	28					2000Hrs		1000Hrs			
	30							500 Hrs			
	32										
	34					1500Hrs					
	36										
	38			2000Hrs		1000Hrs					

Bearing number		600 RPM	720 RPM	750 RPM	900 RPM	1000 RPM	1200 RPM	1500 RPM	1800 RPM
NU2XX NU3XX	NU214								
	15							2000Hrs	
	16								
	17								
	18	3000Hrs						1500Hrs	
	20								
	22							1000Hrs	
	24								
	26					2000Hrs			
	28							500 Hrs	
	30								
	32								
	34			2000Hrs		1000Hrs			
	36								
	38	2000Hrs							
40									
44			1000Hrs		500 Hrs				
48	1000Hrs								

Bearing number		600 RPM	720 RPM	750 RPM	900 RPM	1000 RPM	1200 RPM	1500 RPM	1800 RPM	
222XX 223XX	22220							300Hrs		
	22									
	24	1000Hrs				500 Hrs				
	26									
	28									
	30				300 Hrs					
	32	500 Hrs								
	34									
	36									
	38	500 Hrs								
	40				300 Hrs					
	44									
	48	300 Hrs								

5.5.3 Grease quantity

The amount of grease per replenishment depends on the type, size and construction of the bearings. The minimum amount for replenishment of each bearing is shown in Table 2.

Table 2

Bearing No.		Amount of replenishment
62XX	6210	30g
72XX	6212	40
NU2XX	6213	50
222XX	6214	50
	6215	60
	6216	60
	6217	80
	6218	80
	6220	100
	6222	120
	6224	120
	6226	140
	6228	160
	6230	180
	6232	200
	6234	250
	6236	300
	6238	350
	6240	400
	6244	450
	6248	500

Bearing No.		Amount of replenishment
63XX	6310	40g
73XX	6312	60
NU3XX	6313	80
223XX	6314	80
	6315	100
	6316	100
	6317	120
	6318	120
	6320	160
	6322	220
	6324	270
	6326	300
	6328	400
	6330	450
	6332	500
	6334	600
	6336	700
	6338	800
	6340	900
	6344	900
	6348	900

Fill desirable however to regrease until it replaces and the old grease is entirely replaced. The temperature of the bearing will initially increase because of the excess grease. After a few hours, the excess grease will be expelled through the exit tube and the bearing temperature will return to normal.

5.5.4 Re-greasing



If relubrication is to be performed when the motor is running, stay clear of rotating parts.

It is advisable to re-grease while the motor is running to allow the new grease to be evenly distributed inside the bearing.

Before re-greasing, the inlet fitting should be thoroughly cleaned to prevent any accumulated dirt from being carried into the bearing with the new grease. The outlet or grease drain should be opened to allow the proper venting of old grease.

Use a grease gun to pump grease through grease nipple into bearings slowly. After re-greasing, operate the motor for 10-30 minutes to allow any excess grease to vent out.

5.5.5 Oil relubrication (For oil lubrication types only)

Maintain proper lubrication by checking the oil level periodically and adding oil when necessary. Because of the initial clearing action of the bearing and the expansion of the oil as it comes up to operating temperature, the oil level will be higher after the motor has been in operation for a while than it is with the motor at standstill.

Overfilling should be avoided not only because of the possibility that expansion may force the oil over the oil sleeve and on to the rotor, but also because too high an operating oil level prevents the bearing from clearing itself of excess oil. The resultant churning can cause extra loss, high temperatures, and oxidized oil. If, the oil level goes above the maximum shown on the sight gauge during operation, drain enough oil to bring the level back within the recommended operating range.

Do not permit the operating level to fall below the minimum shown on the sight gauge.

ATTENTION !

Should it ever become necessary to add excessive amount of make-up oil, investigate immediately for oil leaks.

Change the oil at regular intervals. The time between oil changes depends upon the severity of operating conditions and, hence, must be determined by the motor user. Two or three changes a year is typical, but special conditions, such as high ambient temperature, may require more frequent changes. Avoid operating the motor with oxidized oil.

Use only good quality, oxidation-corrosion-inhibiting turbine oils produced by reputable oil companies. The viscosity of the oil to be used depends upon the type and size of the bearing, its load and speed, the ambient temperature, and the amount and temperature of the cooling water (if used). The lubrication nameplate or instructions with each motor specifies the viscosity range of oil suitable for average conditions. The usual oil viscosity recommendations are summarized in Table 3. Operation in ambient temperatures that are near or below freezing may require preheating the oil or the use of special oil. Whenever the motor is disassembled for general cleaning and reconditioning, the bearing housing may be washed out with a suitable cleaning solvent. Be sure that the oil metering hole is clear, and then dry the housing thoroughly before reassembly, and ensure all traces of cleaning solvent have been removed.

Table 3 oil viscosity for vertical motors**

Bearing Type	Oil viscosity	Range of pole
Angular contact ball (72XX , 73XX)	ISO VG32 (150 SSU/100°F)	2 pole
	ISO VG68 (300 SSU/100°F)	4 pole and above
Spherical roller (293XX , 294XX)	ISO VG68 (300 SSU/100°F)	4 pole
	ISO VG150 (700 SSU/100°F)	6 pole and above

**Note: Where a lubrication nameplate is attached to the motor, use the lubrication oil it stipulates.

5.5.6 Cleaning and installation of bearings

- (a) Apply the proper amount of grease to disassembled parts of the bearing after they have been thoroughly cleaned with high quality cleaning oil. Then protect them from contamination before and during assembly.
- (b) Bearing installation

ATTENTION !

Before installing the bearings, make sure that the shaft mounted parts behind the bearings are in place before installation.

Since the bearing is a high precision component, it is important to avoid ingression of dust and foreign matter and hammering during cleaning and installation. Be extremely careful and ensure clean conditions exist during installation and assembly.

ATTENTION !

The best way for bearing installation is heat shrinking. Knocking and hammering during installation should be absolutely avoided.

The bearing should be heated in a bath of clean oil to a temperature of approx. 80°C or using an induction bearing heater with a temperature probe. After warming, slide the bearings in place quickly and nimbly so that it does not shrink onto the shaft before being fully in position. Take care to keep the bearing straight during installation and ensure it is properly seated against the shoulder. Maintain pressure against the shoulder for several seconds to ensure it does not slide back from the shoulder, or become “cocked” on the journal.

Grease the bearing after the temperature returns to normal, and then reassemble the motor.

5.6 Maintenance of sleeve bearing

5.6.1 Daily inspections

- (a) Ensure the volume and quality of lubricating oil are in compliance with specifications.

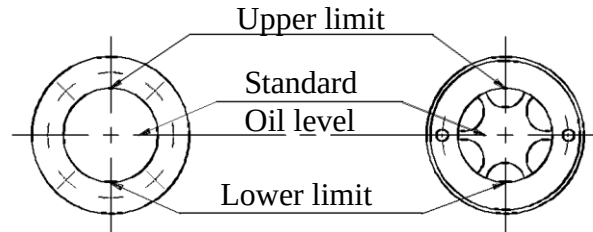


Fig. 22

- (b) Ensure there is motion of the oil ring and it is not clamped, but free to rotate.
- (c) The indicator of the shaft endplay should be restricted within the specified range of the red groove of the shaft or the $\pm 3\text{mm}$ range of the drive-end shaft shoulder. Otherwise the bearing will be destroyed.

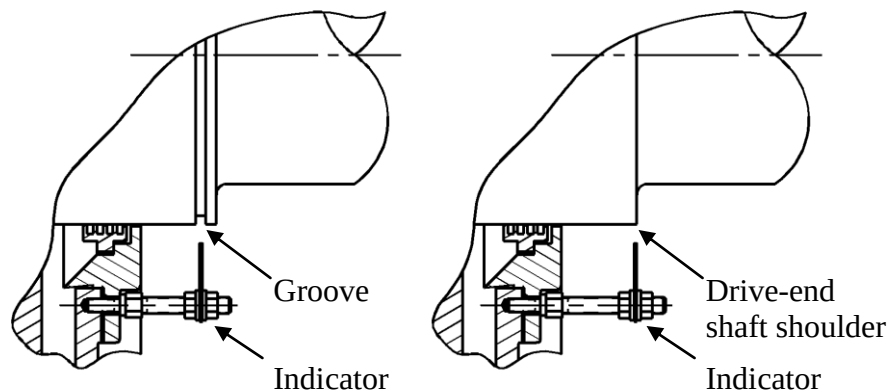


Fig. 23

5.6.2 Regular examination

- (a) Periodical change of oil

The oil reservoirs of self (not flood) lubricated bearings should be drained and refilled about every six (6) months. More frequent changes may be needed on high-speed (3600-rpm) motors or if severe oil discoloration or contamination occurs. In conditions where contamination does occur, it may be advisable to flush the reservoir with kerosene to remove any sediment before new oil is added. Proper care must be taken to thoroughly drain the reservoir of the flushing material before refilling with the new oil.

Refill the reservoir to the center of oil sight glass with a rust and oxidation inhibiting turbine grade oil. Refer to the outline and lubrication nameplate for the correct viscosity.

- (b) Quantity of lubrication oil

Please refer to the lubrication nameplate for oil quantity.

(c) Oil viscosity for horizontal motors with sleeve bearings

Table 4 oil viscosity for horizontal motors

Oil viscosity	Equivalents		Range of pole
	ESSO	MOBIL	
ISO VG32 (150 SSU/100°F)	TERESSO 32	DTE OIL LIGHT	2 pole
ISO VG46 (200 SSU/100°F)	TERESSO 46	DTE OIL MEDIUM	4 pole
ISO VG68 (300 SSU/100°F)	TERESSO 68	OIL HEAVY MEDIUM	6 pole & above

Note: Where a lubrication nameplate is attached to the motor, use the lubrication oil it stipulates.

5.6.3 Disassembly



Prior to disassembling, ensure the power supplies are disconnected and there are no moving parts.

The bearing sleeve is of the spherically seated, self-aligning type. The opposite drive end bearing is normally insulated on larger motors (or when specified). On some motors, the insulation is bonded to the spherical seat of the bearing housing.

ATTENTION !

Extreme care must be exercised in removing the bearing sleeve from the insulated support to avoid damaging this insulation.

The following is the recommended procedure for removing the bearing sleeve:

- Remove the oil drain plug in the housing bottom and drain the oil sump.
- Remove all instrumentation sensors that are in contact with the bearing sleeve. These would include resistance temperature detectors, thermocouples, thermometers, etc.
- Remove the socket head bolts holding the bearing cap and the inner air seal. The end cover plate must also be removed if the non-drive end bearing is being disassembled. Remove the bearing cap and top half of the inner air seal. Place them on a clean, dry surface to avoid damage to the parting surfaces.
- Remove the top half of the bearing sleeve using suitable eyebolts in the tapped holes provided. Lift the bearing top straight up and avoid any contact with the shoulders of the shaft journals that might damage the thrust faces of the bearing. Place on a clean, dry surface taking care to prevent damage to either the parting surfaces or the locating pins that are captive in the top bearing half.
- Remove the screws at the partings in the oil ring and dismantle the ring by gently tapping the dowel pin ends with a soft face mallet. Remove the ring halves and immediately reassemble them to avoid any mix up in parts or damage to the surface at the partings.

- (f) Pull up on the garter spring surrounding the floating labyrinth seal and carefully slip out the top half. Rotate the garter spring until the lock is visible. Twist counter-clockwise to disengage the lock, remove the garter spring, and then rotate the lower half of the seal out of the groove in the bearing housing. Note the condition of these floating labyrinth seals. If they are cracked or chipped, they must be replaced. Do not attempt to reuse a damaged seal.
- (g) To remove the bottom bearing half, the shaft must be raised a slight amount to relieve pressure on the bearing. On the drive end, this can be done by jacking or lifting on the shaft extension. Protect the shaft. On the non-drive end, jacking or lifting can be done using eye bolts threaded into the tapped holes provided in the shaft end.
- (h) Roll the bottom bearing half to the top of the shaft journal and then lift it using suitable eye bolts threaded into the holes provided. Again avoid any contact with the shaft shoulders that could damage the bearing thrust faces. Place the lower bearing half on a clean, dry surface to protect the parting surfaces.



Use extreme care when rolling out the lower bearing half. Keep the hands and fingers well clear of any position where they might be caught by the bearing half if it were accidentally released and suddenly falls back to its bottom position. Serious personal injury could result.

- (i) Protect the shaft journal by wrapping it with clean, heavy paper or cardboard.

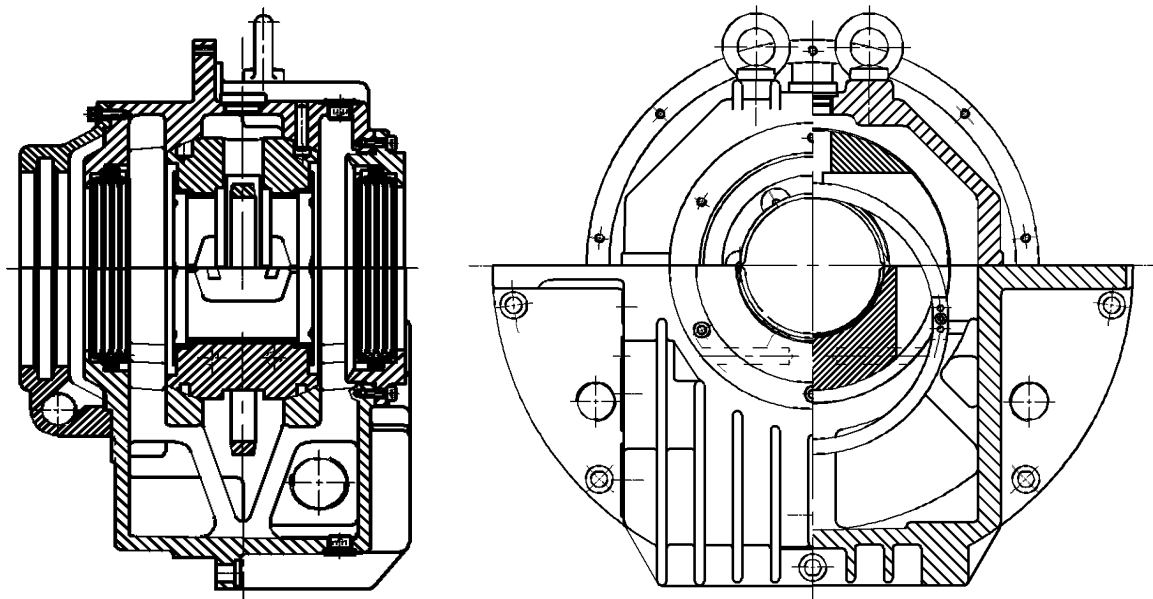


Fig. 24

5.6.4 Reassembly

Bearing reassembly is basically a reverse of the disassembly procedures outlined above, with the following suggestion:

- (a) The interior of the bearing housing should be cleaned and then flushed with clean oil or kerosene.
- (b) The bearing halves and the shaft journal should be wiped clean using lint-free cloth soaked with clean oil.

- (c) All parts should be carefully inspected for nicks, scratches, etc., in any contact surfaces. Such imperfections should be removed by an appropriate method such as stoning, scraping, filing, etc., followed by thorough cleaning.
- (d) Before installing the halves of the floating labyrinth seal, observe their condition. Do not attempt to use a cracked or chipped seal. The bottom half seal has a set of drilled holes in its internal face. These must be placed at the bottom toward the inside of the bearing. Only in this position the accumulated oil can drain back into the housing.
- (e) Put a bead of Curil-T around the seal half O.D.'s on both sides adjacent to the angular spring groove. This will prevent oil from by-passing the seal around its outside.
- (f) Place the bottom seal half on top of the shaft and roll it into position. Install the top half and insert the garter spring pulling up on both ends to permit engaging the lock. Run a bead of Curil-T around the O.D.'s on both sides adjacent to the garter spring groove on this half also.
- (g) Carefully reassemble the two oil ring halves. Inspect the dowel pins for burrs and straightness and make any corrections required. Do not force the ring halves together. Excessive force may alter the roundness or flatness of the oil ring which can change its oil delivery performance. Once assembled, the oil ring should be measured to ensure it is round, if it is not it should be repaired or replaced.
- (h) Some of the pipe plugs in the housing are metric thread type. These are identified as those which have a copper, lead, or similar material washer. If these plugs are removed, be careful not to lose the washers. Before reassembly, inspect the washers and replace them as required.
- (i) Before installing the bearing cap, observe the position of the floating labyrinth seal. The "tab" must be on top to engage the pocket. Failure to position the seal properly will result in damage when the cap is assembled.

ATTENTION !

- (1) **Curil-T is the only approved compound for use in the assembly of the bearings on this motor. Other products may harden and impede the operation.**
- (2) **During the reassembly of the bearing parts, a thin layer of Curil-T should be applied to all gaskets and machined interface surface. This suggestion does not apply to the machined surfaces of the bearing liner halves.**
- (3) **When seating the bearing shell, apply a thin layer of lube oil at the spherical surface of the liner. Slowly roll the lower bearing liner into the bearing housing making sure the split surfaces of the liner and the housing are flush. Gradually lower the shaft onto the bearing. The weight of the shaft will help rotate the bearing liner so that the babbitt surface of the liner will match the slope of the journal. Sometimes it is required to use a rubber mallet to tap lightly on the bearing housing while slowly rolling the shaft to help this seating operation.**

5.6.5 Oil viscosity for vertical motors

Bearing Type	Oil viscosity	Range of pole
RENK Vertical Bearing Inserts Type EV or Kingsbury Type	ISO VG68 (300 SSU/100°F)	4 pole and above

5.7 Maintenance of slip ring (For Wound Rotor only)



Ensure motor is disconnected from power supplies and there are no accessible moving parts before maintenance operation.

5.7.1 Adjustment of carbon brush

(a) Brush pressure for normal operation :

- Electro-graphite brush
 $160 \text{ g/cm}^2 \pm 10\%$ (for slip ring with spiral groove)
 $200 \text{ g/cm}^2 \pm 10\%$ (for slip ring without groove)

When frequent vibrations are evident or the brush is small (area below 0.5 cm^2), the pressure should be greater than as shown.

(b) Adjustment of brush pressure :

The brush pressure should be adjusted to keep normal operation as it wears.

- The brush pressure may be reduced after use, so it is necessary to re-adjust. For adjustment, please turn adjusting screw, pressure adjusting pin or pressure adjusting plate as shown in Fig.25 to obtain the correct tension ($=0.23 \times \text{brush cross sectional area in cm}^2 \pm 10\%$ kg).

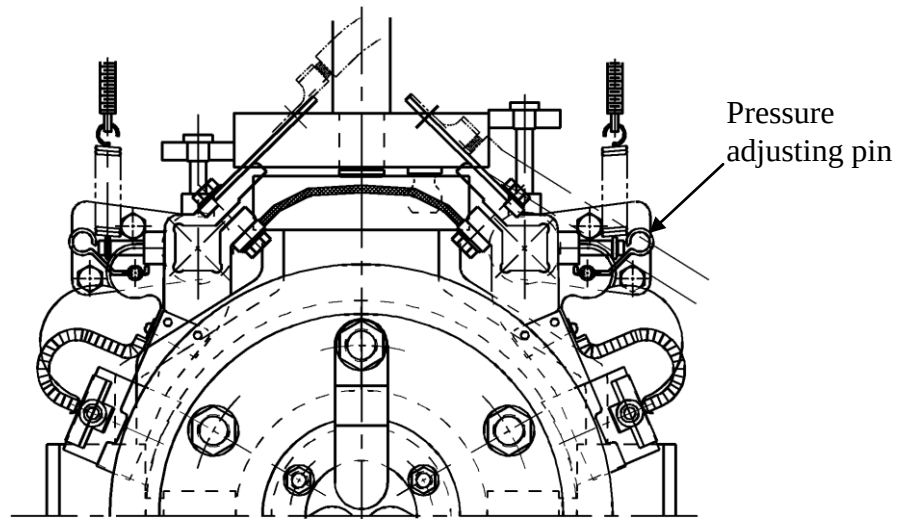


Fig. 25

(c) Brush pressure need not be adjusted if constant force spring is used as shown in Fig.26 and Fig. 27.

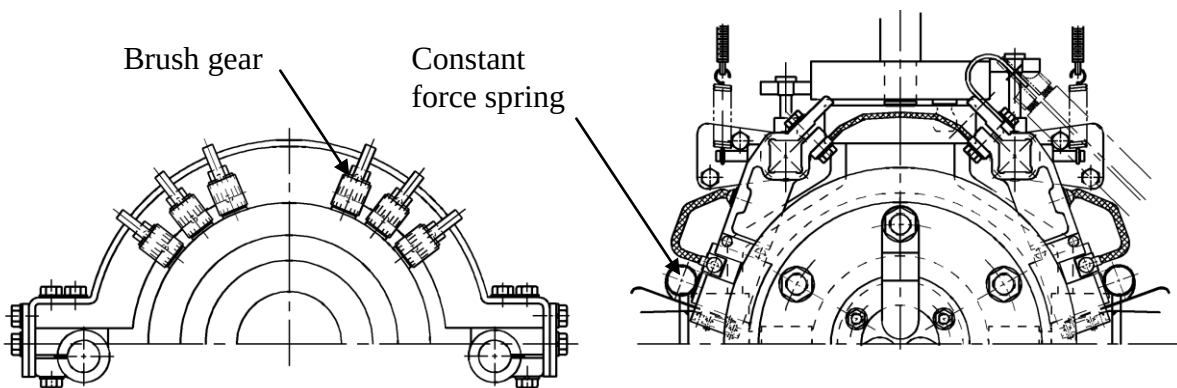


Fig. 26

Fig. 27

5.7.2 Brush replacement

The carbon brush is a part of the equipment which is easily worn away, replace it after it is worn to 1/2~3/5 of original size.

(a) Brush material

The brush material is important to the performance of the motor. Only the most appropriate materials are chosen by TECO-Westinghouse, and are listed on the nameplate of motor. It is important to know this when you replace the brush, only the recommended type and grade should be used.

(b) Dimensions

Brush, holder and gap between them, please refer to CNS 2322 C4051 or JIS C2802.

ATTENTION !

The gap between a brush and its holder is important for good performance and safety of the motor.

(c) Adjustment of new brushes (Shown in Fig.28)

- (1) Polish the new brush with sandpaper until it assumes the appropriate contour of the slip ring which it touches.
- (2) Place sandpaper (JIS R6252 NO.40.....50) on the slip ring with the abrasive face of the paper against the brush to induce a closer contact by rubbing against each other.
- (3) Repeat item 2 with fine sand-paper (JIS R6252 NO. 100 to 200) until the contact surface between brush and slip ring exceeds 80%.
- (4) Finally, clean the contaminated slip ring and brush with clean cloth or vacuum.

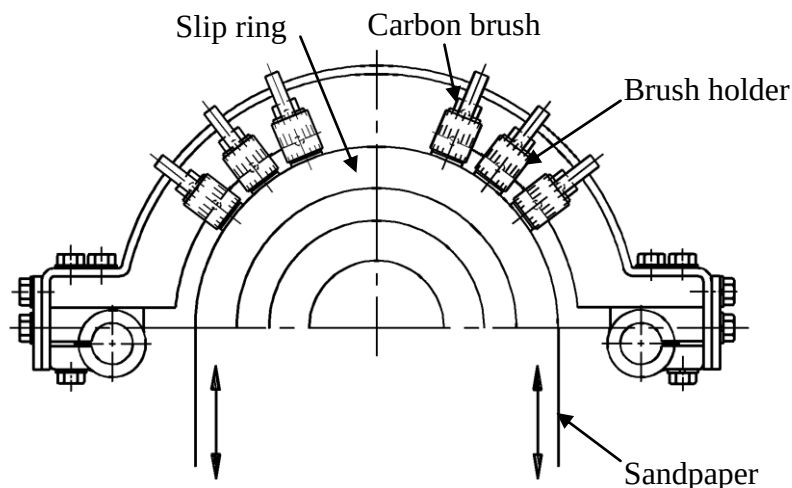


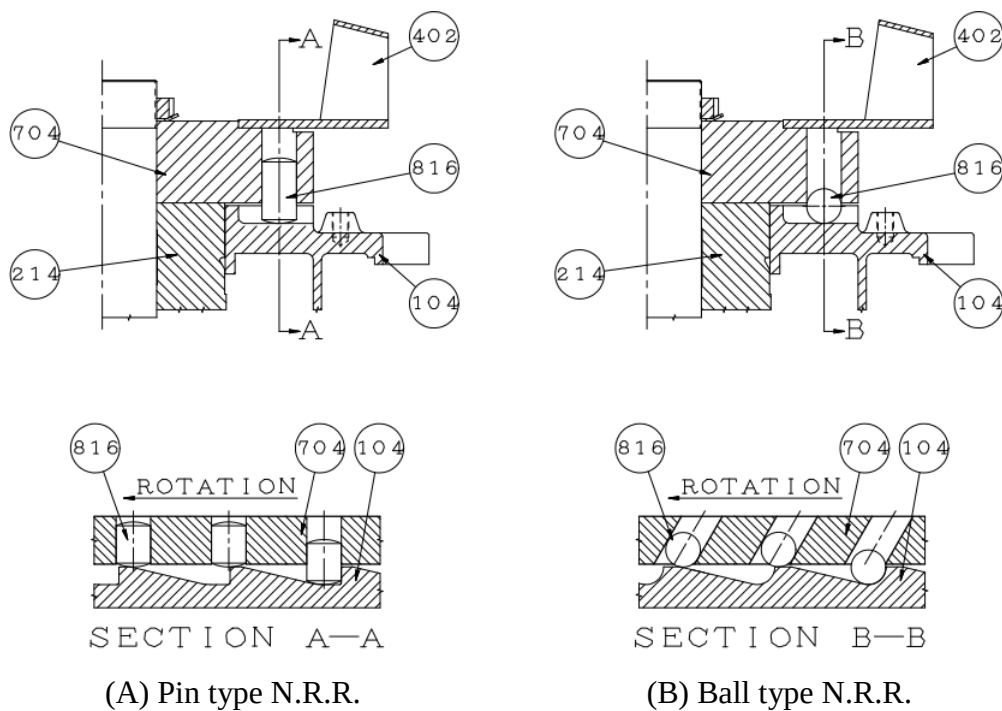
Fig. 28

5.8 Maintenance of non-reverse ratchet mechanism (For Vertical high Thrust Motor only)

5.8.1 Non-reverse ratchet mechanism

In the pump piping system, a check valve and a stop valve should be installed in the discharge line. The check valve, placed between the pump and the stop valve, is to protect the pump from reverse flow and excessive back pressure. The stop valve is used in priming, starting and when shutting down the pump. It is advisable to close the stop valve before stopping the pump. This is especially important when the pump is operated against a high static head.

TECO-Westinghouse vertical high thrust motors are equipped with non-reverse ratchet (N.R.R.) mechanism only when requested by the pump manufacturer. Typical construction of N.R.R. mechanism is shown as Fig.29 below.



ITEM	NAME
104	RATCHET
214	BEARING SEAT
402	EXTERNAL FAN
704	RATCHET PIN CARRIER
816	RATCHET PIN(BALL)

Fig. 29

The N.R.R. mechanism keeps the pump and motor from rotating in the reverse direction. Thus prevents damage from over speeding and damage to water-lubricated pump shaft bearings when, on shutdown, the falling water column tends to drive the pump in the reverse direction.

In normal operation, the ratchet pins are lifted by the ratchet teeth and are held clear by centrifugal force and friction as the motor comes up to speed. When power is removed, the speed decreases and the pins fall. At the instant of reversal, a pin will catch in a ratchet tooth and prevent backward rotation.

5.8.2 Service life

The service life of ratchet pins depends not only on the reverse shock load between the pin and ratchet tooth when pump stopped but also the frequency of pump starting and stop in application.

Over time the pins can become deformed due to this reverse shock load, causing the up and down motion of ratchet pins to become sluggish or jammed and unusual noises will arise.

The recommended replacement period for these ratchet pins is every three (3) years. If the reverse shock load is greater than 30% of motor rated torque or the starting frequency is more than twice per day, then the replacement period is to be halved.

ATTENTION !

The check valve and stop valve in the discharge line should be regularly inspected and maintained to assure the normal function of these valves. This is important to protect the pump and motor from damage and increase the service life of the N.R.R. mechanism.

5.9 Dismantling and Assembly Procedure

Please see the drawing in Appendix 4.

Brackets w/anti-friction bearing	Dismantling brackets	Assembly
TEFC	1. Remove the fan cover & outer fan. 2. Remove securing bolts between the bearing cover-outer (22) and the bracket (18). 3. It may be necessary to remove any seals / grease flingers / temperature sensors etc attached to the shaft or housings. 4. Pull out the bearing cover-outer (22) very carefully. 5. Remove securing bolts hold between the bracket (18) and frame (12). 6. Pull out the bracket (18) gently.	1. Check the bearing assembly. Keep each part very clean. 2. Tighten securing bolts by reverse step of dismantling.

5.10 Records of operation and maintenance

5.10.1 Objective

- (a) Fully understand the purpose of the motors in operation and discover any abnormalities in advance.
- (b) Prevent negligence and omissions in maintenance.
- (c) Map pertinent maintenance plans after fully understanding the operation of the motor.
- (d) Assess the life of the depreciating parts to determine the amount of spare parts to be kept.
- (e) Plan the amount of spare motors and replacement parts to repair the motors in operation according to actual situation and schedule.

5.10.2 Records of operation

- (a) It is advisable to use a primed form with yes/no or right/wrong selections for the operator to easily fill out.
- (b) Principle contents :
 - (1) Serial number of machine.
 - (2) Load machine type.
 - (3) Models and specifications of motors.
 - (4) Three-phase voltage.
 - (5) Three-phase current.
 - (6) Temperature of a motor and bearings when in operation.
 - (7) Ambient temperature, humidity, weather, date and time.
 - (8) Time of start and stop.
 - (9) Special remarks.
 - (10) Operator's name.

5.10.3 Maintenance records

- (a) It is advisable to use a primed form with yes/no or right/wrong selections for the operator to easily fill out.
 - (b) Principle contents :
 - (1) Serial number of machine.
 - (2) Load machine type.
 - (3) Models and specifications of motors.
 - (4) Ordinary operating conditions and data.
 - (5) Cause, date and disposition measures at breakdown.
 - (6) Quantity and name of replaced spare parts.
 - (7) Date of maintenance and initial operation.
 - (8) Items and date of maintenance.
 - (9) Special remarks.
 - (10) Name of maintenance personnel.
-

6. FAULT FINDING AND RECOGNITION

Type of Breakdown	Symptoms	Possible causes	Remedies
Fail to start without load	Motionless and soundless	Power-off	Consult power company
		Switch-off	Switch-on
		No fuse	Install fuse
		Broken wiring	Check wiring and repair
		Broken lead	Check wiring and repair
		Broken windings	Check windings and repair
	Fuse blowing. (Automatic switch trips off, slow start with electromagnetic noise)	Short circuit of circuit switches	Check circuit switches and replace
		Incorrect wiring	Check wiring according to nameplate
		Poor contact at terminals	Lock tightly
		Windings grounded	Factory repair
		Broken windings	Factory repair
		Poor contact of circuit switches	Check and repair
		Broken wiring	Check and repair
		Poor contact of starting switches	Check and repair
		Short circuit of starting switches	Check and repair
		Incorrect connections of starting switches	Connect according to nameplate
Loading after start	Fuse blowing. Fail to restart due to trip-off of automatic switch	Insufficient capacity of fuse	Replace fuse if wiring permits
		Overload	Lighten load
		High load at low voltage	Check circuit capacity and reduce load
	Overheating motor	Overload or intermittent overload	Lighten load
		Under-voltage	Check circuit capacity and power source
		Over-voltage	Check power source
		Ventilation duct clogged	Remove the foreign matter in the duct
		Ambient temperature exceeds 40°C	Correct insulation class F, or lower ambient temperature.
		Friction between rotor and stator	Factory repair
		Fuse blown (Single-phase rotating)	Install the specified fuse
		Poor contact of circuit switches	Check and repair
		Poor contact of circuit starting switches	Check and repair
		Unbalanced three-phase voltage	Check circuit or consult power company

Kinds of Breakdown	Symptoms	Possible causes	Remedies	
Loading after start	Speed falls sharply	Voltage drop	Check circuit and power source	
		Sudden overload	Check machine	
		Single-phase rotating	Check circuit and repair	
	Switch overheat	Insufficient capacity of switch	Replace switch	
		High load	Lighten load	
	Bearing overheating	Lack of oil	Add oil	
		Lack of grease	Add grease	
		Misalignment between motor and machine shafts	Re-align	
		Over speed of bearing outer-ring	Adjust bracket	
		High bearing noise	Replace the damaged bearing	
Noise	Electromagnetic noise induced by electricity	Occurrence from its first operation	May be normal	
		Sudden sharp noise and smoking	Short circuit of windings Should be repaired at factory	
	Bearing noise	Churning sound	May be normal noise from grease circulating through the bearing	
		Rattling noise as result of poor lubrication	Add Grease	
		Larger noise	Inspect cause -replace the damaged bearing	
	Mechanical noise caused by machinery	Loose belt sheave	Adjust key and lock the screw	
		Loose coupling or skip	Adjust the position of couplings, lock key and screw	
		Loose screw on fan cover	Lock fan cover screw tightly	
		Fan rubbing	Adjust fan position	
		Rubbing as a result of ingress of foreign matters	Clean motor interior and ventilation ducts	
		Wind noise	Noise induced by air flowing through ventilation ducts	
		Induced by conveyance machine	Repair machine	
	Vibration	Electromagnetic vibration	Short circuit of windings	Factory repair
			Open circuit of rotor	Factory repair
		Mechanical vibration	Unbalanced rotor	Factory repair
Unbalanced fan			Factory repair	
Broken fan blade			Replace fan	
Unsymmetrical centers between belt sheaves			Align central points	
Central points of couplings not in alignment			Adjust the alignment between motor and driven equipment	
Improper mounting installation			Check mounting and alignment	
Motor mounting bed is not strong enough			Reinforce mounting bed	
Mounting bed vibration caused by near machines			Eliminate the vibration source near motor	
Remarks:				
(1) Circuit switches: These include knife switches, electromagnetic switches, fuse and other connection switch etc.				
(2) Starting switches: These include Delta-Star starters, compensate starters, reactance starters, resistor starters, starting controllers etc.				

7. RECYCLE

7.1 Introduction

TECO obey its environmental and protection policies. TECO has always been committed through the use of recyclable and life cycle analysis of the results to improve environmental protection products. Products, production processes or flow designs are all reflected the concept of environmental protection. TECO's environmental management system through the ISO 14001 certification is used to implement an environmental policy tool.

The following guidelines only deal with the suggestions of environmental treatment on the equipments. Customer shall be responsible for compliance with local regulations. This manual may not include some of the customer's specific content. Project document provides additional documentation.

7.2 Materials Average Content

When producing electrical equipments, the average material content used are as follows:

Material	Die-casting frame Induction machinery	Steel plate frame Induction Machinery
Steel	45 – 56 %	79 - 83 %
Copper	8 – 10 %	12 – 14 %
Cast iron	32 – 43 %	1 – 3 %
Aluminum	0 – 5 %	0 - 1 %
Insulation materials	1 - 2 %	2 – 4 %
Stainless steel	Below 1 %	Below 1 %
Other	Below 1 %	Below 1 %

7.3 Packing Materials Recycling

When the equipments arrived to the place, the packing materials should be removed.

- All wood-made packing materials can be burned.
- The packing materials used with impregnated wood at sea shipping for some country must be recycled according to local regulations.
- The plastic materials around equipments can be recycled.
- The anticorrosive agent covered on the surface of equipments can be cleaned by gasoline-based cleaner or wipers. Treating the wipers must be complied with local regulations.

7.4 Equipment of disassembling

Disassembling equipment is a basic operation because equipment is assembled by bolts. However, due to the heavy weight of equipment, the operator must be required to have received training in handling the transportation of heavy loads to avoid any danger.

7.5 Classification of different materials

7.5.1 Frame, Bracket (bearing housing), Cover and Fan

These parts are made of structural steel and can be recycled according to local regulations. All of auxiliary equipment, cables and bearings must be removed before melting.

7.5.2 Parts with electrical insulation

The stator and rotor are the main part of machinery included electrical materials. Some auxiliary parts also included similar materials and should be used the same methods to dispose. These materials include each insulator in outlet box, exciter, transformer with adjustable voltage and current function, cables, wires, corona discharger and capacitor. Some parts are used for synchronous machineries and some used for few equipments.

All of these parts are in an inert state when equipments were completed.

Some parts (especially the components into stator and rotor) including a large number of copper can be separated by appropriate heat treatment and the organic adhesive materials in insulation materials can be gasified. In order to ensure proper gas combustion, burner should provide an appropriate supplementary burner. In the combustion process of heat treatment, following conditions are recommended to minimize the material distributed processing:

Temperature of Heat treatment : 380- 420°C (716- 788°F)

Duration : Processing object should be kept at that temperature for at least 5 hours when reaching to 90% of target temperature.

Supplementary gas combustion temperature for adhesives smoke: 850-920 ° C (1562-1688 ° F)

Flow rate: adhesives smoke in the combustion chamber should be kept at least three seconds

Note: The distribution of substances include O₂, CO, CO₂, NO_x, C_xH_y gas and micro-particles.

User shall be responsible to ensure that the process comply with local regulations.

Note: You should pay particular attention to thermal processes and heat treatment equipment maintenance, so as not to bring fire or explosion hazard. Since this work will use a variety of devices, so TECO cannot provide a detailed maintenance guideline for treatment process or equipment, customers will be responsible for dealing with these issues.

7.5.3 Permanent Magnet

If permanent magnet synchronous machineries will be totally melted, it's no need to deal with the permanent magnets.

In order to achieve a more complete recovery and removal of equipment or if the rotor will be sent out after recovery, we suggest doing permanent magnet demagnetization. Rotor can be heated in the

furnace until the temperature of a permanent magnet reaches 300 °C (572 °F) to achieve degaussing purpose.



Open or disassemble permanent magnet synchronous machinery or remove the rotor of such equipment will produce stray magnetic fields. It may interfere with or damage to other electrical or electromagnetic devices and components, such as cardiac pacemakers, credit cards and more.

7.5.4 Hazardous Waste

The grease in oil lubrication system is hazardous waste and must be treated by local regulations.

7.5.5 Buried Waste

All insulation materials can be treated as landfill waste.

Appendix 1. Daily inspection

Checking point	Checking item	Description or inspection parts	Method	Criteria or notes
1. Bearing	Oil supply	Oil quantity	Check oil level from oil sight gauge.	In the middle of oil sight gauge.
		Oil pressure (forced oil lubrication only)	Check oil supply pressure gauge near inlet pipe or supply unit.	Within $\pm 20\%$ of specified pressure.
		Oil ring rotation (horizontal sleeve bearing only)	Check oil ring from window at 12 o'clock.	Rotating smoothly
	Oil leakage	Shaft 、 labyrinth seal 、 piping connection 、 parting line of housing	Inspect by eye and touch by hand.	Dampness around housing is normal. But oil accumulation on floor should be checked.
	Temperature	Bearing temperature detector	Check the value is the same as normal.	Recommendation : See 4.2.8
	End play	Axial fluctuation of shaft	Inspect by eye.	The shaft shoulder should not touch the liner.
		Magnetic center	Inspect the magnetic center pointer on drive end.	$\pm 3\text{mm}$
	Vibration	Ref to 4.2.9	If the vibration level is higher than normal, please measure the spectrum by instrument.	Analyze the spectrum.
2. Stator	Noise	Ref to 4.2.9	Listen for unusual noise	Assess noise , stop and inspect if necessary
	Temperature	Winding temperature detector	Check the value is the same as normal.	Recommendation : See 4.2.10
	Load	Voltage 、 current	Check the value from control panel	Voltage variation $< 10\%$ Current $<$ rated current
	Water supply	Water quantity	Check the water flow relay or indicator & temperature.	The water flow rate and temperature limitations are shown on outline drawing.
4. Filter	Dust or pollution	Clean filter	Clean by fresh water	Clean filter
5. Others	Odor	Windings & Bearings	Check winding and bearing temperature monitors	Check load / cooling air flow, oil condition.

Appendix 2. Monthly inspection

Checking point	Checking item	Description or inspection parts	Method	Criteria or notes
1. Bearing	Oil supply	Oil quantity	Check oil level from oil gauge.	In the middle of oil gauge. If the oil quantity is low , please add oil and check for leaks
	Oil leakage	Shaft 、labyrinth seal 、piping connection 、parting line of housing	Inspect by eye and touch by hand.	If oil is leaking, it is important to find the root cause.
2. Stator	Temperature	Winding temperature detector	Check the value if the same as normal.	Recommendation : See 4.2.10
	Appearance	Bolts/nuts for bracket or frame etc.	Inspect by eye and touch by hand.	Re-tighten all loose.
	Resistance	Winding	500VDC/1000VDC megger. Once every three months at least.	Ref to “Operation” 4.1.2 measurement of insulation resistance.
3. Cooler	Water supply	Water quantity	Check the water flow relay or indicator & temperature.	The water flow rate and temperature limitations are shown on outline drawing.
4. Coupling	Appearance	Bolts/nuts	Inspect by eye and touch by hand.	Re-tighten all loose bolts.
5. Space heater	Resistance	Heater wire	500VDC megger.	Ref to “Operation” 4.1.2 measurement of insulation resistance.

Appendix 3. Regular Inspection

item	Checking point	Description	Regular inspection		
			In situ Exterior surface inspection	In situ Open inspection	Removed for Disassembly inspection
1. Inspection before disassembly	(1)	Vibration	Measure and record the vibration levels for reference	☐	☐
	(2)	Temperature	Record bearing, winding & ambient temperature for reference.	☐	☐
	(3)	Coupling	Measure the mounting and shaft end dimensions. Check if any bolts are loose. Check if there are any mounting hole, key & keyway deformation.		☐
	(4)	Alignment	Check and record the alignment for reference		☐
	(5)	Anchor bolt, mounting bolt & nut	Check if there are any parts loose. Check condition of all nuts , bolts, Replace if defective.	☐	☐
	(6)	Adjusting shims	Check if rusty, damaged and replace if damaged.		☐
	(7)	Shaft vibration	Measure the shaft vibration value and record.		☐
	(8)	Foundation level	Check for any deformation that may have occurred.		☐
	(9)	Air gap	Measure this value and record in 3 places at least for each end.		☐
2. Sleeve bearing inspection	Sleeve bearing	According to RENK “Instructions for Maintenance and Inspection”.		☐	☐
3. Stator inspection	(1)	Winding resistance	Use 500VDC/1000VDC megger to measure and record results.	☐	☐
	(2)	Winding appearance	Check if any dust or oil contamination on winding coil		☐
	(3)	Coil end	Check coils for loose blocking, lashings, end rings.		☐
	(4)	Coil insulation	Check coil insulation material for wear, discolouration or damage		☐
	(5)	Cable lead	Check if lead insulation broken, cracked or damaged.		☐
	(6)	Terminal lug	Check for loose or damaged lugs or terminals.		☐
	(7)	Coil wedge	Check for loose or damaged slot wedges.		☐
	(8)	Air guide	Check each bolt & nut to see if any is loose.		☐

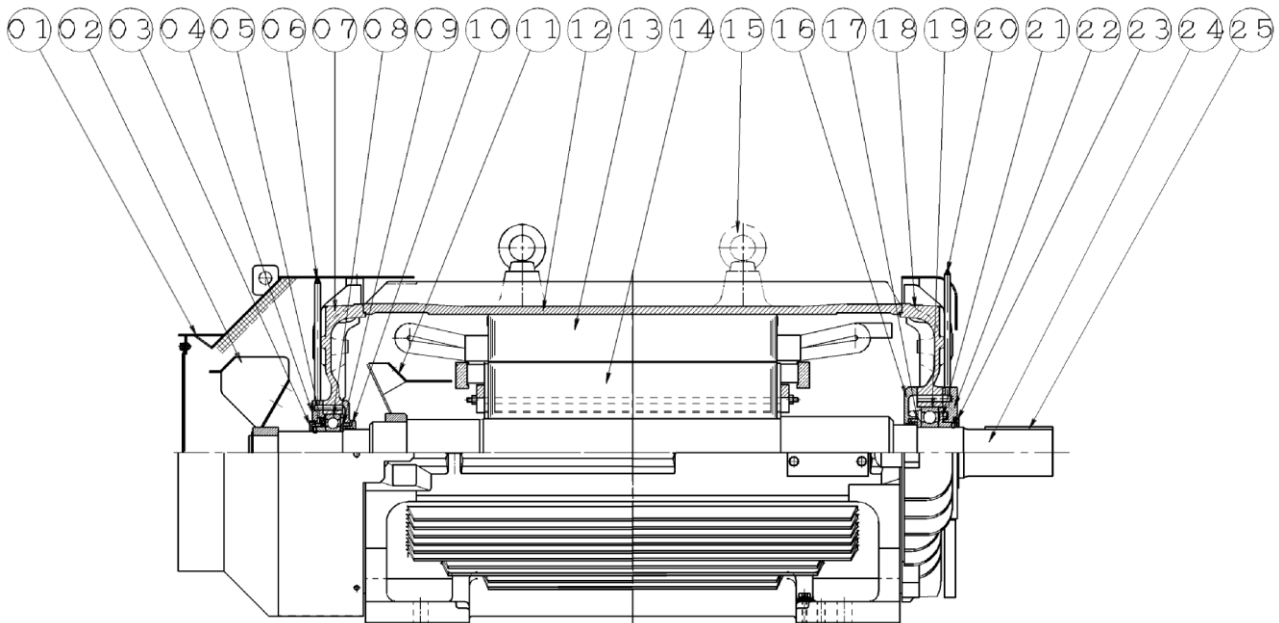
Appendix 3. Regular Inspection (continue)

item		Checking point	Description	Regular inspection		
				In situ Exterior surface inspection	In situ Open inspection	Removed for Disassembly inspection
4. Rotor inspection	(1)	Rotor appearance	Check if any dust or oil contamination is on rotor.			○
	(2)	Rotor bar	Check for loose or damaged bars Check rotor bar end ring welds.			○
	(3)	Rotor core	Check for loose or damaged laminations.		○	○
5. Fan		Fan	Check welded portions for cracks, bolts & nuts, any built up dirt or rust.			○
6. Inspection before operation	(1)	Winding resistance	Use 500VDC/1000VDC megger to measure, record results.	○	○	○
	(2)	Supply lead connection	Check all incoming supply leads correctly connected.		○	○
	(3)	Protection relay	Check protection relay in normal operation.	○	○	○
	(4)	Lubrication oil	Oil level at the middle of oil gauge. Oil inlet pressure correct and oil drains smoothly.	○	○	○
	(5)	Alignment	Check and record the alignment.			○
	(6)	Anchor bolt & mounting bolt	Check all mounting bolts are securely tightened.		○	○
	(7)	Driven equipment	Check if all driven equipment is ready for operation.	○	○	○
	(8)	Cooling water	Check cooling water flow rate & quantity.	○	○	○
7. Inspection before starting	(1)	Rotational direction	Check rotational direction.	○	○	○
	(2)	Oil ring	Check if oil ring runs smoothly.	○	○	○
	(3)	Noise	Check there is no abnormal noise.	○	○	○
	(4)	Vibration	Check if vibration is normal.	○	○	○
	(5)	Bearing temperature	For test run, please keep monitoring for 2hrs at least.	○	○	○
	(6)	Oil level	Check oil level.	○	○	○
	(7)	Current	Make sure current is below rated value shown on nameplate.	○	○	○

Note :

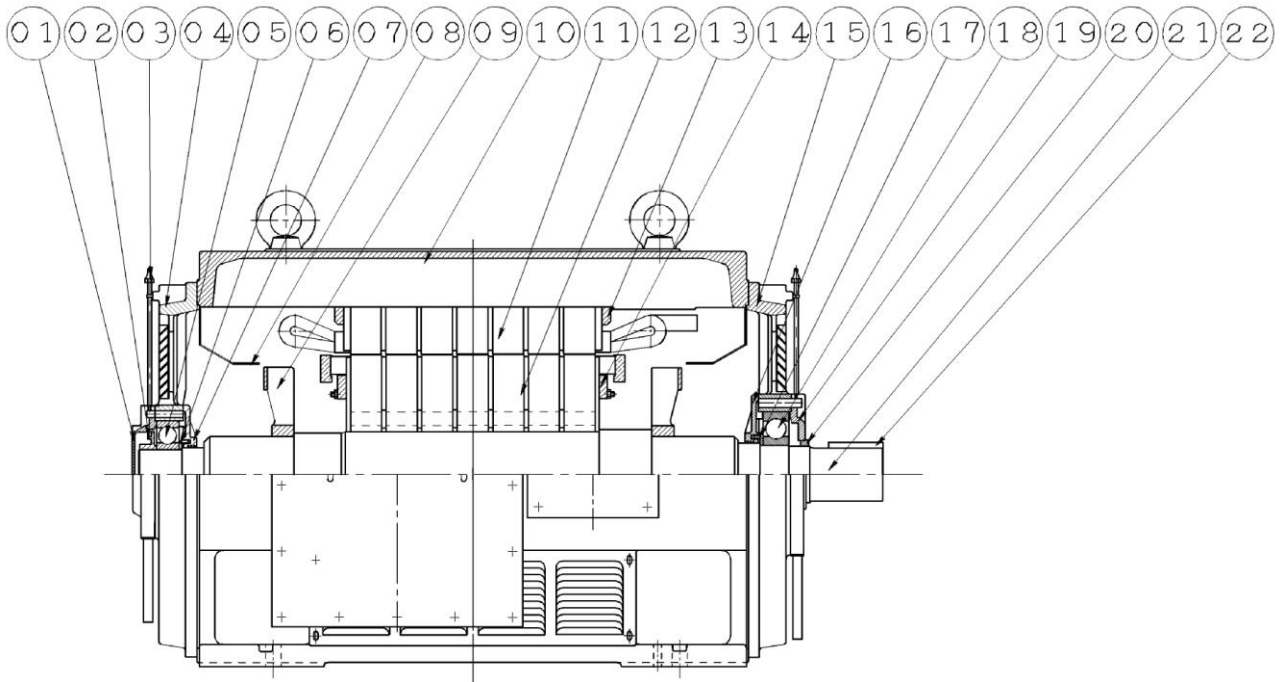
- (a) Disassembly inspection : removing the rotor to inspect the stator & rotor.
Recommendation : every four (4) years, but depends on operation environment conditions & machine type.
 - (b) Open inspection : inspect the maximum possible portions without removing rotor.
Recommendation : every two (2) years, but depends on operation environment conditions & machine type.
 - (c) Exterior surface inspection
Recommendation : every year.
-

Appendix 4. Typical motor cross sectional drawings: SCIM, TEFC



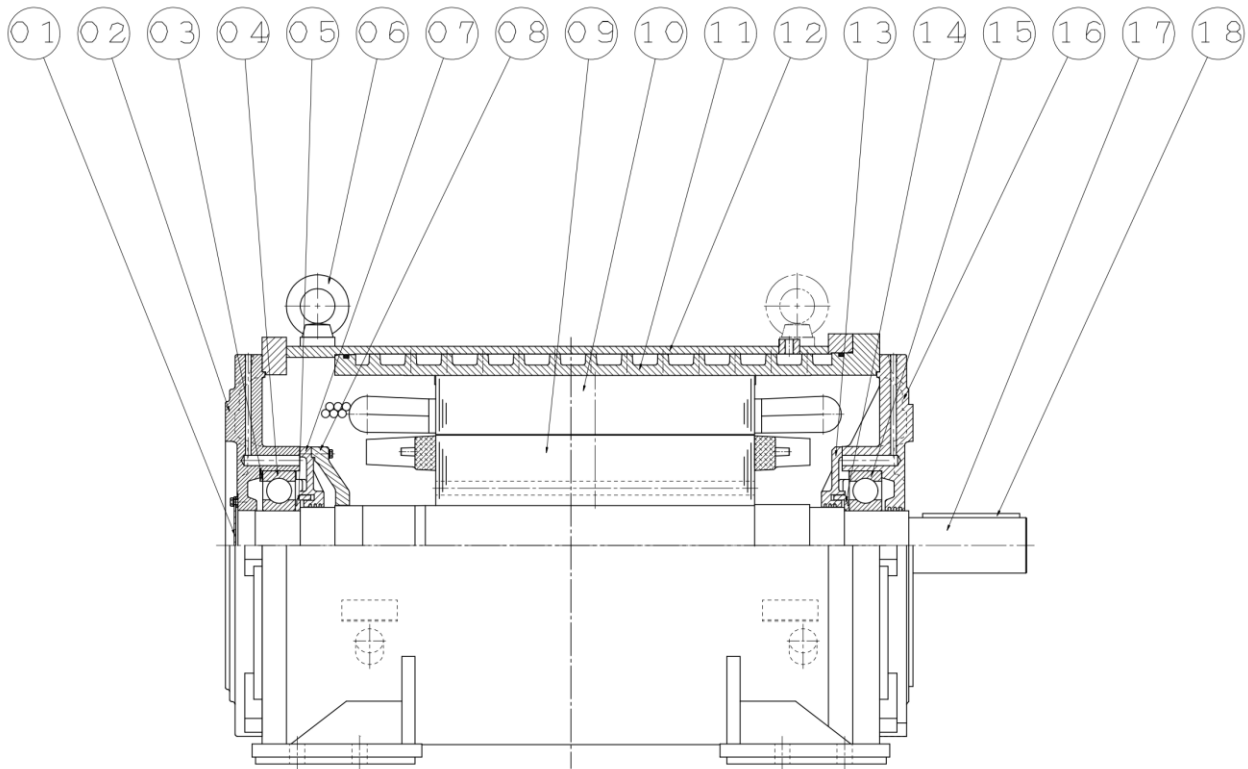
Item	Name	Item	Name
01	FAN COVER(N.D.E)	14	ROTOR
02	EXTERRAL FAN	15	EYE BOLT
03	DUST FLINGER	16	BEARING COVER-INNER
04	BEARING COVER-OUTER	17	GREASE FLINGER
05	GREASE FLINGER	18	END BRACKET
06	GREASE NIPPLE	19	BEARING
07	END BRACKET	20	GREASE NIPPLE
08	BEARING	21	GREASE FLINGER
09	GREASE FLINGER	22	BEARING COVER-OUTER
10	BEARING COVER-INNER	23	DUST FLINGER
11	INNER FAN	24	SHAFT
12	FRAME	25	SHIFT END KEY
13	STATOR		

Appendix 5. Typical motor cross sectional drawings: ODP



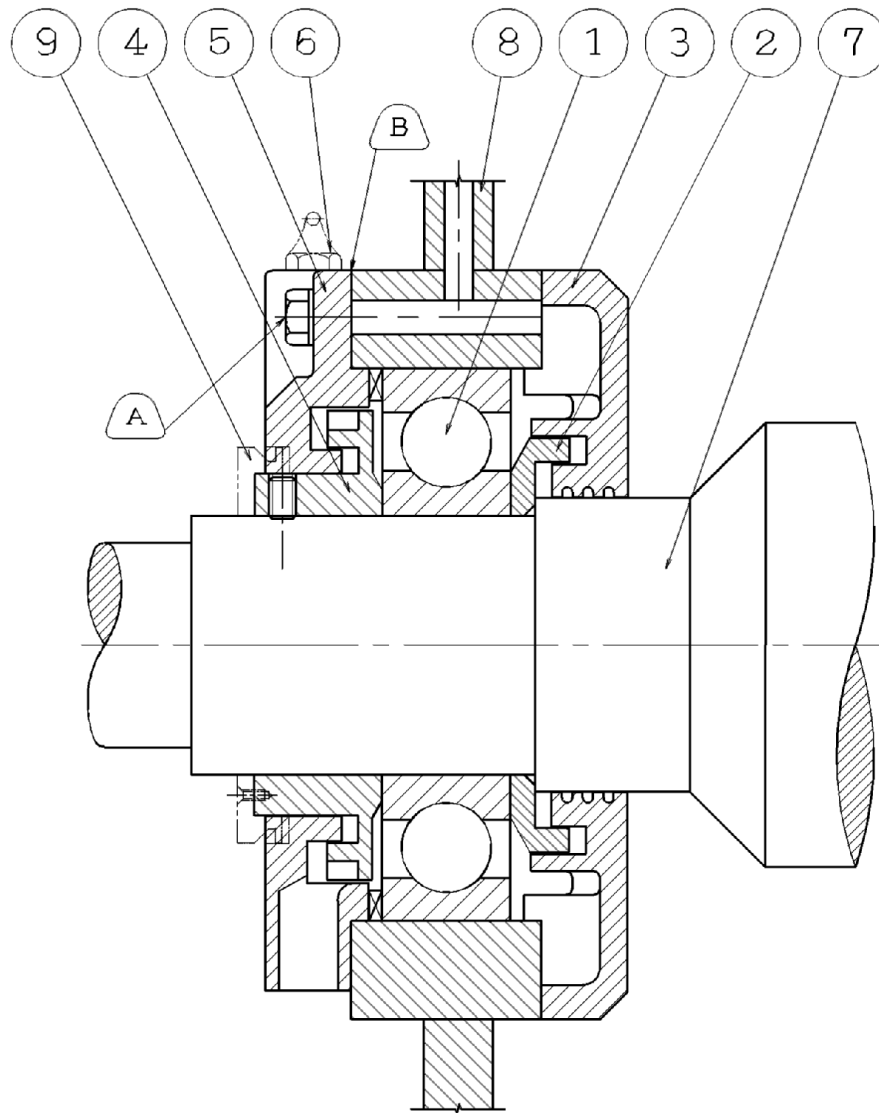
Item	Name	Item	Name
01	BEARING COVER-OUTER	12	R CORE
02	GREASE FLINGER	13	RETAINER RING-S
03	GREASE NIPPLE	14	RETAINER RING-R
04	BRACKET	15	BRACKET
05	BEARING	16	BEARING COVER-INNER
06	STOP RING-BEARING	17	STOP RING-BEARING
07	BEARING COVER-INNER	18	BEARING
08	AIR GUIDE	19	BEARING COVER-OUTER
09	INNER FAN	20	INPRO SEAL
10	FRAME	21	SHAFT
11	S CORE	22	KEY

Appendix 6. Typical motor cross sectional drawings: SCIM, TEWC



Item	Name	Item	Name
01	COVER	10	S CORE
02	FLANGE-BRACKET	11	FRAME-INNER
03	PRE-LOAD SPRING	12	FRAME-OUTER
04	BEARING	13	BEARING COVER-INNER
05	GREASE FLINGER	14	GREASE FLINGER
06	EYE BOLT	15	BEARING
07	BEARING COVER-INNER	16	FLANGE BRACKET
08	BEARING COVER-INNER	17	SHAFT
09	ROTOR	18	KEY

Appendix 7. Typical ball bearing construction drawing

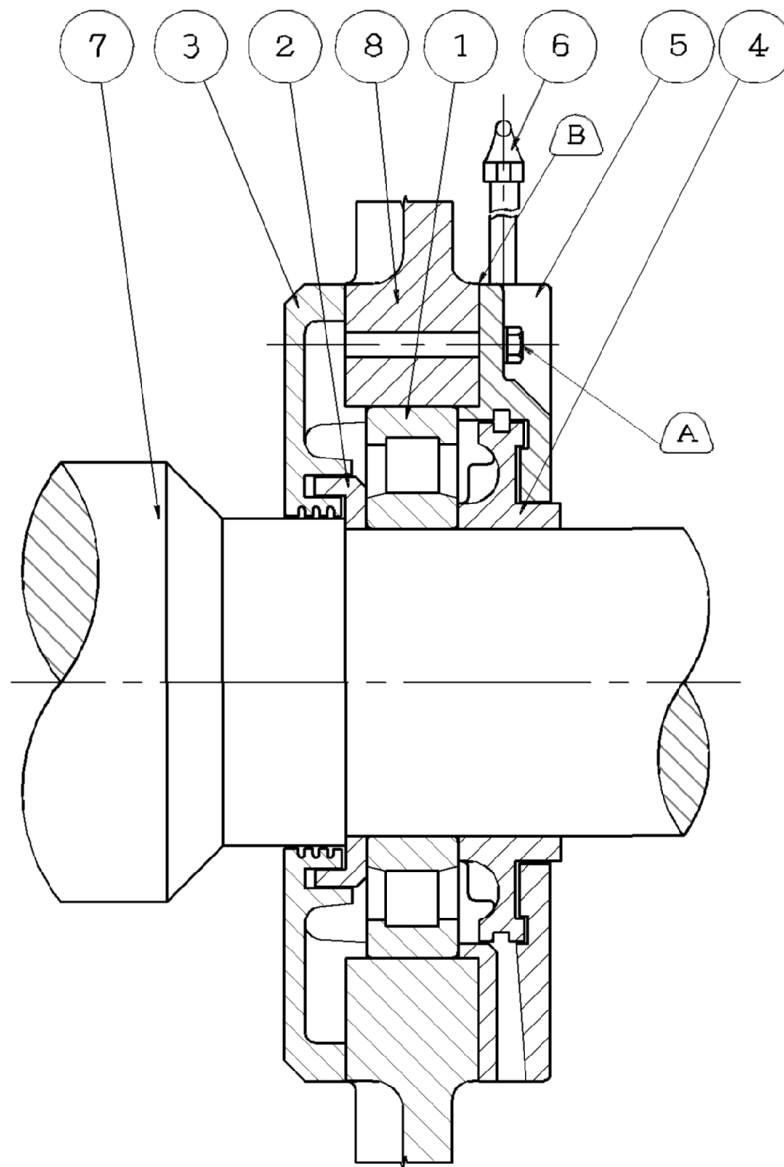


Item	Name	Item	Name
1	Ball Bearing	6	Grease Nipple & Pipe
2	Grease Flinger-Inner	7	Shaft
3	Bearing Cover-Inner	8	Bracket
4	Grease Flinger-Outer	9	Dust Flinger
5	Bearing Cover-Outer		

Please be noted :

1. Use sealing compound on screws (A) and the surface between parts (B).
2. In order to avoid abnormal bearing noise, please fill new grease as full as possible between races during the change process of bearing.

Appendix 8. Typical roller bearing construction drawing

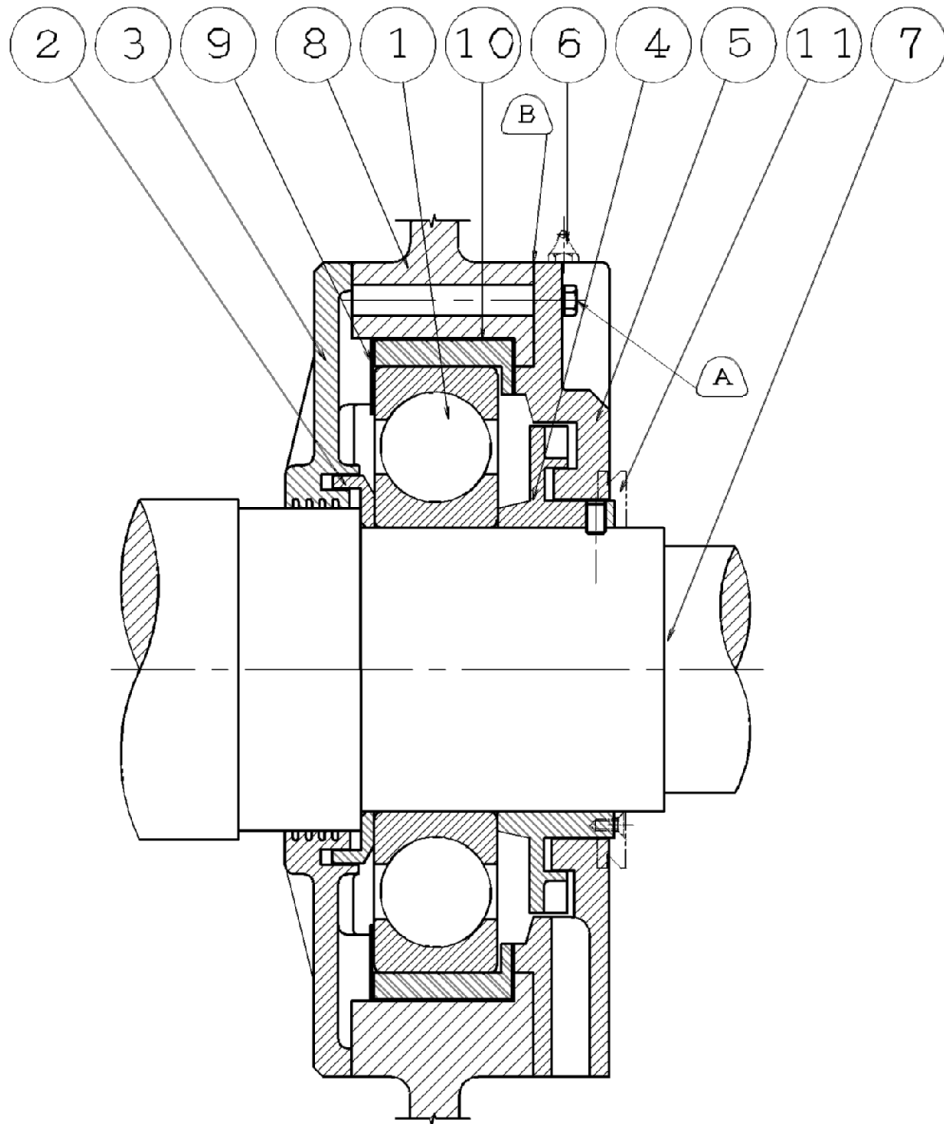


Item	Name	Item	Name
1	Roller Bearing	5	Bearing Cover-Outer
2	Grease Flinger-Inner	6	Grease Nipple & Pipe
3	Bearing Cover-Inner	7	Shaft
4	Grease Flinger-Outer	8	Bracket

Please be noted :

1. Use sealing compound on screws (A) and the surface between parts (B).
2. In order to avoid abnormal bearing noise, please fill new grease as full as possible between races during the change process of bearing.

Appendix 9. Typical ball bearing with insulation bushing construction drawing

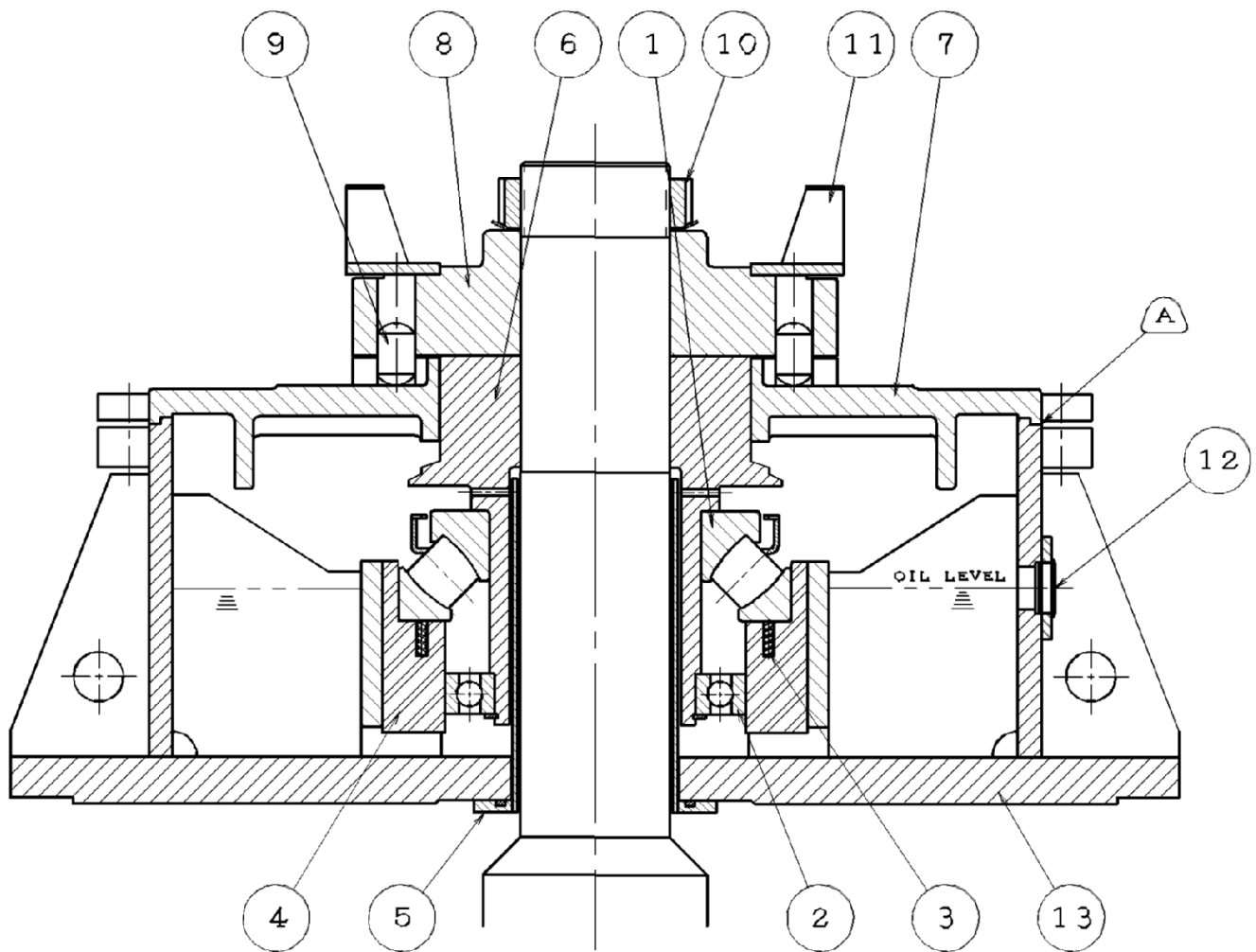


Item	Name	Item	Name
1	Ball Bearing	7	Shaft
2	Grease Flinger-Inner	8	Bracket
3	Bearing Cover-Inner	9	Insulation Plate
4	Grease Flinger-Outer	10	Insulation Bushing
5	Bearing Cover-Outer	11	Dust Flinger
6	Grease Nipple & Pipe		

Please be noted :

1. Use sealing compound on screws (A) and the surface between parts (B).
2. In order to avoid abnormal bearing noise, please fill new grease as full as possible between races during the change process of bearing.

Appendix 10. Typical thrust bearing assembly drawing (vertical machine)

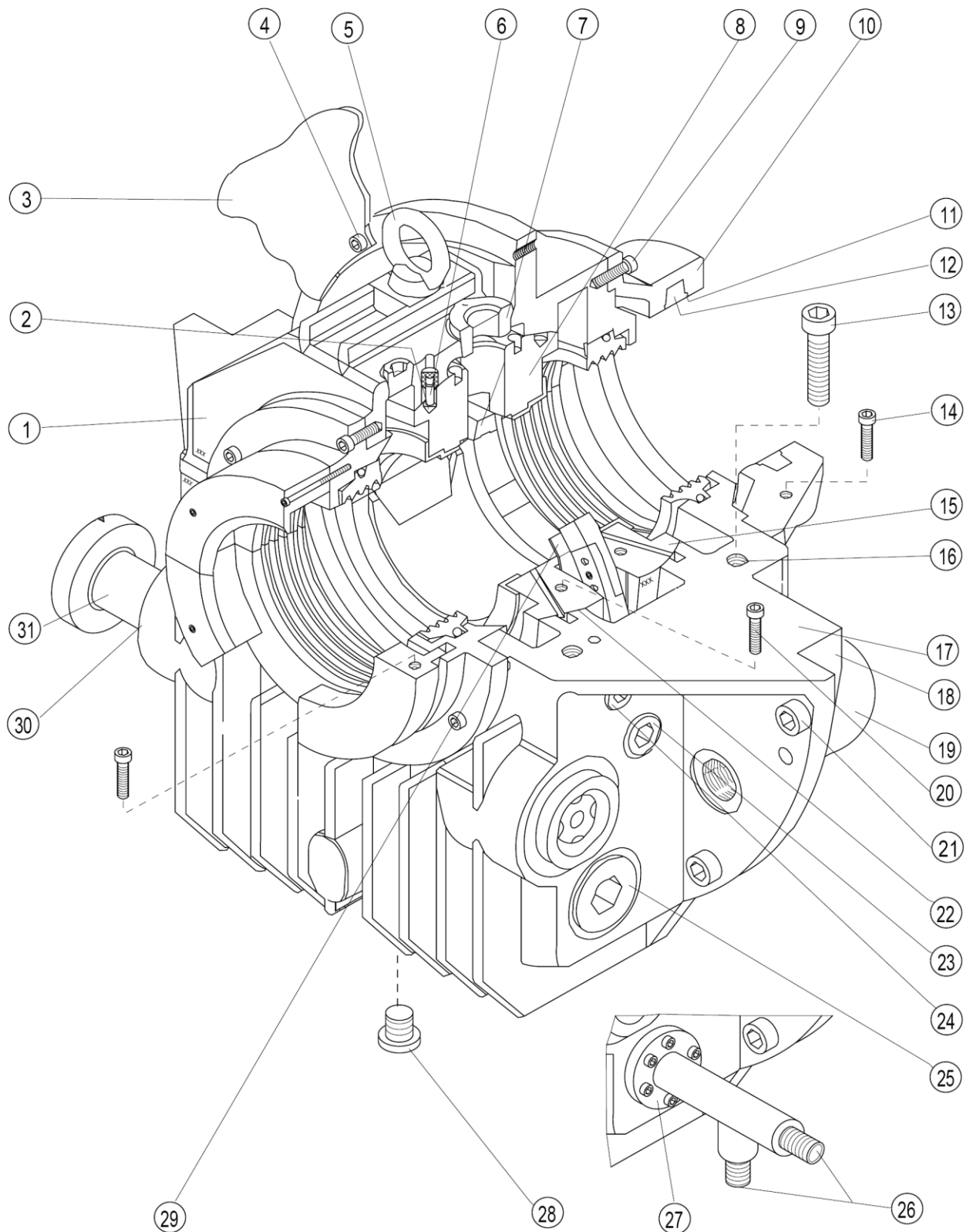


Item	Name	Item	Name
1	Thrust Bearing	8	Ratchet Pin Carrier
2	Ball Bearing	9	Ratchet Pin
3	Spring	10	Lock Nut
4	Insulation Bushing	11	External Fan
5	Oil Standpipe	12	Oil Lever Gauge
6	Upper Bearing Runner	13	Upper Bracket
7	Non-Reverse Ratchet		

Please be noted :

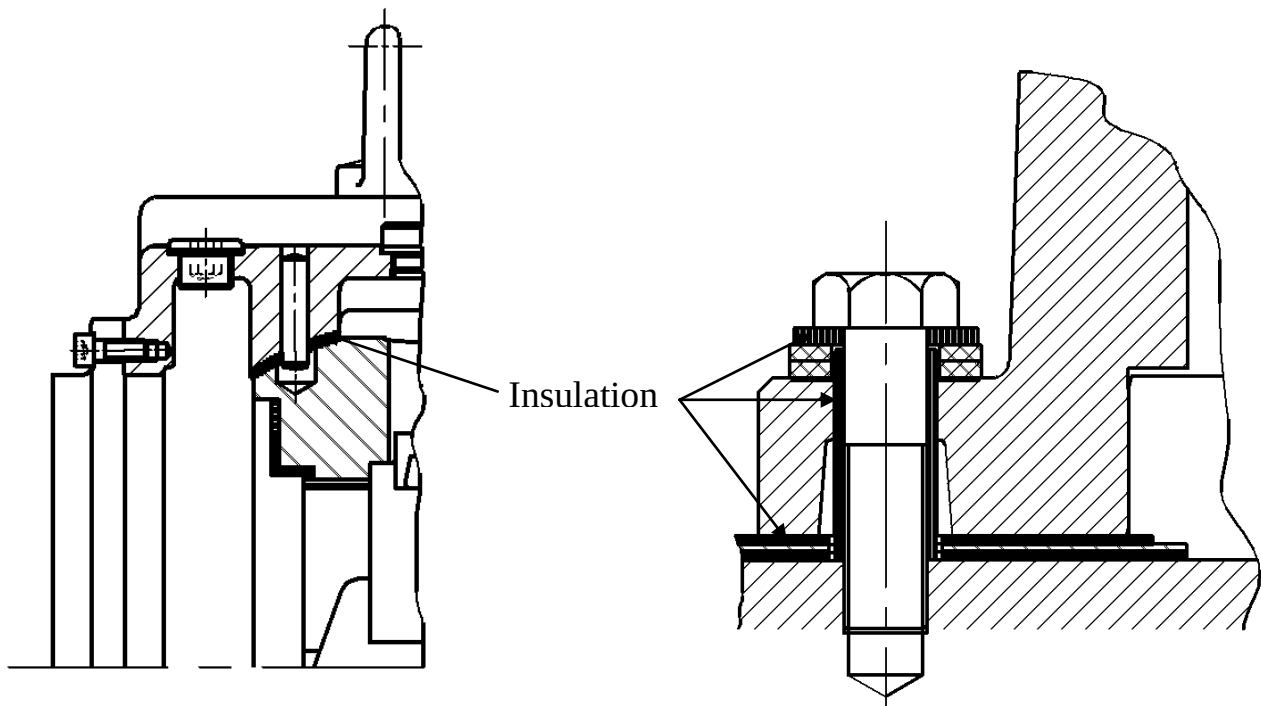
Use sealing compound on spigot of oil tank (A), between non-reverse ratchet (item 7) and upper bracket (item 13).

Appendix 11. Sleeve bearing construction



Item	Name	Item	Name
1	Top half of the housing	2	Positioning pin nut
3	Plate (Assembly opening)	4	Screw
5	Eye bolt	6	Positioning pin
7	Top sight glass	8	Top half of the shell
9	Screw	10	Machine seal
11	Hemp packing seal groove	12	Hemp packing
13	Screw(split line of the housing)		
14	Screw (split line of the machine seal)		
15	Bottom half of the shell	16	Tapped hole
17	Bottom half of the housing	18	Recess
19	Pressure equalizing hose	20	Screw (split line of the shell)
21	Screw	22	Spherical seating
23	Tapped hole for temperature measurement of the journal part		
24	Oil inlet connection hole		
25	Tapped hole for the oil sump temperature measurement		
26	Outlet/Inlet cooling water (optional)		
27	Cooler (optional)		
28	Hexagon head plug (Oil drain plug)		
29	Metal tabs (optional for EMZL.)		
30	Oil outlet connection hole		
31	Oil outlet pipe		

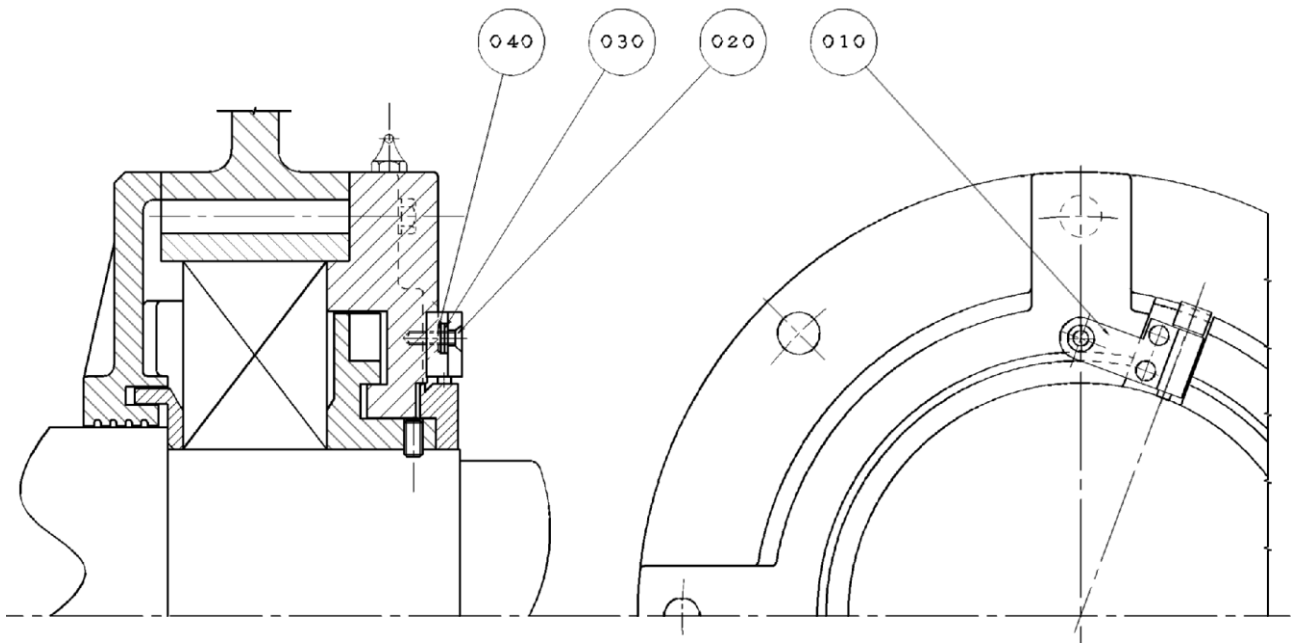
Appendix 12. Mounting of Insulated Sleeve Bearings



Please be noted :

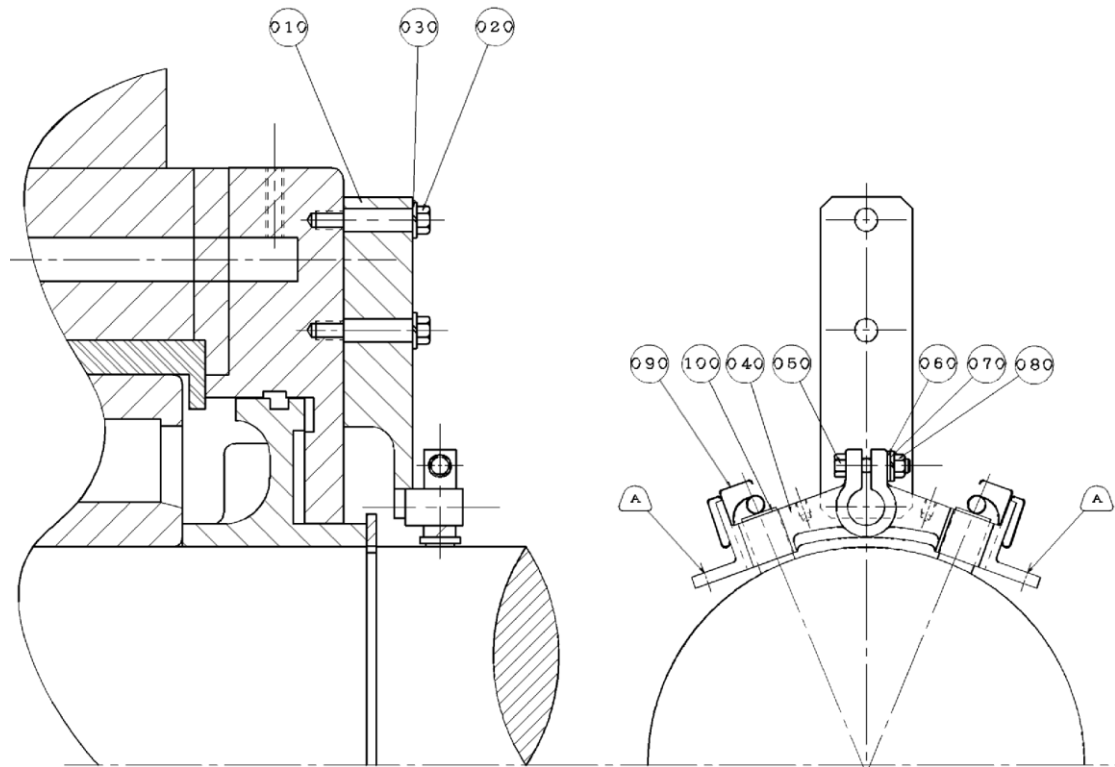
Generally, a pedestal bearing is insulated by means of insulating washers or insulating bushes. (Right hand side of drawing)

Upon request insulated E bearings can be supplied. In this case the spherical seating which accommodates the bearing shell is covered with a non-conductive plastic foil. (Left hand side of drawing)

Appendix 13. Shaft earth brush assembly drawing (TAC)

Item	Name	Item	Name
010	Brush	030	Plain Washer
020	CR C SCREW	040	T Lock Washer

Appendix 14. Shaft earth brush assembly drawing (TECO)



Item	Name	Item	Name
010	Support	060	Plain Washer
020	Hex Bolt	070	S Washer
030	S Washer	080	Hex Nut
040	Brush Holder	090	Brush Spring Assembly
050	Hex Bolt	100	Brush

Please be noted :

Directly connect grounding by a separate wire between one of M6 tap holes (A) on brush holder (item 040) and earth is highly recommended.

Appendix 15. Bolt Torque (kg-cm)

BOLD SIZE	THREAD PITCH	MILD STEEL (property class 4.6 or 4.8)		BRASS
		WITHOUT SPRING WASHER	WITH SPRING WASHER	WITHOUT SPRING WASHER
M4	0.7	25~34	10~13	8.4~11.3
M5	0.8	38~52	20~25	16.2~22.0
M6	1.0	68~97	40~50	28~38
M8	1.25	161~230	90~110	68~91
M10	1.5	288~416	180~230	125~183
M12	1.75	462~660	320~400	230~310
M16	2.0	1010~1440	800~1000	560~760
M20	2.5	2100~3000	1600~2000	1090~1470
M24	3.0	3800~5400	2800~3500	1870~2500
M30	3.5	8000~11500	5800~7250	3800~5100
M36	4.0	14000~20000	10000~12500	6500~8800

Appendix 16. TECO Worldwide Operations

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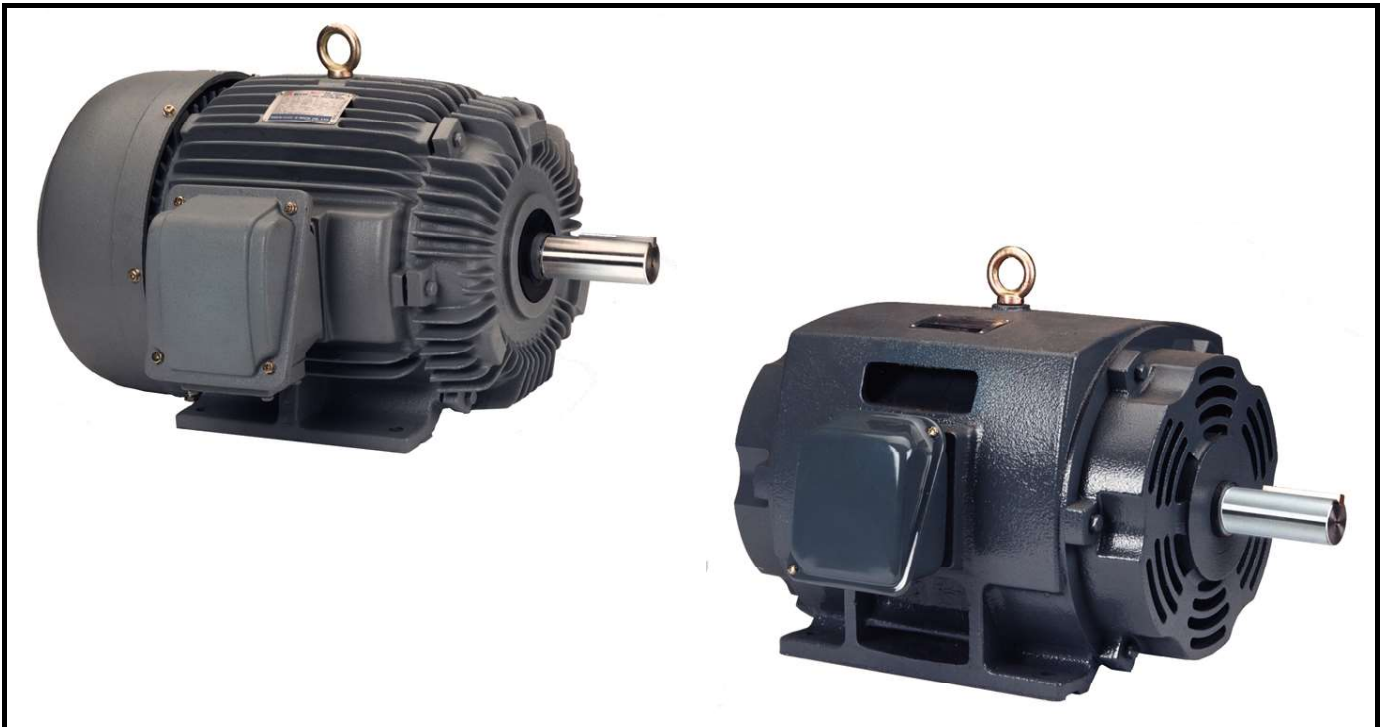
For more information, please contact your local agent
or branch office of TECO-Westinghouse.

TECO Westinghouse

M O T O R S (C A N A D A) I N C .

INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR THREE PHASE INDUCTION MOTORS

Frames 143T - 449T



18060 -109 Ave Edmonton, AB T5S 2K2
Phone: 800-661-4023 780-444-8933 Fax: 888-873-8964

RECEIVING

1. Check nameplate data.
2. Check whether any damage has occurred during transportation.
3. After removal of shaft clamp, turn shaft by hand to check that it turns freely.
4. If motor is to be reshipped (alone or installed to another piece of equipment) the shaft must again be clamped to prevent axial movement.

Note: Remove the bearing clamp before turning the shaft on 284T-449T frame motors.

WARNING

THE FOLLOWING SAFETY PRECAUTIONS MUST BE OBSERVED:

1. Electric rotating machinery and high voltage can cause serious or fatal injury if improperly installed, operated or maintained. Responsible personnel should be familiarized with NEMA MG2; Safety Standards for Construction and Guide Selection. Installation and Use of Electric Motors and Generators; National Electric Code and all local safety requirements.
2. When servicing, all power sources to the motor and to the accessory devices should be de-energized and disconnected and all rotating parts should be at standstill.
3. Lifting means, when supplied, are intended for lifting the motor only. When two lifting devices are supplied with the motor a dual chain must be used.
4. Suitable protection must be used when working near machinery with high noise levels.
5. Safeguard or protective devices must not be by-passed or rendered inoperative.
6. The frame of this machine must be grounded in accordance with the National Electric Code and applicable local codes.
7. A suitable enclosure should be provided to prevent access to the motor by other than authorized personnel. Extra caution should be observed around motors that are automatically or have automatic re-setting relays as they may restart unexpectedly.
8. Shaft key must be fully captive or removed before motor is started.
9. Provide proper safeguards for personnel against possible failure of motor-mounted brake, particularly on applications involving overhauling loads.
10. Explosion proof motors are constructed to comply with the label service procedure manual, repair of these motors must be made by TECO-Westinghouse or CSA/UL Listed service center in order to maintain CSA/UL Listing.

LOCATION

1. Drip-proof motors are intended for use where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. Totally enclosed motors may be installed where dirt, moisture, or dust are present and in outdoor locations.
3. Explosion-proof motors are built for use in hazardous locations as indicated by Underwriters label on the motor.
4. Chemical duty enclosed motors are designed for installation in high corrosion or excessive moisture locations.

Note: in all cases, no surrounding structure should obstruct normal flow or ventilating air through or over the motor.

MOUNTING

1. Mount motor securely on a firm, flat base. All ball bearing normal thrust motors up to and including 256T frame size may be side-wall or ceiling mounted; all others check nearest TECO-Westinghouse office for mounting recommendations.
2. Align motor accurately, using a flexible coupling if possible. For drive recommendations, consult with drive or equipment manufacturer, or TECO-Westinghouse.
3. Mounting bolts must be carefully tightened to prevent changes in alignment and possible damage to the equipment. The recommended tightening torque s for medium carbon steel bolts, identified by three radial lines at 120 degrees on the head, are:

Bolt Size	Recommended Torque (Ft-lb.)	
	Minimum	Maximum
2/8	25	37
1/2	60	90
5/8	120	180
3/4	210	320

4. V-belts Sheave Pitch Diameters should not be less than those shown in Table 1 (NEMA recommended values)
5. Tighten belts only enough to prevent slippage. Belt speed should not exceed 5000 ft. per min.

TABLE 1. V-Belt Sheave Pitch Diameters (MG1-14.42)

Frame Number					V-Belt Sheave			
					Conventional A, B, C, D AND E		Narrow 3V, 5V, AND 8V	
					Minimum Pitch Diameter Inches	*Maximum Width Inches	Minimum Outside Diameter Inches	**Maximum Width Inches
	Horsepower at							
	Synchronous Speed, RPM							
3600	1800	1200	900					
143T	1.5	1	.75	.5	2.2	4.25	2.2	2.25
145T	2-3	1.5-2	1	.75	2.4	4.25	2.4	2.25
182T	3	3	1.5	1	2.4	5.25	2.4	2.75
182T	5				2.6	5.25	2.4	2.75
184T			2	1.5	2.4	5.25	2.4	2.75
184T	5				2.6	5.25	2.4	2.75
184T	7.5	5			3.0	5.25	3.0	2.75
213T	7.5-10	7.5	3	2	3.0	6.5	3.0	3.375
215T	10		5	3	3.0	6.5	3.0	3.375
215T	15	10			3.8	6.5	3.8	3.375
254T	15		7.5	5	3.8	7.75	3.8	4
254T	20	15			4.4	7.75	4.4	4
256T	20-25		10	7.5	4.4	7.75	4.4	4
256T		20			4.6	7.75	4.4	4
284T			15	10	4.6	9	4.4	4.625
284T		25			5.0	9	4.4	4.625
286T		30	20	15	5.4	9	5.2	4.625

TABLE 1. V-Belt Sheave Pitch Diameters (MG1-14.42)

Frame Number					V-Belt Sheave			
					Conventional A, B, C, D AND E		Narrow 3V, 5V, AND 8V	
					Minimum Pitch Diameter Inches	*Maximum Width Inches	Minimum Outside Diameter Inches	**Maximum Width Inches
	Horsepower at							
	Synchronous Speed, RPM							
	3600	1800	1200	900				
324T		40	25	20	6.0	10.25	6.0	5.25
326T		50	30	25	6.8	10.25	6.8	5.25
364T			40	30	6.8	11.5	6.8	5
364T		60			7.4	11.5	7.4	5.785
365T			50	40	8.2	11.5	8.2	5.785
365T		75			9.0	11.5	8.6	5.785
404T			60		9.0	14.25	8.0	7.25
404T				50	9.0	14.25	8.4	7.25
404T		100			10.0	14.25	8.6	7.25
405T			75	60	10.0	14.25	10.0	7.25
405T		100			10.0	14.25	8.6	7.25
405T		125			11.5	14.25	10.5	7.25
444T			100		11.0	16.75	10.0	8.5
444T				75	10.5	16.75	9.5	8.5
444T		125			11.0	16.75	9.5	8.5
444T		150				16.75	10.5	8.5
445T			125		12.5	16.75	12.0	8.5
445T				100	12.5	16.75	12.0	8.5
445T		150				16.75	10.5	8.5

*Max. Sheave width = $2(N-W) - .25$

**Max Sheave width = $N-W$

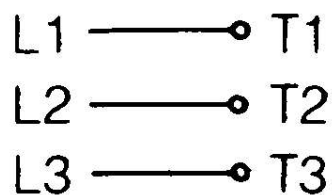
***Sheave ratios greater than 5:1 and center-to-center distance less than the diameter of the large sheave should be referred to TECO-Westinghouse.

POWER SUPPLY & CONNECTIONS

1. Wiring of motor and control, overload protection and grounding should be in accordance with National Electrical Code and all local safety requirements.
2. Nameplate voltage and frequency should agree with power supply. Motor will operate satisfactorily on line voltage within –10% of nameplate voltage; or frequency with –5% and with a combined variation not to exceed –10%. 230-volt motors can be used on 208-volt network systems, but with slightly modified performance characteristics as shown on the nameplate.
3. Dual voltage and single voltage motors can be connected for the desired voltage by following connection diagram shown on the nameplate or inside of the conduit box.
4. All Explosion Proof motors have Temperature Limiting Devices in the motor enclosure to prevent excessive external surface temperature of the motor in accordance with CSA/UL standards. Terminals of thermal protectors (P1 & P2) should be connected to the motor control equipment, according to the connection diagram inside of the conduit box.
5. Standard connection diagram for three phase, not thermally protected, dual rotation motors are shown in diagrams A through E.

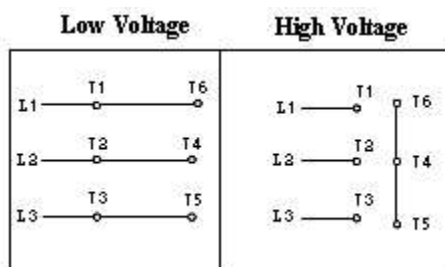
(Note: To change rotation, interchange any two line leads)

A. 3 Lead, Single Voltage

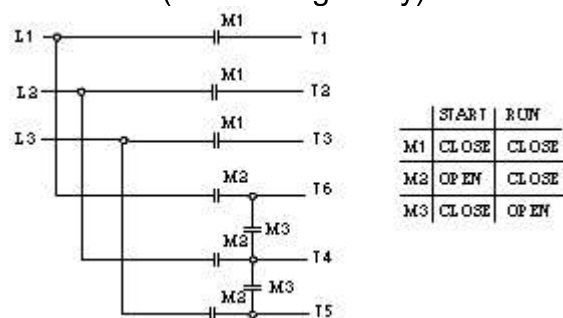


B. 6 Lead, Dual Voltage & Voltage Ratio 1 to 3

B-1 Across the Line Start & Run

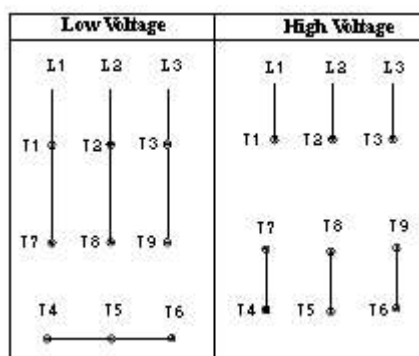


B-2 Wye Start & Delta Run
(Low Voltage only)

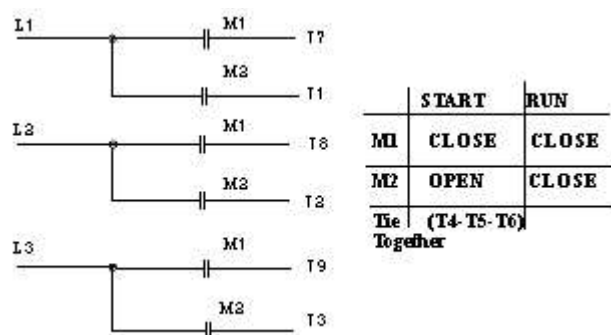


C. 9 Leads; Dual Voltage & Voltage Ratio 1 to 2, Wye Connected

C-1 Across the Line Start & Run

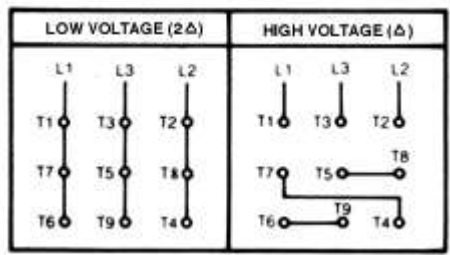


C-2 Part Winding Start
(Low Voltage only)

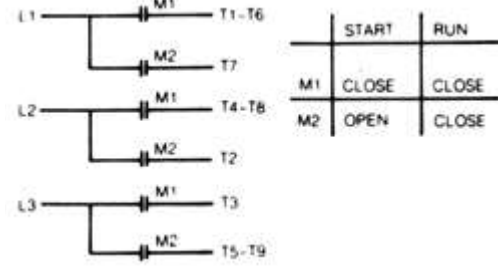


D. 9 Leads; Dual Voltage & Voltage Ratio 1 to 2, Delta Connected

D-1 Across the Line Start & Run

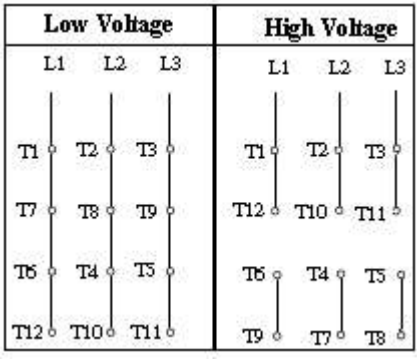


D-2 Part Winding Start (Low Voltage only)

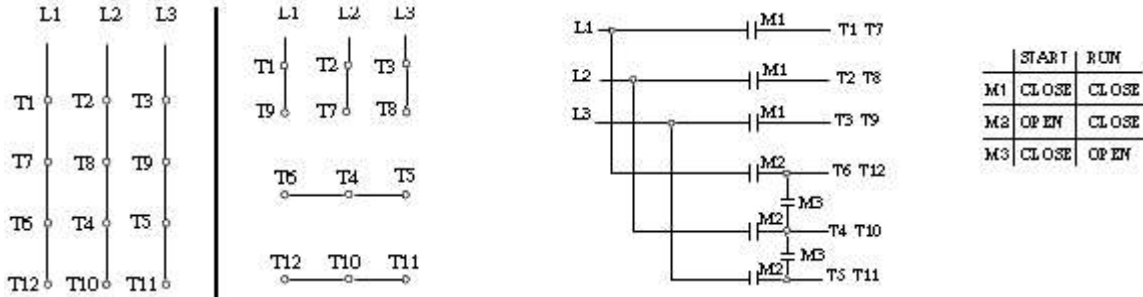


E. 12 Leads, Dual Voltage

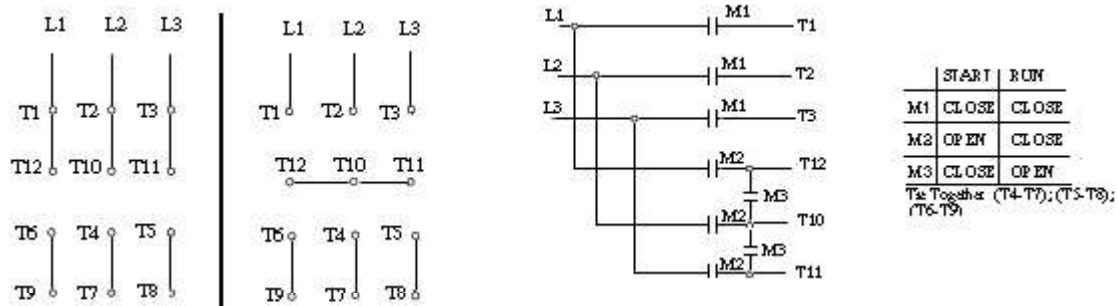
E-1 Across the Line Start & Run



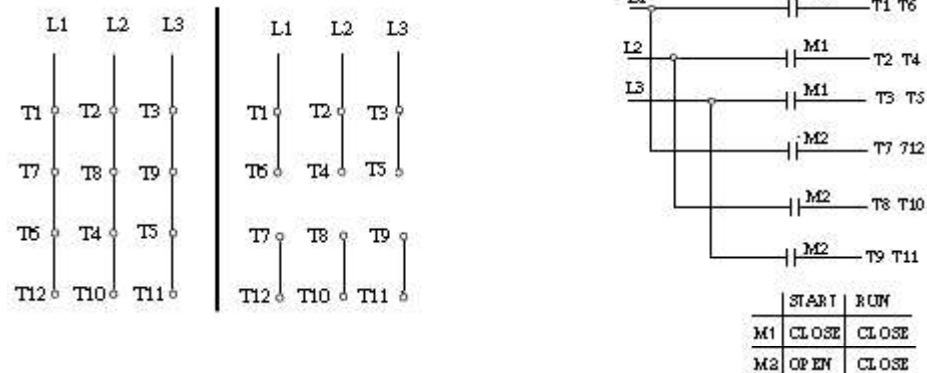
E-2-1 Wye Start & Delta Run (Low Voltage only)



E-2-2 Wye Start & Delta Run (High Voltage only)



E-3 Part Winding Start (Low Voltage only)



***Important:** For Part Winding Start, M2 contactor should be closed within two (2) seconds after M1 contactor is closed.
Only 4 pole and above (e.g., 6P, 8P) motors are satisfactory for Part Winding Start at low voltage.

START UP

1. Disconnect load and start motor. Check direction of rotation. If rotation must be changed, ALLOW THE MOTOR TO STOP COMPLETELY. Interchange any two leads of a three-phase motor.
2. Connect load. The motor should start quickly and run smoothly. If no, shut power off at once. Recheck the assembly including all connections before restarting.
3. If excessive vibration is noted, check for loose mounting bolts too flexible motor support structure or transmitted vibration from adjacent machinery. Periodic vibration checks should be made; foundations often settle.
4. Operate under load for short period of time and check operating current against nameplate.

TESTING

If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with a megohmmeter. Depending on the length and conditions of storage it may be necessary to regrease or change rusted bearings.

If the resistance is lower than one megohm the windings should be dried in one of the following two ways:

1. Bake in oven at temperatures not exceeding 90°C (194°F) until insulation resistance becomes constant.
2. With rotor locked, apply low voltage and gradually increase the current through windings until temperature measured with a thermometer reaches 90°C (194°F). Do not exceed this temperature.

MAINTENANCE

INSPECTION

Inspect motor at regular intervals. Keep motor clean and ventilation openings clear.

LUBRICATION

1. Frame 143T-256T: Double shielded and pre-lubricated ball-bearing motors without grease fittings and don't need relubrication, except on Advantage Plus products which have regreasable features.
2. Frames 280TS, 320-449T(TS): Motors having grease fittings and grease discharge devices at brackets. Motors are shipped with grease for initial running. It is necessary to relubricate anti-friction bearing motors periodically, depending on size and type of service. See Table 2 to provide maximum bearing life. Excessive or too frequent lubrication may damage the motor.

TABLE 2

Horsepower	Standard Conditions	Severe Conditions	Extreme Conditions
1 Thru 30 Hp, 1800 rpm and below	7 years	3 years	180 days
40 Thru 75 Hp, 1800 rpm and below	210 days	70 days	30 days
100 Thru 150 Hp, 1800 rpm and below	90 days	30 days	15 days
1 Thru 20 Hp, 3600 rpm	5 years	2 years	90 days
25 Thru 75 Hp, 3600 rpm	180 days	60 days	30 days
100 Thru 150 Hp, 3600 rpm	90 days	30 days	15 days

Note:

- A. Standard conditions: 8 hours operation per day, normal or light loading, clear and 40°C ambient conditions.
 - B. Severe conditions: 24-hour operation per day or light shock loading, vibration or in dirty or dusty conditions.
 - C. Extreme conditions: With heavy shock loading or vibration or dusty conditions.
 - D. For double shielded bearings, above data (lubrication frequency) means that the bearing must be replaced.
3. Be sure fittings are clean and free from dirt. Using a low-pressure grease gun, pump in the recommended grease until new grease appears at grease discharge hole.
 4. Use ExxonMobil Polyrex EM grease or equivalent polyurea based grease unless special grease is specified on the nameplate.
 5. If relubrication is to be performed with the motor running, stay clear of rotating parts. After regreasing, allow the motor to run for ten to thirty minutes.

RENEWAL PARTS

1. Use only genuine TECO-Westinghouse renewal parts or as recommended by TECO-Westinghouse.
2. When you order renewal parts please specify complete information to TECO-Westinghouse office/agent such as type, frame no., poles, horsepower, voltage, series no., quantity, etc.

**FOR FURTHER INFORMATION PLEASE CONTACT
TECO-WESTINGHOUSE MOTORS (CANADA) INC.**

Technical Documentation

XC1/54C
Optim TEXP | AEHHXG

Date: October 18, 2024

	
	Date: October 18, 2024

Technical Data Sheet

Motor Type: AEHHXG	Catalogue No: XC1/54C
--------------------	-----------------------

Nameplate Information

HP	Pole	RPM	Frame	Voltage	Hz	Phase
1.5	4	1740	145TC	230 / 460	60	3
Enclosure	Ins. Class	Service Factor	Time Rating	NEMA Design	Rated Amb.	Rated Altitude
TEXP	F	1.15	Continuous	C	-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.					
86.50	84.00	87.00	85.50	75.50	67.00	53.50
Torque				Current (A)		
Full Load (lb-ft)	Locked Rotor (% FLT)	Pull Up (% FLT)	Break Down (% FLT)	No Load	Full Load	Locked Rotor
4.53	300	305	375	2.5 / 1.3	4.3 / 2.2	40.00 / 20.00
NEMA KVA Code	Inertia (WR ²)			Safe Stall Time (s)		Noise Level Sound Press. dB(A)
	Rotor (lb-ft ²)	NEMA Load (lb-ft ²)	Max. Allowable (lb-ft ²)	Cold	Hot	
M	0.103	8.60	34.00	31	22	50.0

VFD Duty Information

MAX HP	Current (A)	Speed Range			VFD		S.F.
		CT	VT	CHP	Carrier Hz	Type	
1.5	2.15	12-60Hz	3-60Hz	60-90Hz	3-6kHz	VPWM or CPWM	1.0

Hazardous Locations Information

Additional Certifications

CSA/UL Certified	Other Certification
Class I, Div 1, Groups C & D; Class II, Div 1, Groups E, F & G Class I, Zone 1, Groups IIB & IIA; Class II, Div 1, Groups E, F & G	
Temp Code (Sinewave / VFD)	T3B / T3B

Additional Information

Bearings		Approx. Weight
DE	NDE	lbs
6205ZZ	6205ZZ	70

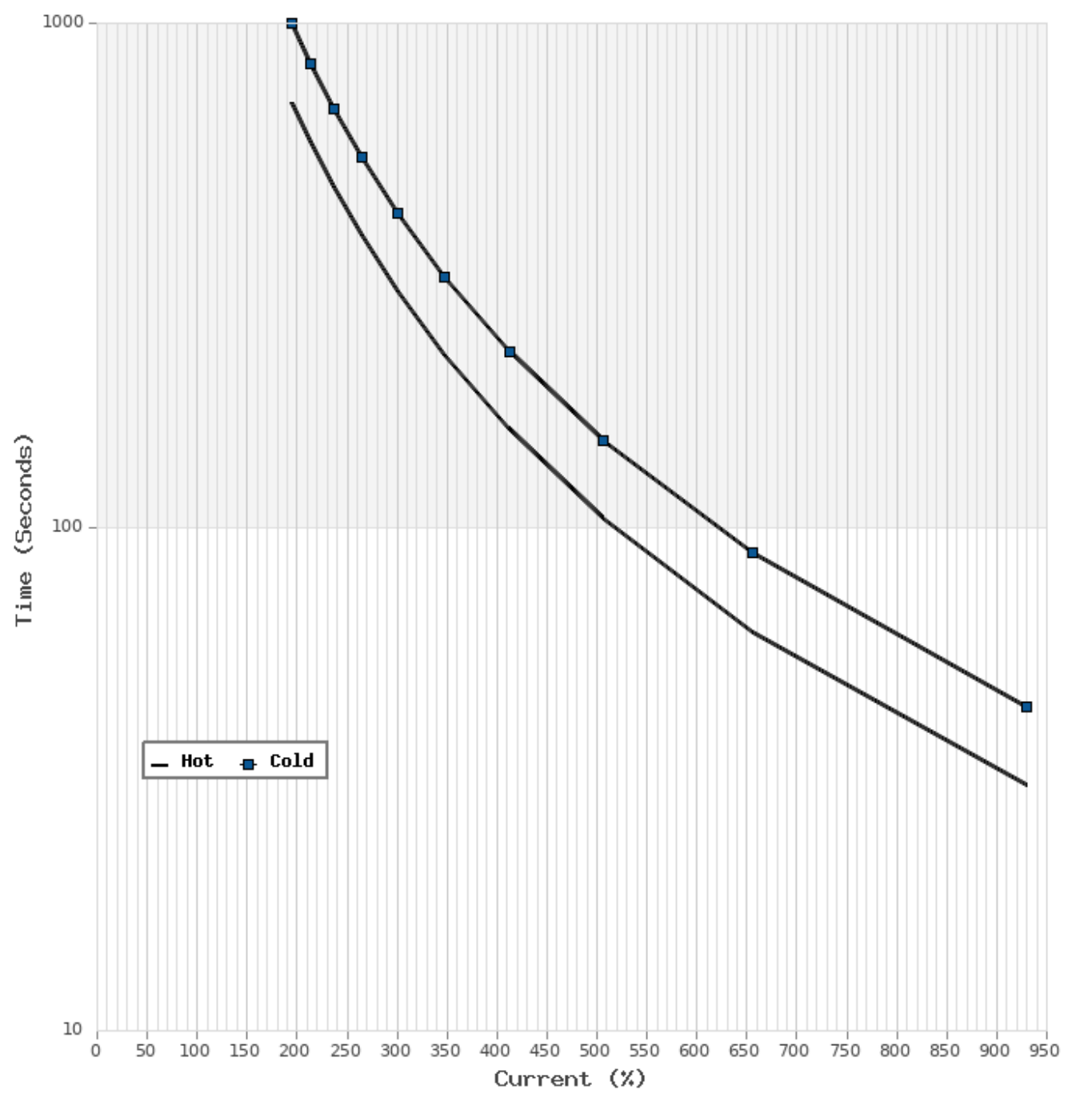
	
	Date: October 18, 2024

Nameplate Drawing

Optim TEXP					
TYPE	AEHHXG		CAT. NO.	XC1/54C	
OUTPUT	1.5 HP 1.12 kW		FRAME	145TC	TEXP
R.P.M.	1740		POLE	4	INS. F
VOLTS	230 / 460		PHASE	3	Hz 60
AMPS	4.3 / 2.2		CODE	M	S.F. 1.15
AMBIENT	40 °C		NOM. EFF. 86.50		MIN. EFF. 84.00
BEARINGS	6205ZZ / 6205ZZ				RATING Cont.
SER. NO.	TBD		DESIGN	C	WT. 70 LBS
PWM VFD DUTY	VT	CT	CP		S.F.
	3-60Hz	12-60Hz	60-90Hz		1.0

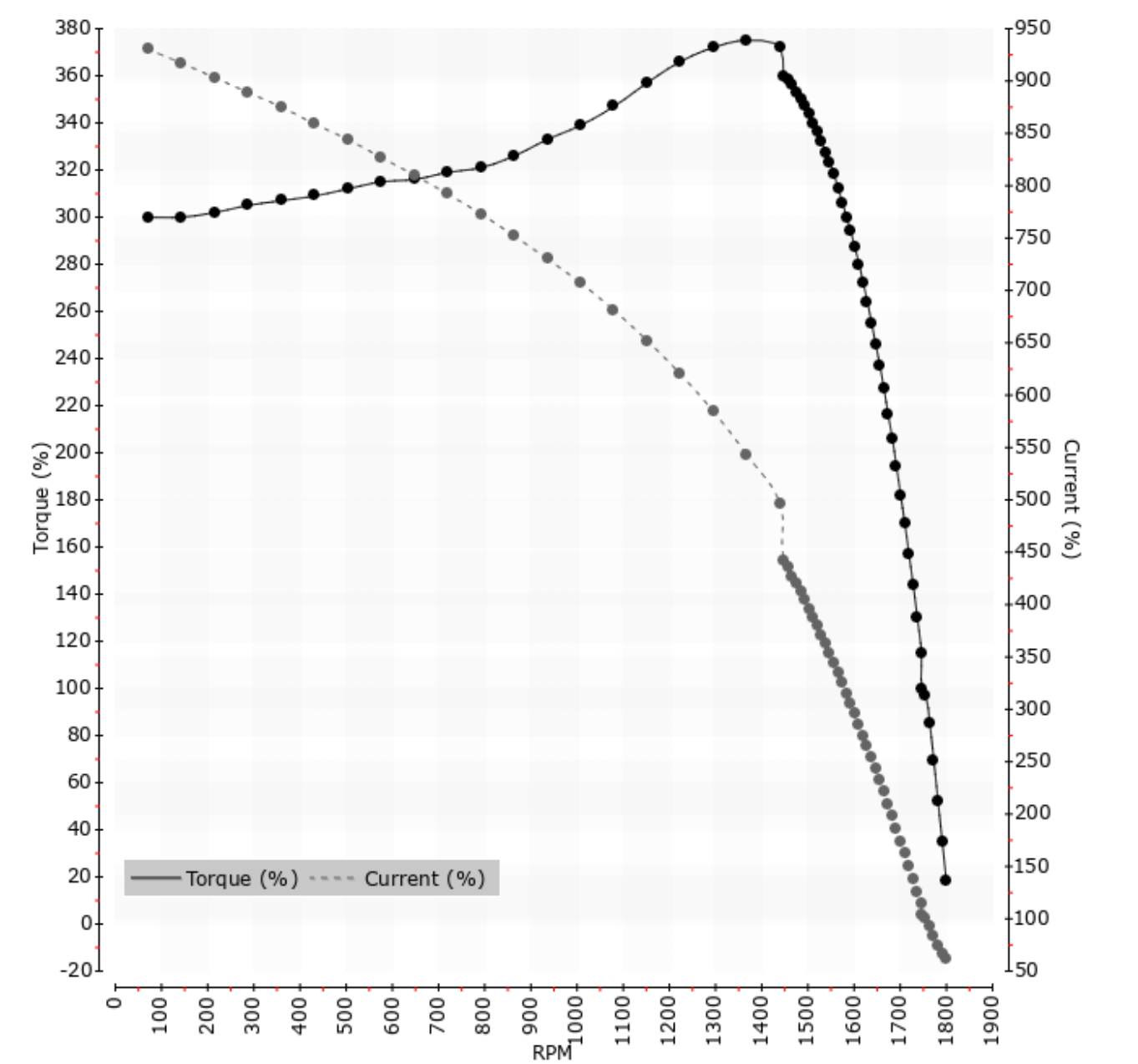
Thermal Limit Curves

Motor Type: AEHHXG		Catalogue No: XC1/54C		Family: Optim TEXP	
HP	1.5	Safe Stall Time		Full Load A	4.3 / 2.2 A
Voltage	230 / 460V 60Hz	Hot	22 s	% Inrush	930 / 930 %
RPM	1800	Cold	31 s	Locked Rotor A	40.00 / 20.00 A



T-N and I-N Curves

Motor Type: AEHHXG		Catalogue No: XC1/54C		Family: Optim TEXP	
HP	1.5	Full Load T	4.53 lb-ft	Full Load A	4.3 / 2.2 A
Voltage	230 / 460V 60Hz	Locked Rotor T	300 %	Locked Rotor A	40.0 / 20.0 A
RPM	1800	Pull Up T	305 %	Break Down T	375 %



DATA SHEET

Three Phase Induction Motor - Squirrel Cage



Customer :

Product line : NEMA Premium Efficiency Three-Phase Product code : 14636474

Frame	: 213/5TC	Cooling method	: IC411 - TEFC
Insulation class	: F	Mounting	: F-1
Duty cycle	: Cont.(S1)	Rotation ¹	: Both (CW and CCW)
Ambient temperature	: -20°C to +40°C	Starting method	: Direct On Line
Altitude	: 1000 m.a.s.l.	Approx. weight ³	: 99.2 kg
Protection degree	: IP55	Moment of inertia (J)	: 0.0620 kgm ²
Design	: B		

Output [HP]	5	5	5	5
Poles	6	6	6	6
Frequency [Hz]	60	50	50	50
Rated voltage [V]	230/460	380	400	415
Rated current [A]	13.7/6.83	8.10	7.82	7.55
L. R. Amperes [A]	92.9/46.4	44.5	47.7	49.1
LRC [A]	6.8x(Code J)	5.5x(Code G)	6.1x(Code H)	6.5x(Code H)
No load current [A]	6.90/3.45	3.41	3.68	3.90
Rated speed [RPM]	1170	960	965	970
Slip [%]	2.50	4.00	3.50	3.00
Rated torque [kgfm]	3.10	3.78	3.76	3.74
Locked rotor torque [%]	170	140	160	190
Breakdown torque [%]	260	200	229	250
Service factor	1.15	1.00	1.00	1.00
Temperature rise	80 K	80 K	80 K	80 K
Locked rotor time	102s (cold) 57s (hot)	54s (cold) 30s (hot)	54s (cold) 30s (hot)	54s (cold) 30s (hot)
Noise level ²	55.0 dB(A)	53.0 dB(A)	53.0 dB(A)	53.0 dB(A)
Efficiency (%)	25%			
	50%	88.5	88.5	87.5
	75%	89.5	88.5	88.5
	100%	89.5	86.8	88.5
Power Factor	25%			
	50%	0.58	0.65	0.58
	75%	0.70	0.76	0.71
	100%	0.76	0.80	0.77

Bearing type Sealing Lubrication interval Lubricant amount Lubricant type	Drive end	Non drive end	Foundation loads	
	: 6308 2RS	: 6207 2RS	Max. traction	: 123 kgf
	: Oil Seal	: Lip Seal	Max. compression	: 222 kgf
	: -	: -		
	: -	: -		
	Mobil Polyrex EM			

Notes

This revision replaces and cancel the previous one, which must be eliminated.

- (1) Looking the motor from the shaft end.
- (2) Measured at 1m and with tolerance of +3dB(A).
- (3) Approximate weight subject to changes after manufacturing process.
- (4) At 100% of full load.

These are average values based on tests with sinusoidal power supply, subject to the tolerances stipulated in NEMA MG-1.

Rev.	Changes Summary	Performed	Checked	Date
Performed by		Page 1 / 6 Revision		
Checked by				
Date	10/09/2022			

DATA SHEET

Three Phase Induction Motor - Squirrel Cage



Customer : _____

Thermal protection

ID	Application	Type	Quantity	Sensing Temperature
1	Winding	Thermostat - 2 wires	1 x Phase	155 °C

Rev.	Changes Summary		Performed	Checked	Date
Performed by				Page	Revision
Checked by				2 / 6	
Date	10/09/2022				

LOAD PERFORMANCE CURVE

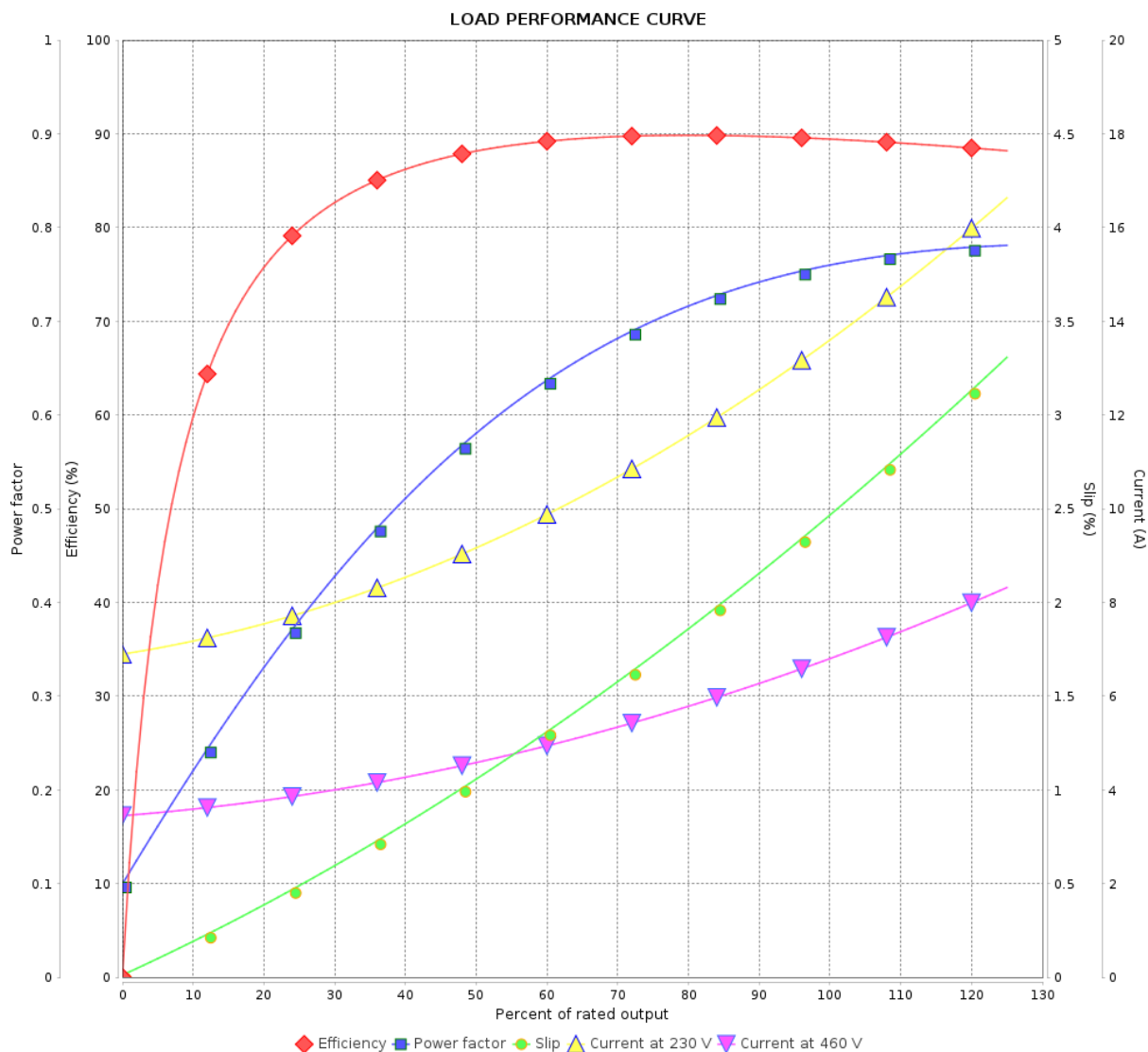
Three Phase Induction Motor - Squirrel Cage



Customer : _____

Product line : NEMA Premium Efficiency Three-Phase

Product code : 14636474



Performance : 230/460 V 60 Hz 6P

Rated current : 13.7/6.83 A
 LRC : 6.8
 Rated torque : 3.10 kgfm
 Locked rotor torque : 170 %
 Breakdown torque : 260 %
 Rated speed : 1170 rpm

Moment of inertia (J) : 0.0620 kgm²
 Duty cycle : Cont.(S1)
 Insulation class : F
 Service factor : 1.15
 Temperature rise : 80 K
 Design : B

Rev.	Changes Summary	Performed	Checked	Date
Performed by		Page 3 / 6Revision		
Checked by				
Date	10/09/2022			

LOAD PERFORMANCE CURVE

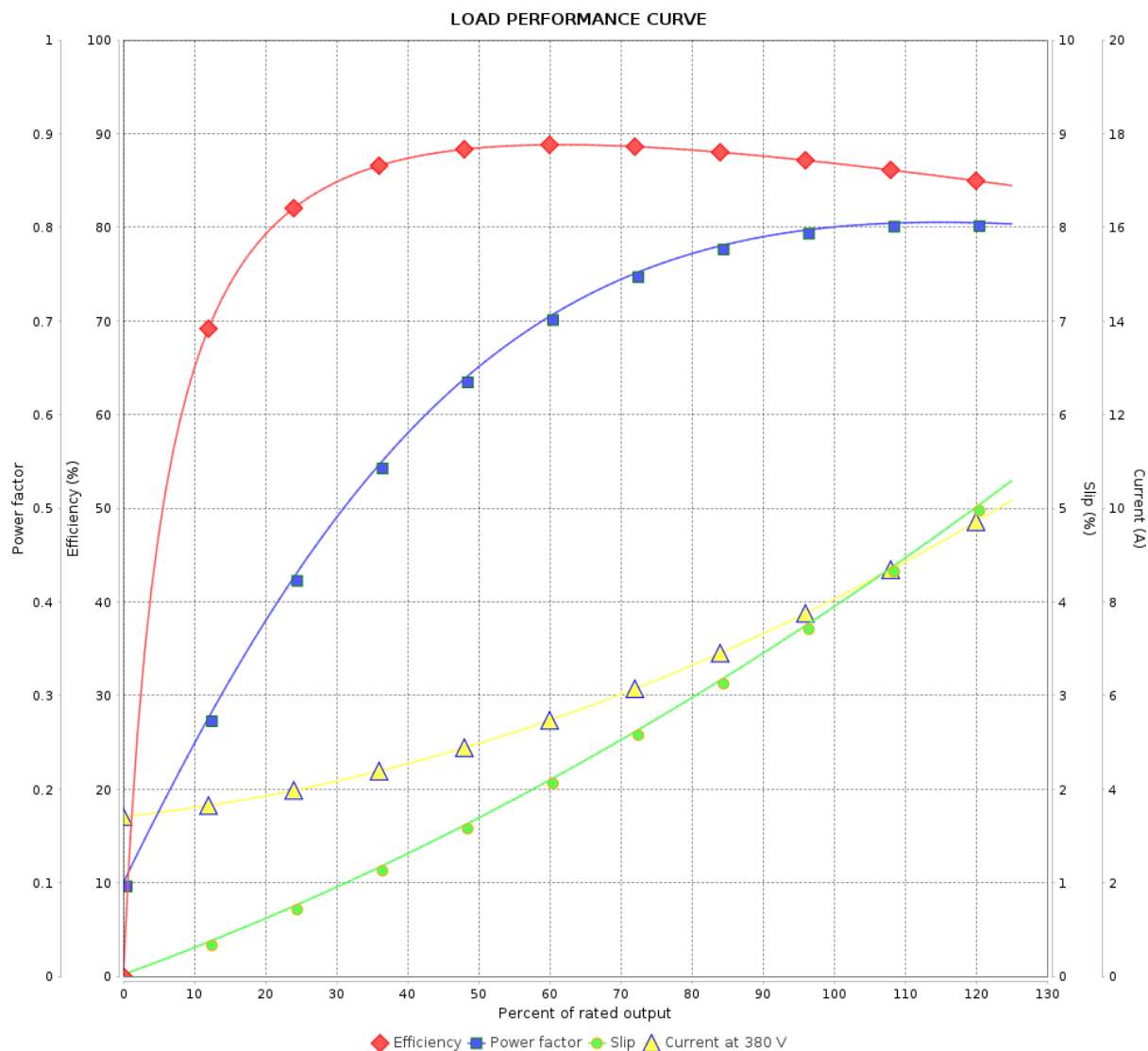
Three Phase Induction Motor - Squirrel Cage



Customer :

Product line : NEMA Premium Efficiency Three-Phase

Product code : 14636474



Performance : 380 V 50 Hz 6P IE3

Rated current : 8.10 A
 LRC : 5.5
 Rated torque : 3.78 kgfm
 Locked rotor torque : 140 %
 Breakdown torque : 200 %
 Rated speed : 960 rpm

Moment of inertia (J) : 0.0620 kgm²
 Duty cycle : Cont.(S1)
 Insulation class : F
 Service factor : 1.00
 Temperature rise : 80 K
 Design : B

Rev.	Changes Summary		Performed	Checked	Date
Performed by				Page	Revision
Checked by				4 / 6	
Date					
	10/09/2022				

LOAD PERFORMANCE CURVE

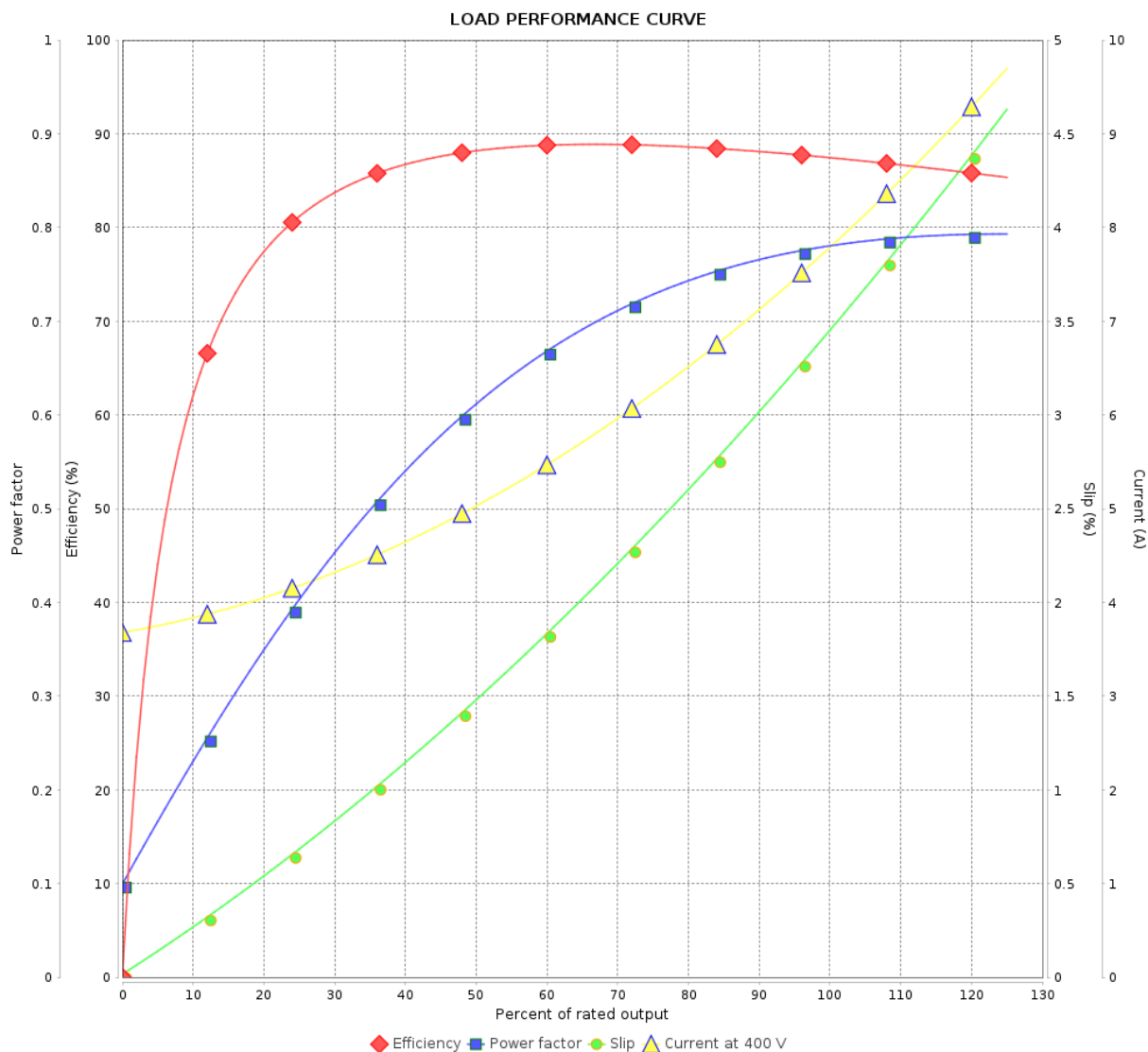
Three Phase Induction Motor - Squirrel Cage



Customer : _____

Product line : NEMA Premium Efficiency Three-Phase

Product code : 14636474



Performance : 400 V 50 Hz 6P IE3

Rated current : 7.82 A
 LRC : 6.1
 Rated torque : 3.76 kgfm
 Locked rotor torque : 160 %
 Breakdown torque : 229 %
 Rated speed : 965 rpm

Moment of inertia (J) : 0.0620 kgm²
 Duty cycle : Cont.(S1)
 Insulation class : F
 Service factor : 1.00
 Temperature rise : 80 K
 Design : B

Rev.	Changes Summary	Performed	Checked	Date
Performed by		Page 5 / 6Revision		
Checked by				
Date	10/09/2022			

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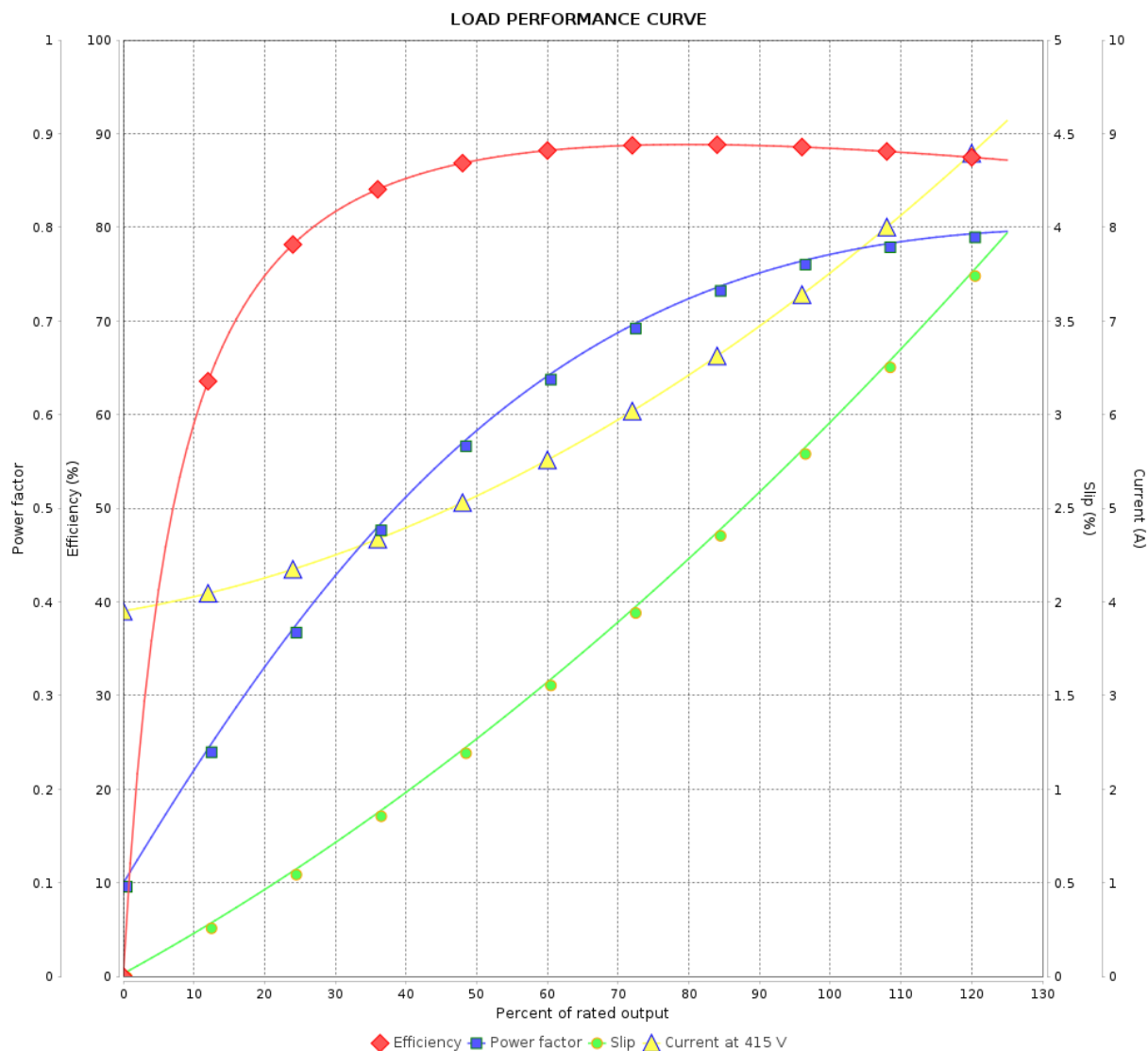
Three Phase Induction Motor - Squirrel Cage



Customer :

Product line : NEMA Premium Efficiency Three-Phase

Product code : 14636474

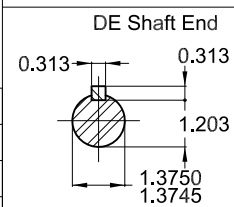
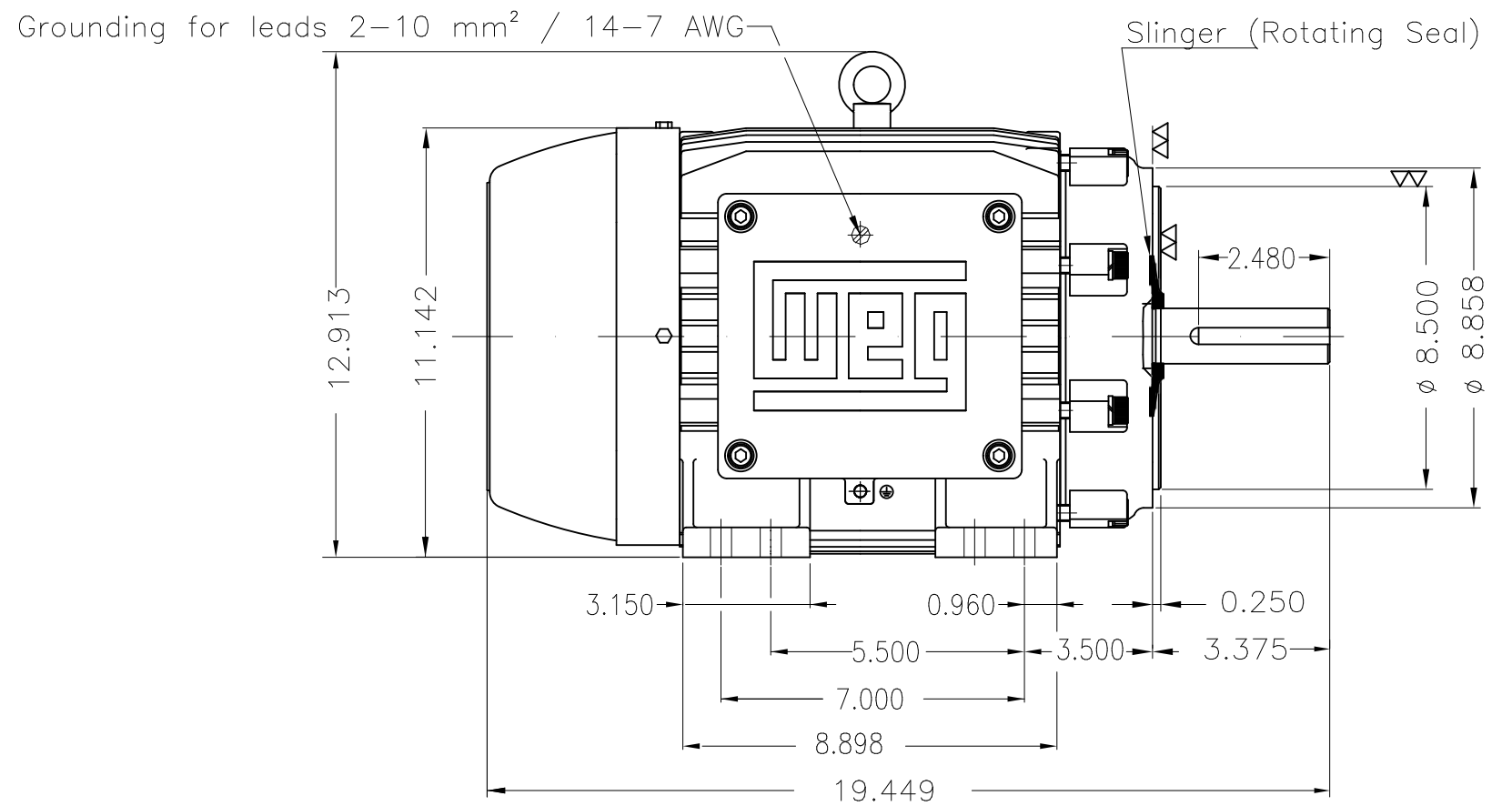
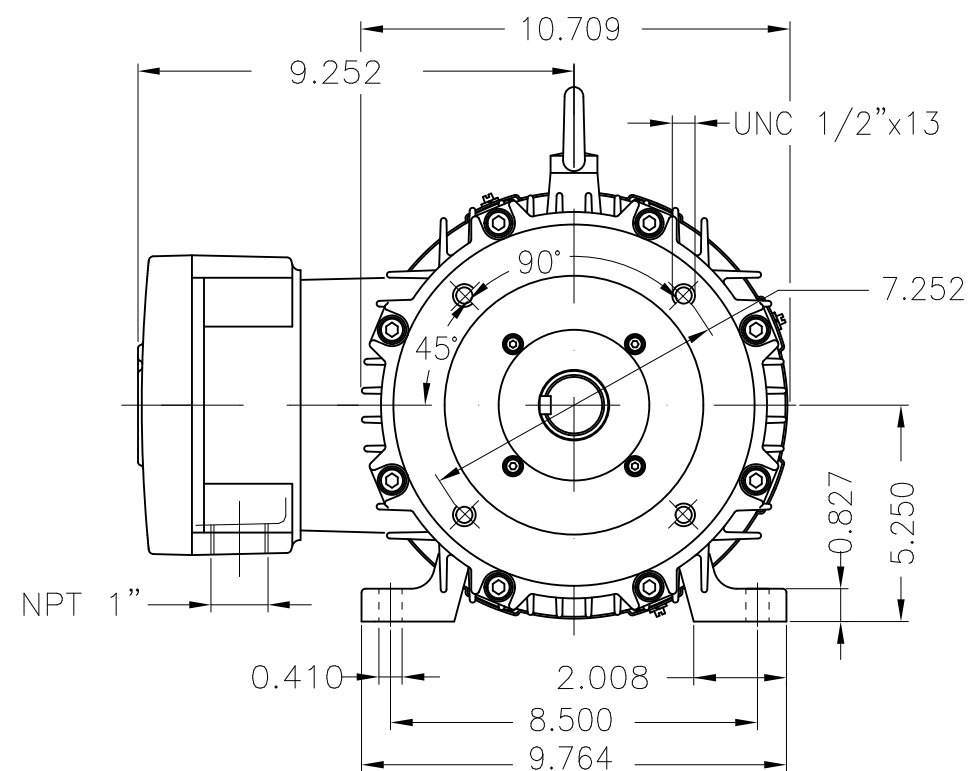


Performance : 415 V 50 Hz 6P IE3

Rated current : 7.55 A
LRC : 6.5
Rated torque : 3.74 kgfm
Locked rotor torque : 190 %
Breakdown torque : 250 %
Rated speed : 970 rpm

Moment of inertia (J) : 0.0620 kgm²
Duty cycle : Cont.(S1)
Insulation class : F
Service factor : 1.00
Temperature rise : 80 K
Design : B

Rev.	Changes Summary		Performed	Checked	Date
Performed by				Page	Revision
Checked by				6 / 6	
Date					
	10/09/2022				



Color RAL 5009
Painting plan 202P
Mounting NEMA F-1
Mounting B34R(D)

5 HP 06 Poles 60 Hz									A
ECM	LOC	SUMMARY OF MODIFICATIONS			EXECUTED	CHECKED	RELEASED	DATE	VER
EXECUTED	DAT	VIEWER	USER	  THREE PH. MOTOR EXPLOSION PROOF PREM. EFF. FRAME 213/5TC IP55 TEFC			PREVIEW		
CHECKED							WDD		
RELEASED									
REL DT.		WMO	Jaragua do Sul		Product Engineering	SHEET	1 / 1		



AXH air-coolers
air-x-limited

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Claremore, OK 74017 Fax (918) 283-9229
info@axh.com www.axh.com

Proposal / Job No. 144811D
Date 4/2/2014
Page 1 OF 1

1	Purchaser	ENERFLEX	Ultimate User	MEG ENERGY
2	Inquiry / PO#	Q1130362 / PO 4500101462	Destination	AB
3	# Units	1	Reference	SGC-2821
4	Assembly	PACKAGED	Draft	FORCED
			Overall Size , Ft	Est Wt 13000 LBS

THERMAL & MECHANICAL DESIGN

5	Service	CLOW	AC
6	Flow	75GPM	4.73MMSCFD
7	Fluid	50%GLY	32.5MW
8	Temp. In / Out, °F	155.0 / 130.0	212.0 / 110.0
9	Pressure, PSI		95PSIG
10	Pressure Drop, PSI	2.9	5.3
11	Heat Load, BTU/HR	856900**	1532200***
12	True LMTD	38.4	37.1
13	Overall Rate, U	146.5	81.1
14	Fouling Factor	.0005	.0020
15	Surface, Tube / Total, Sq Ft	153 / 2433	513 / 7643
16	Sections, #	(1)	(1)
17	Design Temp, °F Max / Min	300 / -20	300 / -20
18	MWP / Test Press, PSIG	* 14 / 75	230 / 299
19	Pass Arrangement	CROSSFLOW	CROSSFLOW
20	# Tube Rows	3	4
21	# Tube Passes	2	3
22	Tubes, OD x BWG	5/8X16	3/4X16
23	Material	SA214 STEEL	SA179 STEEL
24	# Per Section / Length, Ft	68 / 14	190 / 14
25	Turbulators		
26	Accelerators		
27	Fins, Type	HI-EFF	HI-EFF
28	Material	AL	AL
29	Nozzles, Rating / Type	150RF	150RF
30	Material	SA105	SA105
31	#-Inlets / Size In	(1) 3	(1) 4
32	#-Outlets / Size In	(1) 3	(1) 4
33	Headers, Type	REC TUBE	BOX
34	Material	A500	SA516-70
35	Corrosion Allow, In		.0625
36	Grooved Tubesheet	SGL	DBL
37	Plugs, Type	TAPER	SHOULDER
38	Plugs Material	STEEL	A105 STEEL
39	PWHT		
40	ASME Code & Nat'l Board		YES
41	CRN		
42	Add'l Specs & Options		
43	API		
44	Louvers / Hail Screen	MAN /	AUTO /
45	Inspection / NDT		SX

FX= 100% X-Ray of all header seam, attachment & nozzle butt welds. **SX=** Spot X-Ray of 1 long seam & 1 end closure, per header
BX= 100% X-Ray of all nozzle butt welds. **UT =** 100% UT of all header seam, attachment & nozzle butt welds. **H =** Hardness testing.

AIR-SIDE PERFORMANCE		FAN DATA		DRIVER DATA	STRUCTURAL
46	Ambient Air Temp, In °F	90	Fan(s) (1) MOORE-10K-36VT	Type	Guards FAN / DRIVE
47	Elevation, Ft	3000	Blade Material ALUMINUM	V-BELT DRIVE BY (1) 25HP,	DISCHARGE GUARD
48	Air Flow, SCFM	77,521	HP / Fan 18.1	1800RPM, 575/60/3, TEFC, VFD	SOFT BUGSCREEN
49	Outlet Air Temp, °F	117.9	Dia, In / # Blades 96 / 6	COMP. MOTOR (CSA)	GALVANIZED CAGED LADDER
50	Min Air Temp, °F	-20	RPM 389	CLASS 1, DIV 2	
51			Tipspeed, FPM 9776		
52	Est. Noise Data:	84 dBA @1m, 64 dBA @ 15m	Pitch, Deg 19.5		

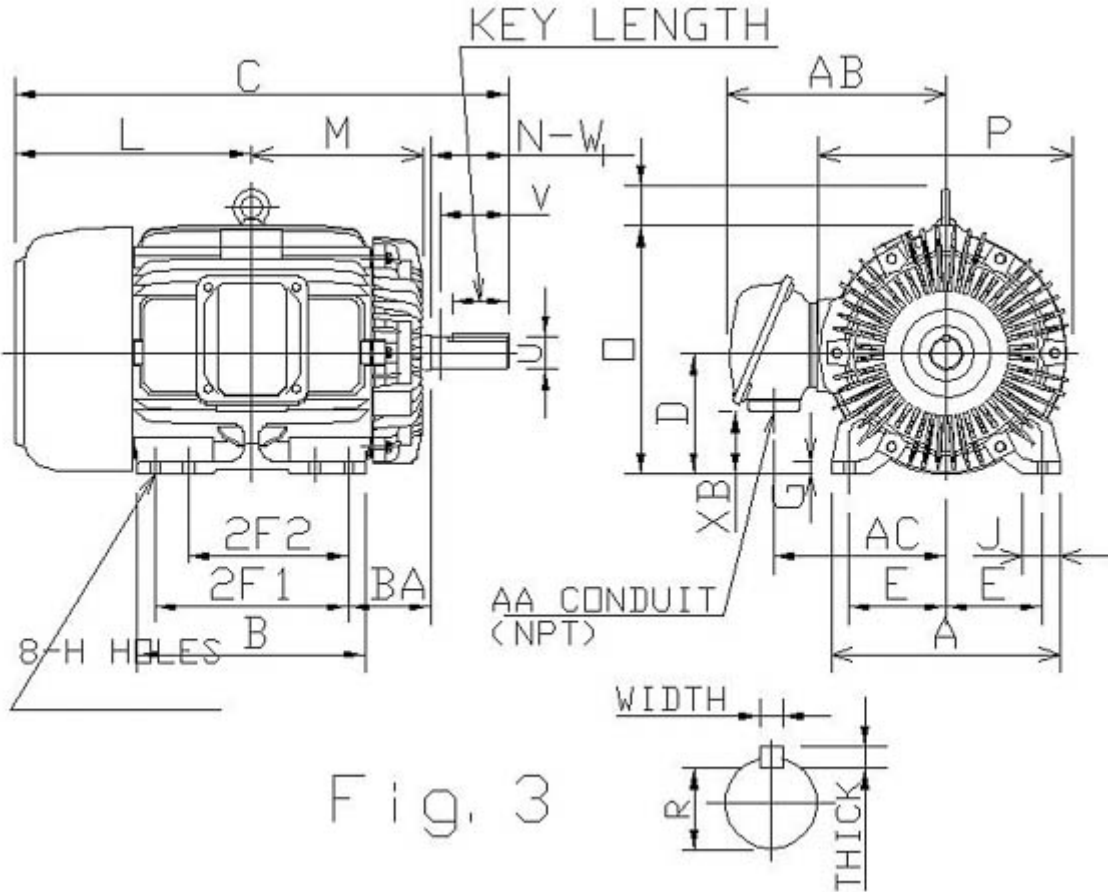
Additional Info. *-BUILT TO STANDARD 150# DESIGN BUT DESIGNATED 14# TO AVOID THE NEED FOR PROVINCIAL REGISTRATION

** - INCLUDES 10% EXCESS HEATLOAD

*** - INCLUDES 4,503 #/HR HYDROCARBON CONDENSING

Dimensional Drawing

Catalogue	Type	HP	RPM	Voltage	Hz	Frame Size
PDH0254	AEHH8N	25	1800	230 / 460	60	284T



Mounting					A	B	C	CL1	CL2	D	G
E	2F1	2F2	H	BA							
5.5	9.5		0.53	4.75	14	11.7	26.8			7	0.78

J	K	L	M	O	P	T	Terminal Housing			
							AA	AB	AC	XB
2.95		12.68	9.23	14.52	15.04	2.36	1.5	13.92	10.57	3.54

Shaft Extension			Key			Keyseat
N-W	U	V	Width	Thick	Length	R
4.62	1.875	4.5	0.5	0.5	3.28	1.591

Bearings		Weight Lbs	Drive Method	Dimensions
DE	NDE			
6311ZZ	6310ZZ	453	Direct Coupling / Belt Drive	Inches

	
	Date: October 18, 2024

Technical Data Sheet

Motor Type: AEHH8N	Catalogue No: PDH0254
--------------------	-----------------------

Nameplate Information

HP	Pole	RPM	Frame	Voltage	Hz	Phase
25	4	1765	284T	230 / 460	60	3
Enclosure	Ins. Class	Service Factor	Time Rating	NEMA Design	Rated Amb.	Rated Altitude
TEFC	F	1.15	Continuous	C	-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.					
93.60	92.40	93.60	93.60	86.00	83.00	77.00
Torque				Current (A)		
Full Load (lb-ft)	Locked Rotor (% FLT)	Pull Up (% FLT)	Break Down (% FLT)	No Load	Full Load	Locked Rotor
74.37	205	165	240	16.4 / 8.2	58.2 / 29.1	366.00 / 183.00
NEMA KVA Code	Inertia (WR ²)			Safe Stall Time (s)		Noise Level Sound Press. dB(A)
	Rotor (lb-ft ²)	NEMA Load (lb-ft ²)	Max. Allowable (lb-ft ²)	Cold	Hot	
G	4.586	122.00	500.23	36	25	68.0

VFD Duty Information

MAX HP	Current (A)	Speed Range			VFD		S.F.
		CT	VT	CHP	Carrier Hz	Type	
25	29.08	6-60Hz	3-60Hz	60-90Hz	3-6kHz	VPWM or CPWM	1.0

Hazardous Locations Information

Additional Certifications

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

Additional Information

Bearings		Approx. Weight
DE	NDE	lbs
6311ZZ	6310ZZ	453

Immersion Heaters

CX & DX Series

Installation, Operation, & Maintenance Instructions

Special Notes



CAUTION

ELECTRIC SHOCK HAZARD. All electric heating equipment installations must be performed by qualified personnel in accordance with the local electrical codes and standards and must be effectively grounded to eliminate shock hazard.



WARNING

FIRE/EXPLOSION HAZARD. This heater shall be used with protection controls. The following controls are recommended:

Liquid Immersion Applications

- Liquid level control to maintain all the heating elements totally immersed at all times, in conjunction with temperature controls to limit the liquid temperature below the maximum allowable process design temperature, or
- Heating elements sheath temperature controls to limit to the maximum allowable sheath design temperature

Gaseous and/or vapour phase immersion applications

- Heating elements sheath temperature controls to limit to the maximum allowable sheath design temperature.

Note: This heater is not intended to be used in hazardous locations and does not bare the required certification or product markings required to be used in hazardous locations.



WARNING

FIRE/EXPLOSION HAZARD. Do not exceed the ratings of the flange as listed in ANSI B16.5. In case of code stamped or registered heater, do not exceed the rating as stated in the data report and/or registration documents. Do not operate the heater in the presence of combustible gases, vapours, dusts or fibres unless the heater is specifically marked for the hazardous location and heater operating temperature does not exceed the temperature code rating. Corrosion of the sheath could result in a ground fault which, depending upon the fluid being heated, could cause a fire or an explosion.



WARNING

FIRE HAZARD. If a thermostat is provided, it is designed for temperature control service only. Since the thermostat does not fail safe, it should not be used for temperature limiting duty. Wiring to this device is the users' responsibility.

Heaters are capable of developing high temperatures, therefore extreme care should be taken to:

- Do not use this heater in area classified as hazardous locations.
- Maintain distance between heater and combustible materials.



CAUTION

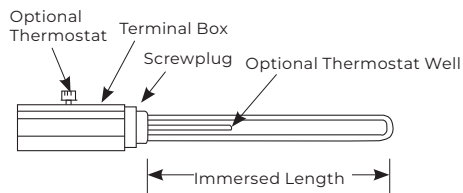
CAUTION. This document presents the minimum requirement pertaining to the installation, operation, and maintenance of the respective equipment as required by the manufacturer only. Any additional considerations, including but not limited to any design consideration, in-service inspection, and fitness-for-service assessment for all pressure boundary components to meet any safety principles and local jurisdictional regulatory requirements, shall be the responsibility of the user.



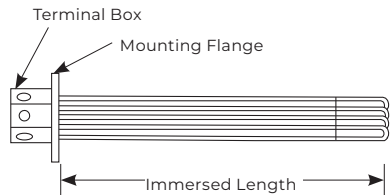
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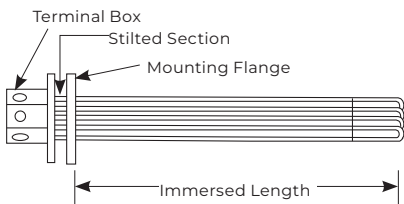
A. DIAGRAMS



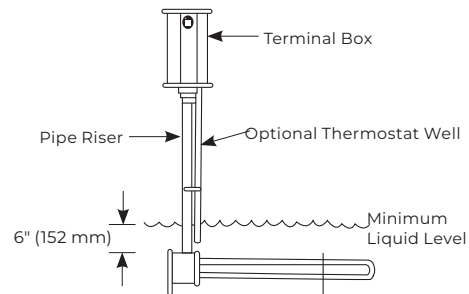
Screwplug Immersion Heater



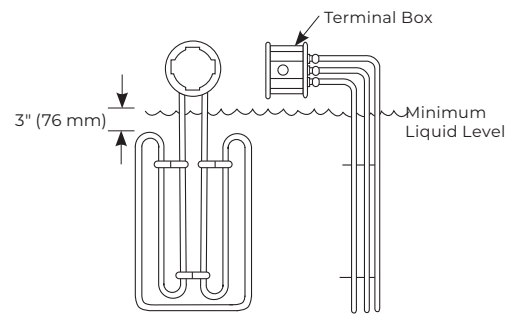
Flanged Immersion Heater



Flanged Immersion Heater
(with optional tilted terminal box)



Over-the-Side Immersion Heater
(bottom mount)



Over-the-Side Immersion Heater
(side mount)

B. DESCRIPTION

1. Immersion heaters for liquid service are designed for operation only while completely immersed in liquids. Never allow the heating elements to be exposed while energized or failure will result.
4. Protect terminals of heating elements from drippings, condensation, fumes, spray or any other substance which could result in element contamination.
5. When melting solids by direct immersion, a surface vent should be provided to allow gases to escape. Operate the heater on $\frac{1}{2}$ voltage until melted material completely covers the heating elements. Heaters used for this purpose may require special design features. Check factory for recommendations.



CAUTION

CAUTION Use the heater only in liquids and at pressures for which it was designed (unless specifically designed for non-liquid applications). Normally copper sheath is recommended in water, steel or alloy sheath in oil, and the appropriate alloy sheath for heating chemical solutions. Check factory for recommendations.

2. In the case of flanged (and some screwplug type) heaters where a gasket seal is required, the gasket surface should be clean and dry before the heater is seated.



WARNING

WARNING DO NOT insulate over the heater flange, tilted area and terminal enclosure.

3. The terminals must be protected at all times from moisture or vapour. In hazardous locations, explosion resistant terminal housings must be used. In outdoor locations, moisture resistant housings are required. It is recommended to use a drip loop to prevent moisture from entering the terminal box via the wire.

C. INSTALLATION



CAUTION Heaters with overtemperature devices require specific installation orientation.



ELECTRIC SHOCK HAZARD Disconnect all power before installing or servicing the heater. Failure to do so could result in personal injury and/or property damage. All maintenance and installation should be done by qualified personnel in compliance with local codes.



FIRE OR SHOCK HAZARD Moisture accumulation on the dielectric material of the elements, sheath corrosion or overtemperature on the heaters could cause a fault to ground generating arcing and molten metal. Install proper ground fault protections to prevent personal injury or property damage.



WARNING Heaters are electrical components, designers are responsible for the proper integration to the electrical systems, including protections, backups, and controls.

1. Unpack and check heater for any damage that may have been caused during shipping.
2. Remove any protective packaging in the screw or flange connecting fitting.
3. Remove any dessicant material in the electrical box.
4. Insert heater into vessel/reservoir and verify that the heating elements are not making contact with the surface of the vessel.
5. Check that all terminal connections are tight.



CAUTION Use copper conductors only with sufficient current carrying capacity for the heater circuit load and in accordance with the local electrical code. Check the heater nameplate for minimum conductor temperature rating. Temperature deration factors must be applied for heaters operating above 30°C (86°F).

6. Check supply voltage for compliance with heater nameplate voltage. DO NOT connect the heater to a voltage source other than listed on the heater nameplate.
7. A line voltage or pilot duty thermostat should be used to control the heater. The pilot duty thermostat must be used with a contactor and (if required) a transformer. Generally, heaters supplied with built-in thermostats will be factory prewired if suitable for line voltage operation. Integral thermostats not factory prewired are usually intended for pilot duty.
8. It is recommended that the control circuits be supplied from the isolated secondary windings of transformers avoiding the need for two supply circuits, or as an alternative, that mechanical or electrical interlocking be provided so that both supplies must be disconnected before live parts can be made accessible.
9. If there is even the slightest possibility that the liquid level may fall below the elements, a level control switch or overtemperature sensing device affixed to the uppermost heating element is required. Check factory for recommendations.
10. If the heater is installed in a pressurized system, a safety relief valve must be used to prevent a hazardous pressure buildup.
11. Horizontal element support bundles may be necessary with an immersed length over 1270 mm (50").
12. For flange heaters installed in a pressurized system, proper bolting hardware must be used that is suitable for the pressures and temperatures of the equipment. Use an appropriate gasket for the pressure and temperature; torque the bolts on an even clockwise or counter clockwise pattern.

D. OPERATION



CAUTION

RISK OF EXPLOSION Do not operate heater at voltages higher than the rating specified on the nameplate. Failure to do this will cause elevated temperatures.



WARNING

WARNING For metal sheathed heaters, prior to operation an insulation resistance check must be performed. Heater with values less than 0.5 MΩ should follow a drying process. Please contact factory for details on procedure if heater is under 0.5 MΩ.



WARNING

FIRE Hazard Heater should be submersed in the fluid for proper operation and to avoid element overheating that could result in fire or damage of the heater.



WARNING

WARNING When operating the heaters in a closed system or vessel, system designers must ensure that proper controls are used to maintain the temperature and pressure at normal levels.



WARNING

WARNING Low megohm on heating elements with epoxy or hermetic seals cannot be serviced in the field. Typical resistance values when sealed are 1000 MΩ or greater.

1. Check that all connections are tight.
2. If a thermostat is provided, verify that it is operating properly by cycling it and verifying cutout.
3. Perform an IR test prior to energization and verify that levels are acceptable (500,000 ohms min).
4. Energize the heater and check for signs of hotspots in the electrical connections or vessel.
5. Retorque all bolted fitting connections and all electrical connections after 10 cycles.
6. Always maintain a minimum of 51 mm (2") of liquid above the heated portion of the element or element failure may result.
7. Heating elements should be kept above sediment deposits or it may overheat and shorten life expectancy.

E. MAINTENANCE



WARNING

WARNING Disconnect all power before servicing the heater or heated equipment. Failure to do so could result in personal injury and/or property damage. All maintenance and installation should be done by qualified personnel in compliance with local codes.

1. Heaters stored for prolonged periods may absorb moisture. Using a 500V DC megger (insulation resistance tester) check the value of the insulation resistance to ground for each circuit. Initial readings of over 500,000 ohms to ground are normally acceptable. Should lower readings be observed, check factory for instructions.
2. Periodically check electrical connections for tightness and check wire insulation for any damage and replace if necessary.
3. Remove the immersion heater periodically to inspect for corrosion, sludge build-up and for scale removal. Do not continue to use a heater showing visible signs of damage.



PLEASE ADHERE TO INSTRUCTIONS IN THIS MANUAL
Failure to do so may be dangerous and may void certain provisions of your warranty.

For further assistance, please call 24-hr hotline: 1-877-325-3473 (U.S.A. and Canada)
Please have model and serial numbers available before calling.

WARRANTY: Under normal use the Company warrants to the purchaser that defects in material or workmanship will be repaired or replaced without charge for a period of 18 months from date of shipment, or 12 months from the start date of operation, whichever expires first. Any claim for warranty must be reported to the sales office where the product was purchased for authorized repair or replacement within the terms of this warranty.

Subject to State or Provincial law to the contrary, the Company will not be responsible for any expense for installation, removal from service, transportation, or damages of any type whatsoever, including damages arising from lack of use, business interruptions, or incidental or consequential damages.

The Company cannot anticipate or control the conditions of product usage and therefore accepts no responsibility for the safe application and suitability of its products when used alone or in combination with other products. Tests for the safe application and suitability of the products are the sole responsibility of the user.

This warranty will be void if, in the judgment of the Company, the damage, failure or defect is the result of:

- Vibration, radiation, erosion, corrosion, process contamination, abnormal process conditions, temperature and pressures, unusual surges or pulsation, fouling, ordinary wear and tear, lack of maintenance, incorrectly applied utilities such as voltage, air, gas, water, and others or any combination of the aforementioned causes not specifically allowed for in the design conditions or,
- Any act or omission by the Purchaser, its agents, servants or independent contractors which for greater certainty, but not so as to limit the generality of the foregoing, includes physical, chemical or mechanical abuse, accident, improper installation of the product, improper storage and handling of the product, improper application or the misalignment of parts.

No warranty applies to paint finishes except for manufacturing defects apparent within 30 days from the date of installation.

The Company neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the product(s).

The Purchaser agrees that all warranty work required after the initial commissioning of the product will be provided only if the Company has been paid by the Purchaser in full accordance with the terms and conditions of the contract.

The Purchaser agrees that the Company makes no warranty or guarantee, express, implied or statutory, (including any warranty of merchantability or warranty of fitness for a particular purpose) written or oral, of the Article or incidental labour, except as is expressed or contained in the agreement herein.

LIABILITY: Technical data contained in the catalog or on the website is subject to change without notice. The Company reserves the right to make dimensional and other design changes as required. The Purchaser acknowledges the Company shall not be obligated to modify those articles manufactured before the formulation of the changes in design or improvements of the products by the Company.

The Company shall not be liable to compensate or indemnify the Purchaser, end user or any other party against any actions, claims, liabilities, injury, loss, loss of use, loss of business, damages, indirect or consequential damages, demands, penalties, fines, expenses (including legal expenses), costs, obligations and causes of action of any kind arising wholly or partly from negligence or omission of the user or the misuse, incorrect application, unsafe application, incorrect storage and handling, incorrect installation, lack of maintenance, improper maintenance or improper operation of products furnished by the Company.

Visit www.thermon.com to contact a Thermon representative near you.

HEAD OFFICE: 7171 SOUTHWEST PKWY | BUILDING 300 SUITE 200 | AUSTIN, TX | 78735 | UNITED STATES
CALORITECH: 2721 PLYMOUTH DRIVE | OAKVILLE, ON | L6H-5R5 | CANADA

Thermoplongeurs

Séries CX et DX

Instructions pour l'installation, le fonctionnement et l'entretien

Remarques particulières



RISQUE D'ÉLECTROCUTION. Toutes les installations d'équipement électrique de chauffage doivent être réalisées par un personnel qualifié, conformément aux codes et normes électriques locaux, et doivent être dûment mises à la terre afin de supprimer les risques d'électrocution.



DANGERS D'INCENDIE/D'EXPLOSION LIÉS. Cet appareil de chauffage doit être utilisé avec des commandes de protection. Les contrôles suivants sont recommandés :

Applications d'immersion liquide

- un régulateur de niveau de liquide pour maintenir tous les éléments chauffants entièrement immergés en tout temps, ou
- des régulateurs de gaine de contrôle de températures élevées afin de limiter la température maximale permise de la gaine.

Applications d'immersion en phase gazeuse et/ou vapeur



- des régulateurs de gaine de contrôle de températures élevées afin de limiter la température maximale permise de la gaine.

Note: Cet appareil de chauffage n'est pas destiné à être utilisé dans des endroits dangereux et ne porte pas la certification ou les marques de produit requises pour être utilisé dans des endroits dangereux.



RISQUE D'INCENDIE ET D'EXPLOSION. Ne dépassez pas les puissances nominales de la bride figurant dans la norme B16.5 ANSI. En présence d'un code imprimé sur un appareil chauffant enregistré, ne pas dépasser la valeur indiquée dans le rapport de données et/ou les documents d'enregistrement. Ne faites pas fonctionner le thermoplongeur en présence de gaz combustibles, de vapeurs combustibles, de poussières combustibles ou de fibres combustibles, à moins que le thermoplongeur ne soit spécialement prévu pour un tel emplacement dangereux, et que la température de fonctionnement du thermoplongeur ne dépasse pas le code de température. La corrosion de la gaine peut résulter en un défaut à la terre, qui, selon la nature du liquide en cours de réchauffement, pourrait causer un incendie ou une explosion.

RISQUE D'INCENDIE. Si un thermostat est fourni, il est conçu uniquement à des fins de contrôle de la température. Puisque le thermostat ne dispose d'aucun système le protégeant des défaillances, il ne faut pas s'en servir pour limiter la température. C'est à l'utilisateur qu'il revient d'effectuer le câblage de ce dispositif.

Les thermoplongeurs peuvent atteindre des températures élevées, c'est pourquoi il faut faire extrêmement attention de prendre les mesures suivantes:

- N'utilisez pas cet appareil de chauffage dans une zone classée comme zone dangereuse.
- Conserver une certaine distance entre le thermoplongeur et les matières combustibles.



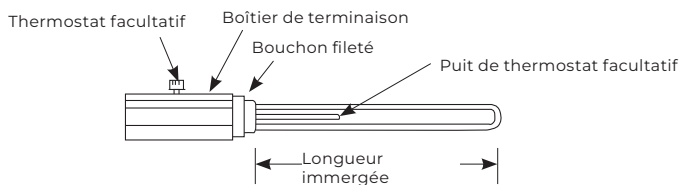
MISE EN GARDE. Ce document présente les exigences minimales relatives à l'installation, au fonctionnement et à l'entretien de chaque équipement, tel que requis par le fabricant. Toute considération supplémentaire, y compris, mais sans s'y limiter, toute considération de conception, d'inspection en service et d'évaluation de l'aptitude au service, pour tous les composants à limite de pression, afin de respecter des principes de sécurité et des exigences réglementaires locales, relève de la responsabilité de l'utilisateur.



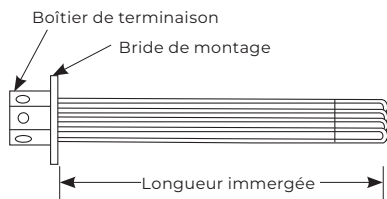
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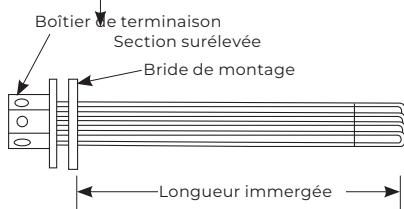
A. DIAGRAMMES



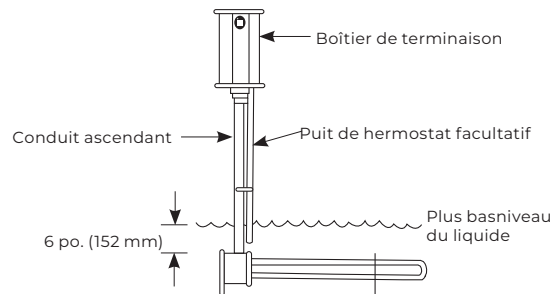
Thermoplongeur à bouchon fileté



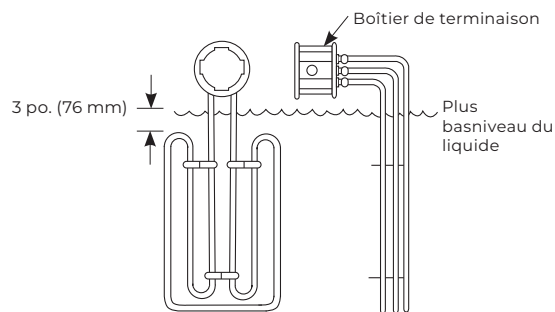
Thermoplongeur à bride



Thermoplongeur à bride
(avec boîtier de terminaison surélevée facultatif)



Thermoplongeur amovibles pour montage de fond



Thermoplongeur amovibles pour montage de fond

B. DESCRIPTION

1. Les thermoplongeurs employés pour des liquides sont conçus pour ne fonctionner que s'ils sont complètement immergés dans des liquides. Ne laissez jamais les éléments chauffants à l'air libre tandis qu'ils fonctionnent, sans quoi une panne se produira.



MIS EN GARDE

MIS EN GARDE. Ne vous servez du thermoplongeur que dans des liquides, et à des pressions pour lesquelles il a été conçu (à moins qu'il n'ait été conçu particulièrement pour des applications non liquides). Normalement, la gaine en cuivre est recommandée dans l'eau, la gaine en acier ou en alliage dans l'huile, et la gaine en alliage appropriée sert à chauffer /es solutions chimiques. Demandez à l'usine de vous donner ses recommandations.

2. Dans le cas des thermoplongeurs à bride (et certains modèles à bouchon fileté), si un joint d'étanchéité est nécessaire, la surface du joint d'étanchéité doit être propre et sèche avant que le thermoplongeur ne soit mis en place.



ATTENTION

ATTENTION. Défense d'isoler par-dessus la bride, la zone surélevée et le boîtier de terminaison du thermoplongeur.

3. Les bornes doivent être protégées à tout moment de l'humidité et des émanations. Dans les lieux à risques, il faut employer des boîtiers de terminaison antideflagrants. À l'extérieur, des boîtiers résistants à l'humidité sont obligatoires. Il est recommandé d'employer un anneau d'écoulement pour empêcher l'humidité de pénétrer dans le boîtier de terminaison à travers le câble.
4. Protégez les bornes des éléments chauffants contre les écoulements, la condensation, les émanations, les pulvérisations ou contre toute autre substance qui pourrait provoquer une contamination des éléments.
5. Lorsque vous faites fusionner des solides par immersion directe, il faut prévoir un orifice de ventilation à la surface, afin de laisser les gaz s'échapper. Faites fonctionner le thermoplongeur à ½ tension, jusqu'à ce que la matière fusionnée recouvre complètement les éléments chauffants. Les thermoplongeurs utilisés dans ce but peuvent nécessiter des caractéristiques de conception spéciales. Demandez à l'usine de vous donner ses recommandations.

C. INSTALLATION



MIS EN GARDE. Les thermoplongeurs dotés de dispositifs de surchauffe nécessitent une orientation particulière d'installation.



RISQUE D'ÉLECTROCUTION. Debranchez toute l'alimentation électrique avant d'installer, de réparer ou d'entretenir le thermoplongeur. Faute de quoi, il y a un risque de blessures physiques et/ou d'endommagement des lieux et objets qui s'y trouvent. L'entretien et l'installation, dans leur ensemble, doivent être effectués par un personnel qualifié et se conformer aux codes locaux.



RISQUE D'INCENDIE OU RISQUE D'ÉLECTROCUTION. L'accumulation d'humidité sur la matière diélectrique des éléments, la corrosion des gaines, ou la surchauffe des thermoplongeurs peut provoquer un défaut de la mise à la terre, ce qui produira des étincelles et la fusion du métal. Pour éviter toute blessure physique ou tout endommagement des lieux et objets qui s'y trouvent, installez des protections adéquates contre les défauts de mise à la terre.



MIS EN GARDE. Les thermoplongeurs sont des composants électriques. Les concepteurs sont responsables de l'intégration correcte dans les systèmes électriques, ce qui englobe les protections, les systèmes de relèvement et les contrôles.

1. Déballer le thermoplongeur. Vérifiez-le pour détecter tout dommage qui aurait pu survenir pendant le transport.
2. Retirez le conditionnement de protection du raccord de couplage à bouchon fileté ou à bride.
3. Retirez le produit dessiccant situé dans le coffret électrique.
4. Insérez le thermoplongeur dans la cuve ou le réservoir. Vérifiez que les éléments chauffants ne sont pas en contact avec la surface de la cuve.
5. Vérifiez que tous les raccordements des bornes sont bien serrés.
6. Vérifiez que la tension de l'alimentation est conforme à la tension figurant sur la plaque signalétique du thermoplongeur. **NE BRANCHEZ PAS** le thermoplongeur à une source de tension autre que celle figurant sur la plaque signalétique du thermoplongeur.
7. Il faut se servir d'un thermostat de circuit de commande ou de tension de ligne pour commander le thermoplongeur. Le thermostat de circuit de commande doit être utilisé avec un contacteur et (au besoin) un transformateur. En général, les thermoplongeurs fournis avec des thermostats intégrés seront câblés d'avance à l'usine si cela convient à un fonctionnement sur tension de secteur. Les thermostats intégrés qui ne sont pas câblés d'avance à l'usine sont normalement prévus pour une fonction avec un circuit de commande.
8. Il est recommandé d'alimenter les circuits de commande à partir des bobinages secondaires isolés des transformateurs, en évitant le besoin de deux circuits d'alimentation. Autrement, il est recommandé de fournir l'enclenchement électrique afin que les deux alimentations soient débranchées avant que des parties électrifiées ne puissent être rendues accessibles.
9. S'il existe une possibilité, même faible, de voir le niveau de liquide tomber au-dessous des éléments, il est obligatoire d'avoir un commutateur de contrôle du niveau ou un dispositif de détection de surchauffe, fixé sur l'élément chauffant le plus haut. Demandez à l'usine de vous donner ses recommandations.
10. Si le thermoplongeur est installé dans un système pressurisé, une soupape de sûreté et de décharge doit être employée pour empêcher une accumulation dangereuse de la pression.
11. Des faisceaux horizontaux de soutien des éléments peuvent s'avérer nécessaires si la longueur immergée dépasse 1270 mm (50 po).
12. Pour les thermoplongeurs à bride installés dans un système pressurisé, la quincaillerie de boulonnage adéquate doit être employée. Elle doit convenir aux pressions et aux températures de l'équipement. Employez un joint d'étanchéité adéquat pour la pression et la température de l'équipement. Serrez les boulons selon un schéma uniforme, soit dans le sens des aiguilles d'une montre, soit dans le sens inverse des aiguilles d'une montre.



ATTENTION. Utilisez uniquement des conducteurs en cuivre dont l'intensité de courant admissible est suffisante pour la charge du circuit du thermoplongeur, conformément au code électrique local. Consultez la plaque signalétique du thermoplongeur pour connaître les caractéristiques thermiques minimales du conducteur. Les facteurs de réduction de la valeur nominale du courant doivent être appliqués pour les thermoplongeurs fonctionnant à plus de 30°C (soit 86°F).

D. FONCTIONNEMENT



RISQUE D'EXPLOSION. Ne faites pas fonctionner le thermoplongeur à des tensions supérieures à la puissance nominale figurant sur la plaque signalétique. Faute de quoi, vous provoquerez des températures élevées.



ATTENTION. Pour les thermoplongeurs à gaine démetal, il faut effectuer une vérification de la résistance de l'isolation avant le fonctionnement. Un thermoplongeur dont les valeurs sont inférieures à 0,5 MΩ doit être soumis à un processus d'assèchement. Adressez-vous à l'usine qui vous expliquera la procédure si les valeurs du thermoplongeur sont inférieures à 0,5 MΩ.



RISQUE D'INCENDIE. Pour que le thermoplongeur fonctionne bien, et pour éviter la surchauffe des éléments chauffants, qui pourrait provoquer un incendie ou endommager le thermoplongeur, il faut que le thermoplongeur soit immergé dans le liquide.



ATTENTION. Quand on fait fonctionner le thermoplongeur dans un système fermé ou dans une cuve, les concepteurs du système doivent faire attention que les contrôles adéquats sont employés pour conserver la température et la pression à un niveau normal.



ATTENTION. Le problème d'une résistance faible des mégohms sur les éléments chauffants dotés de sceaux époxy ou hermétiques ne peut pas être résolu sur place. Les valeurs normales de la résistance, en présence de sceaux, sont de 1000 MΩ ou plus.

1. Vérifiez que tous les branchements sont serrés.
2. Si un thermostat est fourni, vérifiez qu'il fonctionne correctement en le faisant passer par son cycle et en vérifiant la coupure du circuit.
3. Effectuez un test IR avant la mise sous tension. Vérifiez que les niveaux sont acceptables, à 500,000 ohms.
4. Mettez le thermoplongeur sous tension. Vérifiez les signes de pointes locales de température dans les raccords électriques ou dans la cuve.
5. Au bout de dix cycles, resserrez toutes les raccords de coupure à boulons, et tous les raccords électriques.
6. Maintenez toujours un minimum de 51 mm (2 po) de liquide au-dessus de la partie chauffée de l'élément, sans quoi l'élément peut tomber en panne.
7. Les éléments chauffants doivent être gardés au-dessus des dépôts de sédiments, sans quoi, ils peuvent surchauffer et s'user prématurément.

E. ENTRETIEN



ATTENTION. Debranchez toute l'alimentation électrique avant d'installer, de réparer ou d'entretenir le thermoplongeur. Faute de quoi, il y a un risque de blessures physiques et/ou d'endommagement des lieux et objets qui s'y trouvent. L'entretien et l'installation, dans leur ensemble, doivent être effectués par un personnel qualifié et se conformer aux codes locaux.

1. Les thermoplongeurs entreposés pendant de longues périodes peuvent absorber de l'humidité. À l'aide d'un mégohmmètre 500 VDC (appareil de mesure de résistance de l'isolation), vérifiez la valeur de la résistance de l'isolation à la terre pour chaque circuit. Des relevés initiaux de plus de 500,000 ohms à la terre sont normalement acceptables. Si vous obtenez des relevés inférieurs, consultez l'usine qui vous donnera ses instructions.
2. De temps en temps, vérifiez que les branchements électriques sont serrés. Vérifiez que l'isolation des câbles n'est pas endommagée. Remplacez-la au besoin.
3. De temps en temps, retirez le thermoplongeur afin de l'inspecter et de détecter toute corrosion ou accumulation de dépôts, et de retirer le calcaire. Ne continuez pas à vous servir d'un thermoplongeur sur lequel des signes de dommages sont visibles.

Pour de l'aide supplémentaire, veuillez composer notre numéro d'urgence 24 h par jour: 1-800-410-3131 (U.S.A. et Canada). Merci de préparer vos numéros de modèle et de série avant d'appeler.

GARANTIE: Dans des conditions normales d'utilisation, la Société garantit à l'acheteur que les produits ayant des défauts matériels ou de fabrication seront réparés ou remplacés sans frais pour une période de 18 mois à compter de la date d'expédition ou 12 mois à partir de la date de début de fonctionnement, selon la date qui arrive à expiration la première. Toute réclamation dans le cadre de la garantie doit être adressée à l'agence commerciale dans laquelle le produit a été acheté afin d'obtenir une réparation ou un remplacement selon les termes de cette garantie.

Non obstant toute loi fédérale ou provinciale au contraire, la Société ne pourra être tenue pour responsable des frais encourus pour l'installation, le retrait du service, le transport ou les dommages de quelque nature que ce soit, y compris les dommages résultant d'un manque d'utilisation, d'interruptions d'activité ou de dommages directs ou indirects.

La Société ne peut anticiper ou contrôler les conditions d'utilisation du produit et, par conséquent, décline toute responsabilité quant à l'application et l'adaptation en toute sécurité de ses produits lors de leur utilisation seuls ou en combinaison avec d'autres produits. Il est de la seule responsabilité de l'utilisateur d'effectuer des tests pour vérifier l'application et l'adaptation en toute sécurité des produits.

Cette garantie sera nulle si, à l'appréciation de la Société, le dommage, la panne ou le défaut a été causé par:

- Des vibrations, des radiations, de l'érosion, de la corrosion, une contamination du processus, des conditions opératoires anormales, le température et la pression, une poussée ou une pulsation anormale, l'encrassement, une usure normale, un manque d'entretien, des services appliqués de manière inappropriée tels que le voltage, l'air, le gaz l'eau et autres, ou toute autorisées par les conditions de régime; ou
- Tout acte omission de la part de l'Acheteur ses agents, employés ou entrepreneur indépendant, comprenant pour une plus grande précision, mais pas au point de limiter la généralité de ce qui précède, une mauvaise utilisation physique, chimique ou mécanique, un accident, une mauvaise installation du produit, de mauvaises conditions de stockage ou de manipulation du produit, une application inappropriée ou en défaut d'alignement des pièces.

Aucune garantie ne s'applique à la finition de peinture, excepté dans le cas de défauts de fabrication apparents dans les 30 jours à compter de la date d'installation.

Le Société n'assume ni m'autorise aucune personne à assumer en son nom toute autre obligation ou responsabilité en rapport avec le/les produit(s).

L'Acheteur accepte que la Société ne fournisse aucune garantie, expresse, implicite ou légale (y comprise toute garantie de qualité marchande ou de convenance à des fins particulières), écrite ou orale, du produit ou de la main-d'oeuvre indirecte, à l'exception des dispositions exprimées ou contenues dans le présent accord.

RESPONSABILITÉ: Les données techniques contenues dans le catalogue ou sur le site Web sont sujettes à modification sans préavis. La Société se réserve le droit d'apporter des modifications par rapport aux dimensions ou à la conception si nécessaire. L'Acheteur reconnaît que la Société ne sera pas dans l'obligation de modifier ces articles manufacturés avant la formulation des modifications de conception ou des améliorations apportées aux produit par la Société

La Société ne sera pas tenue de dédomager ou d'indemniser l'Acheteur, l'utilisateur final ou toute autre partie pour les actions, les réclamations les responsabilités, les préjudices les sinistres, la perte d'usage, la perte d'activité, les dommages, les dommages indirects ou consécutifs, les demandes, les sanctions, les amendes, les dépenses (y compris les dépenses légales), les pertes, les obligations et les conséquences d'une action de quelque nature que ce soit découlant entièrement ou en partie de la négligence ou de l'omission de l'utilisateur ou de la mauvaise utilisation, de la mauvaise application, de l'utilisation dangereuse, de mauvaise installation, du manque d'entretien, du mauvais entretien ou de la mauvaise opération des produits fournis par la Société.

Visit www.thermon.com to contact a Thermon representative near you.

HEAD OFFICE: 7171 SOUTHWEST PKWY | BUILDING 300 SUITE 200 | AUSTIN, TX | 78735 | UNITED STATES
CALORITECH: 2721 PLYMOUTH DRIVE | OAKVILLE, ON | L6H-5R5 | CANADA

WARNING! Read all important information notices on pages 2-4



Electric Forced Air Heaters for Hazardous Locations

FX6 Series

Installation Operation Maintenance Instructions



Model Coding

FX6	-	480	3	60	-	350	-	T	
Model Series		Heater Voltage 208V, 240V, 480V, 600V		Hertz 50, 60		Heater Kilowatts ÷ 10			
6th Generation			Phase 1, 3					T - XT-211 Thermostat with slim junction box	C - Heresite® coating
								XT- 411 Thermostat with large junction box	A - Stainless steel cabinet
								D - Built-in disconnect	U - Continuous fan
									L - Large junction box
									P - Built-in pilot light



approved Locations

The Electric Forced Air Heaters are cUL_{us} listed certified for the following locations:
Class I, Division 1 & 2, Groups C & D; Class II, Division 1, Groups E, F & G; Class II,
Division 2, Groups F & G; Class I, Zones 1 & 2, Groups IIA & IIB; Zones 20, 21 & 22;
Temperature Code T3B 329°F (165°C) (50 Hz & 60 Hz Models)

For details of hazardous locations with potential for explosion, refer to the Canadian
Electrical Code, Part 1, Section 18 or National Electrical Code articles 500-516.

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WARNING. Improper installation adjustment, alteration, excessive vibration, service, or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing, operating or servicing this equipment.



WARNING. Do not operate the heater in the presence of combustible gases, vapors, dusts, or fibers unless the heater is specifically marked for the hazardous location and heater operating temperature does not exceed the temperature code rating.

Failure to do so can result in equipment explosion that can cause property damage, fatal personal injury, or death. In addition, heater cannot be operated at voltages higher than the rating specified on the nameplate. Operation at higher voltages will result in increased amp draw which will cause elevated temperatures. Exposed surface at elevated temperatures can cause fire or bodily harm.

Failure to follow this instruction manual, including but not limited to installation procedure, operation procedure, and maintenance requirement may results in equipment explosion, fire, and/or bodily harm.



WARNING. Appropriate protection against ground faults, such as a ground-fault circuit interrupter or GFCI, is required for this equipment, as well as compliance with all applicable electrical codes and standards. Failure to provide protection against electrical grounding or bonding during the use of this equipment can result in property damage, personal injury, or death.

Special Notes

The following special notices highlight important information in the installation, operation and maintenance sections.



This symbol indicates a potentially hazardous situation, which, if not avoided, can result in personal injury or damage to the equipment.



This symbol indicates a potentially hazardous situation, which, if not avoided, may be a shock hazard.



This symbol indicates an imminently hazardous situation, which, if not avoided, could result in death or serious injury.

A. HEATER MAINTENANCE CHECKLIST

Heater Model _____ Date of Maintenance _____

Serial Number _____ Maintenance Done By _____

Comments _____



WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater.

IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel.

Lock the switch in the “OFF” (open) position and/or tag the switch to prevent unexpected power application.

This heater should only be serviced by personnel with heating and hazardous location equipment experience.

A.1 Preventative Maintenance Grid

Cells of the grid with check boxes inside are the minimum maintenance measures required to be performed at the indicated time periods.

To-Do	Description	Regular Service				Severe Service			
		Annual Start Up	Monthly	Every 3 Months	Every 6 Months	Annual Start Up	Monthly	Every 3 Months	Every 6 Months
Clean	Remove dust using compressed air. Do not spray with water or solvents. Do not immerse in water or solvents. Clean the following: 1. Motor 4. Fan 2. Louvers 5. Fan Guard 3. Finned Tubes	☐		☐		☐		☐	
Check	1. Motor for smooth, quiet operation 2. Louvers for proper angle and tightness 3. All explosion-proof covers for tightness 4. Pressure relief device for signs of leakage. See Figure 1, page 5 and refer to A.3 Annual, page 4 for further instructions.	☐				☐		☐	
Electrical Inspection	1. Inspect all terminal connections and conductors:* Tighten loose connections. Replace conductors with damaged insulation and frayed wiring.*	☐			☐	☐		☐	
	2. Inspect contactor contacts: If badly pitted, burned or welded shut, replace with factory supplied contactor.*	☐			☐	☐		☐	
	3. Check fuses: The correct fuse rating and type are printed on the circuit board. Always ensure a backup fuse is available on the PCB.*	☐			☐	☐		☐	
Mechanical Inspection	1. Fluid leakage: Inspect the Pressure Relief Device (PRD) label indicator for signs of rupture and degradation. If any fluid leakage occurs from the heater, disconnect it from the power supply and replace the core immediately.*		☐			☐	☐		
	2. Enclosures: The interiors of each enclosure must be clean, dry, and free of foreign materials.*	☐				☐		☐	
	3. Motor shaft bearing and play: If the motor does not run quietly and smoothly and has excessive play, replace the motor.*	☐				☐		☐	

*For drilling rigs, this should be done every rig re-location.

A.2 Periodic (before and as required during heating season)

• Clean

- ☐ Motor
- ☐ Louvers
- ☐ Finned Tubes
- ☐ Fan
- ☐ Fan Guard

• Check

- ☐ Motor for smooth, quiet operation
- ☐ Louvers for proper angle and tightness
- ☐ All explosion-proof covers for tightness
- ☐ Pressure relief device for signs of leakage. See Figure 1, page 5 and refer to A.3 Annual, page 4, for further instructions.

A.3 Annual (before heating season)

• Mechanical Check

- ☐ Fluid leakage. The heater core is vacuum charged and contains proprietary heat transfer fluid. Inspect the Pressure Relief Device label indicator for signs of rupture and degradation. If the paper is torn, disintegrated or otherwise compromised this is an indication that fluid has leaked from the core. If any fluid leakage occurs from the heater, disconnect it from the power supply and have the core replaced. A factory supplied exchange core can be shipped from stock. Refer to Section Repair & Replacement, page 18 for details.
- ☐ All enclosures. Interior of enclosures must be clean, dry and free of foreign materials. Threaded covers must be installed and hand tight.

Note: Enclosure joints are metal to metal. Do not use gasket material or sealant in joints. A grease is applied to the joints at the factory and should be left intact.
- ☐ Motor shaft bearing play. Replace motor if play is excessive, or if motor does not run quietly and smoothly. Motor bearings are permanently lubricated.
- ☐ Fan. Replace immediately if cracked or damaged.
- ☐ Louvers. Screws should be tight. Louvers shall not be fully closed or override stops.
- ☐ Tightness of all hardware. All nuts and bolts, including mounting hardware, must be tight.
- ☐ Turn heater on for a minimum of five minutes. Check for warm air exiting heater through louvers. Crackling or pinging noises within heater during start-up are normal.

• Electrical Check

- ☐ All terminal connections and conductors. Tighten loose connections. Conductors with damaged insulation must be replaced.
- ☐ Inspect contactor contacts. If badly pitted, burned or welded shut, replace with factory supplied contactor. For severe duty conditions such as arctic duty or drilling rigs, Therman recommends the contactor be replaced every two years.
- ☐ Fuses. Fuse rating and type are on printed circuit board. Correct fuse must be in the active fuse clip. It is recommended that a spare fuse be stored in the spare fuse clip.
- ☐ All explosion-proof conduits. Replace damaged conduits. All threaded conduit connections must have a minimum 5 turns engagement. Straight threaded conduit must protrude a minimum of 1/16" (1.6 mm) inside enclosures. Taper threaded connections must be at least hand tight.
- ☐ Electrical resistance on all load side legs. Reading should be balanced ($\pm 5\%$).

B. IMPORTANT NOTICES



WARNING. Read and adhere to the following. Failure to do so may result in severe or fatal injury. **WARRANTY WILL BE VOID.**



WARNING. Appropriate protection against ground faults, such as a ground-fault circuit interrupter or GFCI, is required to be used with this equipment. Failure to provide protection against electrical grounding or bonding during the use of this equipment can result in property damage, personal injury, or death. In addition, this equipment must be effectively grounded in compliance with all applicable electrical codes and standards.

1. Read and follow all instructions in this manual.
2. Heater is to be used only in atmospheres having an ignition temperature higher than the heater's maximum rated operating temperature as shown on the heater data plate. Refer to applicable electrical codes for additional information.
3. Heater to be used only in the hazardous locations indicated on the heater's data plate.
4. Heater is for dry indoor use only. Do not immerse in water. Do not store or use in areas exposed to rain or snow.
5. Heater is to be connected and serviced only by a qualified electrician experienced with hazardous location equipment.
6. Installation and wiring of the heater must adhere to all applicable codes.
7. Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater. IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application.
8. This heater is equipped with a bimetal over-temperature high-limit. It is of the automatic reset type and therefore the heater may restart without warning. The unit comes with secondary high-limit that will trip an internal breaker if it goes over-temperature. If secondary high limit activates, the heater requires inspection by authorized personnel. The heater is not to be operated with either over-temperature protection devices bypassed or circumvented.
9. Venting pressure of the Pressure Relief Device (PRD) is factory set. Do not tamper with lock nut. (See Figure 1, page 5.)
10. Do not tamper or remove warning label indicator on the PRV.
11. The heater is equipped with a backup overpressure relief device. This is a single use device. If activated, do not circumvent this device to operate the heater. Activation of this device necessitates removing the heater immediately from service for evaluation.
12. Operate the heater only while it is permanently mounted in an upright position. Refer to Section D. Installation, page 7 for details.
13. Heater must be kept clean. When operating in a dirty environment, regularly clean the finned tubes, fan, and fan guard. Follow the recommended maintenance procedures. Refer to Section A. Heater Maintenance Checklist, page 3 for details.
14. The heater core is vacuum charged and contains proprietary heat transfer fluid. If any fluid leakage occurs from the heater, disconnect it from the power supply and have the core replaced with a factory supplied core. Refer to Section I. Repair & Replacement, page 18 for details.
15. Do not operate the heater with any of the louvers fully closed or overriding their stops.
16. Do not operate the heater in atmospheres corrosive to steel or aluminum.
17. Do not operate heater in ambient temperatures above 104°F (40°C).
18. Use factory approved replacement parts only.
19. See applicable electrical codes for seal requirements in field installed conduits. Factory installed conduits require no further sealing.
20. Crackling or pinging noises within the heater core during start up may occur. This is normal.
21. Air discharge near the bottom of the heater may be warmer than the top. This is normal.
22. If there are any questions or concerns regarding the heater, contact the factory. Refer to the back cover of this manual for details.

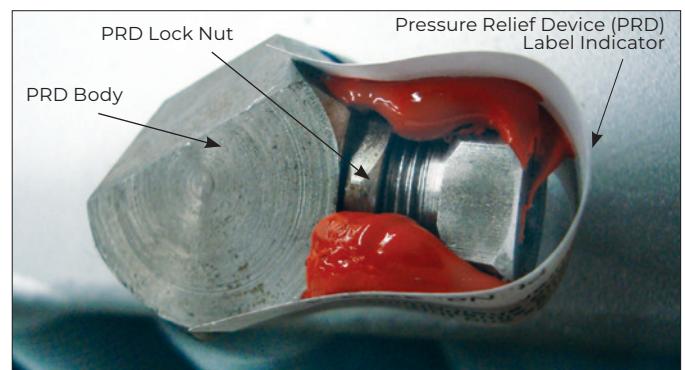


Figure 1

C. TROUBLESHOOTING TIPS

1. Heater is not operating.
 - 1.1 Check all fuses in heater control box.
 - 1.2 Check remote disconnect switch and circuit breaker.
 - 1.3 Check voltage supplied to the heater – refer to the heater data plate for voltage requirements.
 - 1.4 Check thermostat by turning it and check continuity with a multimeter.
 - 1.5 Check the condition of the disconnect switch if the heater is so equipped. Measure continuity through the disconnect by engaging the switch.
 - 1.6 Verify that there is a jumper wire present between terminals 5 and 6 on the terminal block located in the control box.
 - 1.7 Check that internal breaker has not opened. If internal breaker has opened it is indication that an over-temperature event has occurred. Heater must be thoroughly evaluated by qualified personnel to ensure it is in proper working order before resetting this device.
2. Contactor is chattering.
 - 2.1 Check supply voltage.
 - 2.2 Check wiring connections. Tighten all loose electrical connections.
 - 2.3 Check thermostat for continuity (See 1.4, page 6). If thermostat does not break continuity replace thermostat.
3. Contactor is burned or welded.
 - 3.1 Check the contactor for burn marks and blackening. Replace the contactor.
 - 3.2 Check incoming power to the heater to ensure there are no voltage fluctuations.
4. Heat exchanger is dirty.
 - 4.1 Clean the heat exchanger using compressed air.
5. Pressure Relief Devices.
 - 5.1 If there are signs that the Pressure Relief Device has released fluid, Pressure Relief Device indicator is broken, blackening around the Pressure Relief Device exit hole, or there are fluid stains visible on the top louver, shut the unit down immediately. Activation requires the heater be removed from service for inspection by authorized personnel. Do not circumvent the overpressure devices to operate the heater. Lock out/ tag out heater according to site procedures.
 - 5.2 Check for restricted air flow, bad motor, broken thermostat or malfunctioned high limit.
 - 5.3 There is a secondary Pressure Relief Device to insure safety of the unit.
 - 5.4 If the secondary pressure relief device has opened, shut the unit down immediately. This is a single use device. Activation requires the heater be removed from service for inspection by authorized personnel. Do not circumvent the overpressure device to operate the heater. Lock out/ tag out heater according to site procedures.
6. Heater is cold on top and warm on bottom.
 - 6.1 The core may have lost its vacuum. Check the pressure relief devices for signs of loss of fluid and verify that the pressure relief devices label indicator is not broken. If pressure relief devices has released, send the unit in for repair or replace the core.
 - 6.2 If the Pressure Relief Device does not indicate loss of fluid, the heater should operate normally.
 - 6.3 The ambient temperature may be too low. If the ambient temperature is very cold the top of the core will be colder than the bottom – this is normal.
7. Unit cycles on high limit – unit turns on and turns off within less than 5 minutes.
 - 7.1 Check and see if the pressure relief devices has released fluid. Core may have lost most or all of its fluid. If Pressure Relief Device has released, the unit requires inspection by authorized personnel.
 - 7.2 The core may be dirty, fan may not be working or may be turning the wrong direction (the fan must rotate clockwise as seen from the front of the unit) objects may be stuck in the heat exchanger for drying or warming up – remove any items from the exchanger.
8. The Ground Fault Interrupter (GFI) trips on the main panel, or heater blows fuses.
 - 8.1 Check that you have a fuse of the proper amperage rating.
 - 8.2 Check the pressure relief device for signs of loss of fluid and verify that the pressure relief device label is not broken.
 - 8.3 If condition is not observable, send heater in for repair.
 - 8.4 Heat exchanger needs to cool in order to engage switch to "ON" position.
 - 8.5 Contact factory if further assistance is needed.
9. The fan is turning but very little air comes from the front of the heater.
 - 9.1 Check fan rotation and ensure that the fan turns clockwise as seen from the front of the heater. Refer to the Installation section below for more information.
 - 9.2 Check motor winding resistance and verify that they are within tolerance.
 - 9.3 Check fan blade set screws to ensure fan blade is not loose on the motor shaft.

D. INSTALLATION General Guideline for Installation and Wiring

All applicable codes must be adhered to. For optimum heating, the heater should be installed as follows:

D.1 Mechanical

1. Location

- 1.1 There are no obstructions that may impede the heater's air inlet or discharge.
- 1.2 The air discharge is directed into open areas and not at occupants.
- 1.3 The air discharge is not directed at a thermostat.
- 1.4 The air discharge is directed across areas of heat loss, such as doors and windows (see Figure 2, page 7).
- 1.5 The air discharge is directed along and at a slight angle toward exterior walls (see Figure 2, page 7).
- 1.6 If equipment freeze protection is important, direct air discharge at equipment.
- 1.7 Air discharge streams support each other and create a circular air flow. It is not required that the heater's air throw reaches the next heater (see Figure 2, page 7).

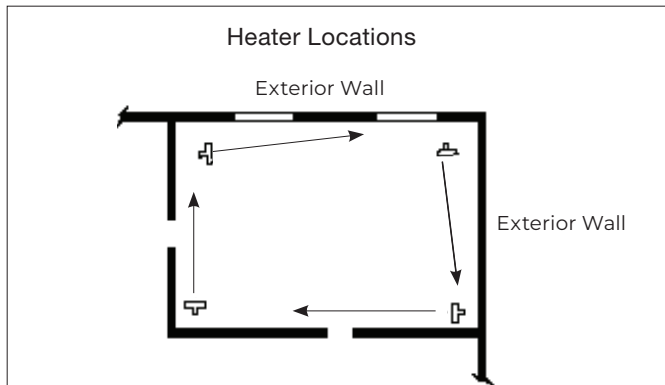


Figure 2

2. Mounting

- 2.1 The heater must be permanently mounted in a level, upright position for operation. See Figure 3, Figure 4, and Figure 5 on page 7 and 8 for maximum tilt angles, installation clearances, and physical dimensions. For ease of installation, a variety of mounting kits are available from the factory.
- 2.2 The mounting structure must be strong enough to:
 - Support the heater's weight (refer to Section F. Specifications, page 14).
 - Provide sufficient stiffness to prevent excessive vibration.
 - Withstand harsh situations such as transportable installations.

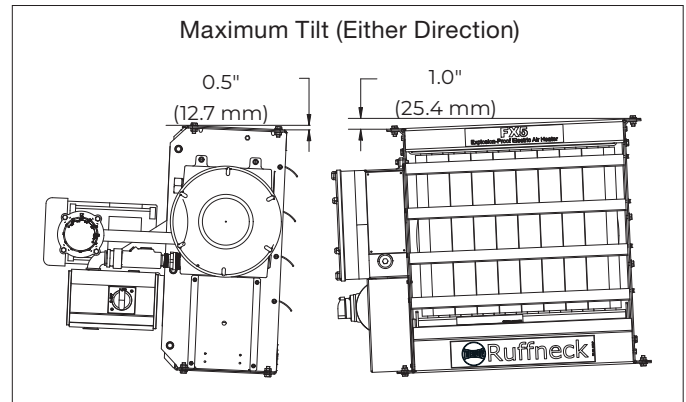


Figure 3

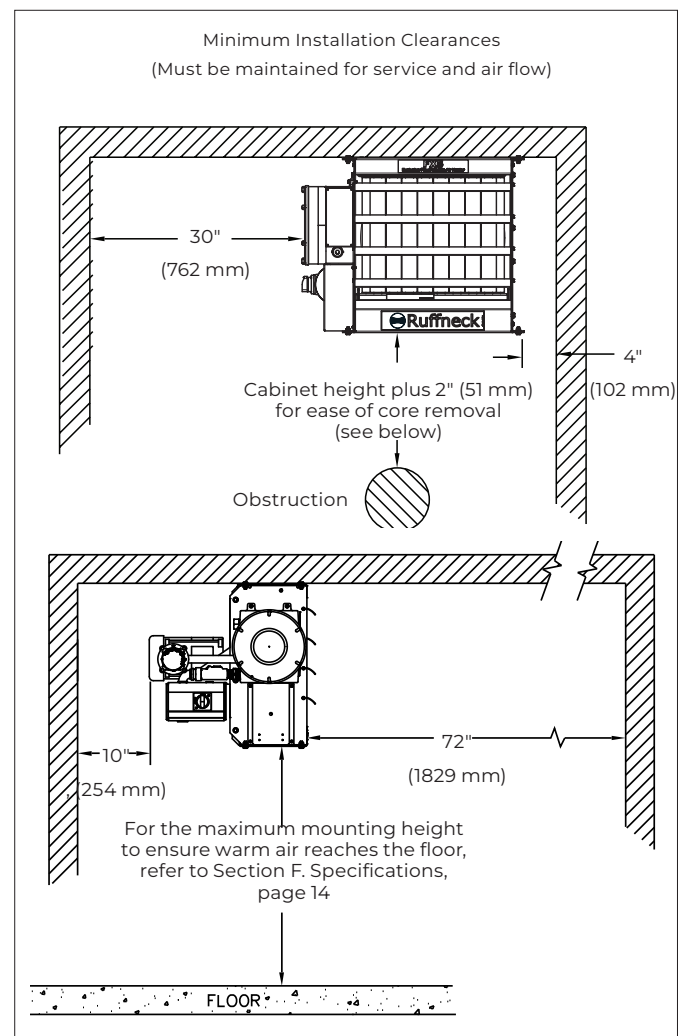
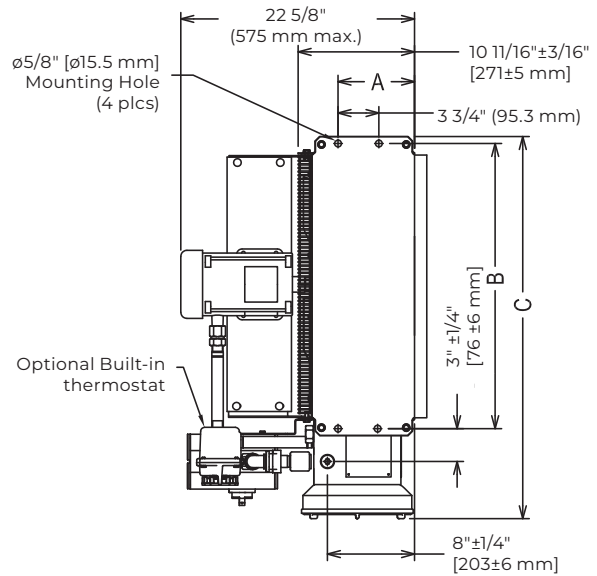


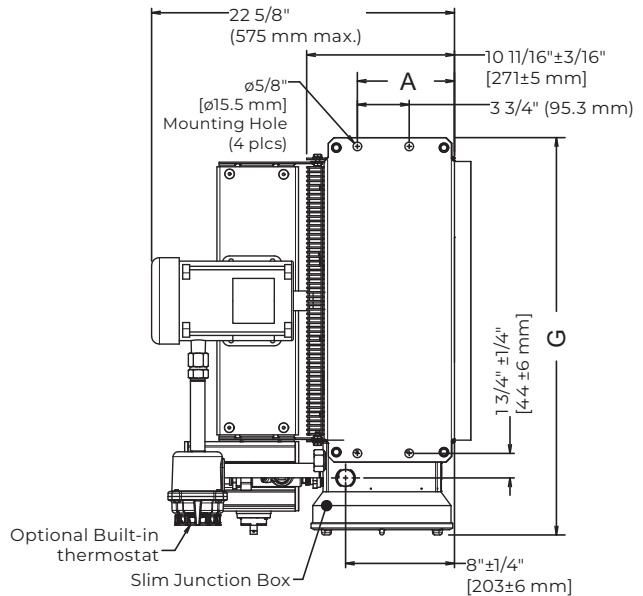
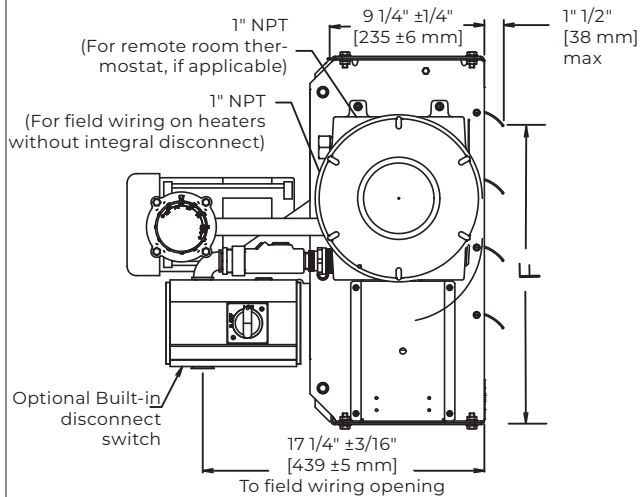
Figure 4

Dimensional Tolerances $\pm 1/8"$ [± 3 mm]
Unless otherwise specified.

DIM.	kW	2.5–10	12.5–20	20.9–35	DIM. TOL. $\pm$
A	in.	7	7	7	1/8
	mm	178	178	178	3
B	in.	18–3/16	22–5/16	26–1/4	1/8
	mm	462	566	667	3
C	in.	27	31	35	3/16
	mm	686	787	889	4
D	in.	19	23	27	1/8
	mm	484	586	688	3
E	in.	19–7/16	23–7/16	27–7/16	3/8
	mm	492	596	697	10
F	in.	17–1/2	19–1/2	21–13/16	5/16
	mm	444	495	554	8
G	in.	24–5/8	28–5/8	32–5/8	3/16
	mm	625	727	828	4



Large Control Housing



Slim Control Housing

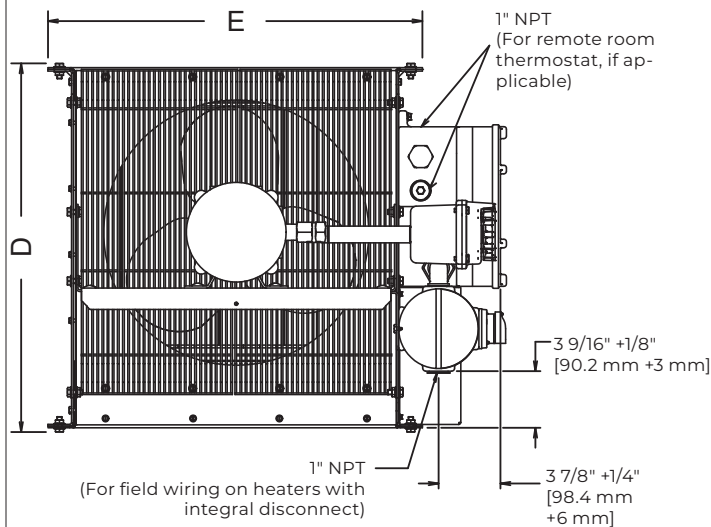


Figure 5



WARNING. Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater.

IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel. Lock the switch in the "OFF" (open) position and/or tag the switch to prevent unexpected power application. Installation and wiring of the heater must adhere to all application codes.

1. General

- 1.1 Use only copper conductors and approved explosion-proof wiring methods during installation. Refer to Section E. FX6 Technical Data, page 12 to 13 and heater data plate for conductor rating.
- 1.2 External overcurrent protection is required. Refer to Section E. FX6 Technical Data, page 12 to 13 and heater data plate for voltage, frequency amperage, and phase. Supply voltage is to be within 10% of the data plate voltage.
- 1.3 The heater must be installed by qualified personnel in strict compliance with electrical codes.
- 1.4 All heaters come factory prewired and ready for direct connection to the power supply leads.
- 1.5 The heater must be individually fused, preferably with Class J time-delay fuses for maximum safety. Unless stated otherwise in your local code, fuse size shall be 125% of line current or next size larger.

2. Field Wiring

- 2.1 The supply conductors, ground conductor, and room thermostat conductors (see D.3 Wiring Schematics, page 11) all pass through the 1" NPT opening (see Figure 6, page 9) and are to be wired into the control enclosure (see Figure 7, page 9).

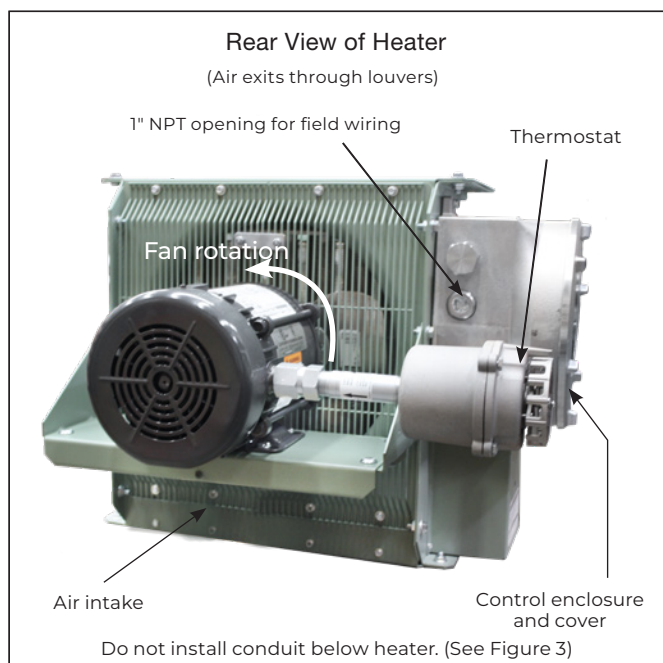


Figure 6

- 2.2 Heater may be supplied with a factory installed built-in room thermostat (see Figure 8, page 10). On heaters not supplied with this option, it is recommended that a remote room thermostat be used. Connect the remote room thermostat conductors to the printed circuit board terminal block marked "TSTAT". Any thermostat used with this heater must:
 - Be of an explosion-proof type
 - Be rated 125V minimum
 - Have a minimum 2 amp capacity
 - Open on temperature rise

- 2.3 Heater may be supplied with a factory installed built-in integral disconnect. (See Figure 8, page 10)

Field Wiring for Integral Disconnect:

- Power Supply conductors and Ground conductor pass through 1" NPT opening of Disconnect Enclosure (see Figure 8, page 10). Supply conductors to be wired to Disconnect Switch inside. Ground conductor to be wired to Ground Lug fastened to inside of Disconnect Enclosure.
 - If applicable, Remote Room Thermostat conductors pass through 1" NPT opening (see Figure 8, page 10) and are to be wired to printed circuit board terminals marked "T'STAT".
 - To reduce risk of ignition of hazardous atmospheres, conduit runs must have a sealing fitting connected within 18" (457 mm).
- 2.4 Factory installed conduits require no further sealing. Integral Disconnect is sealed at factory.
 - The internal grounding terminal in the control enclosure (or in the integral disconnect enclosure when this option is provided) shall be used as the equipment grounding means. An external bonding terminal is provided for a supplementary bonding connection where local authorities permit or require such a connection.

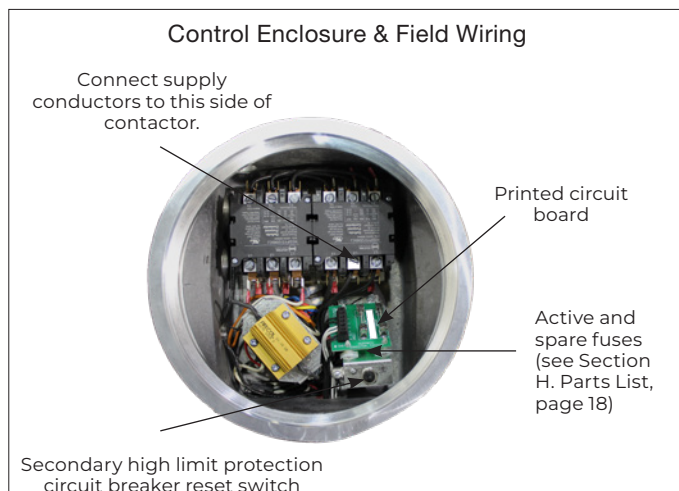


Figure 7

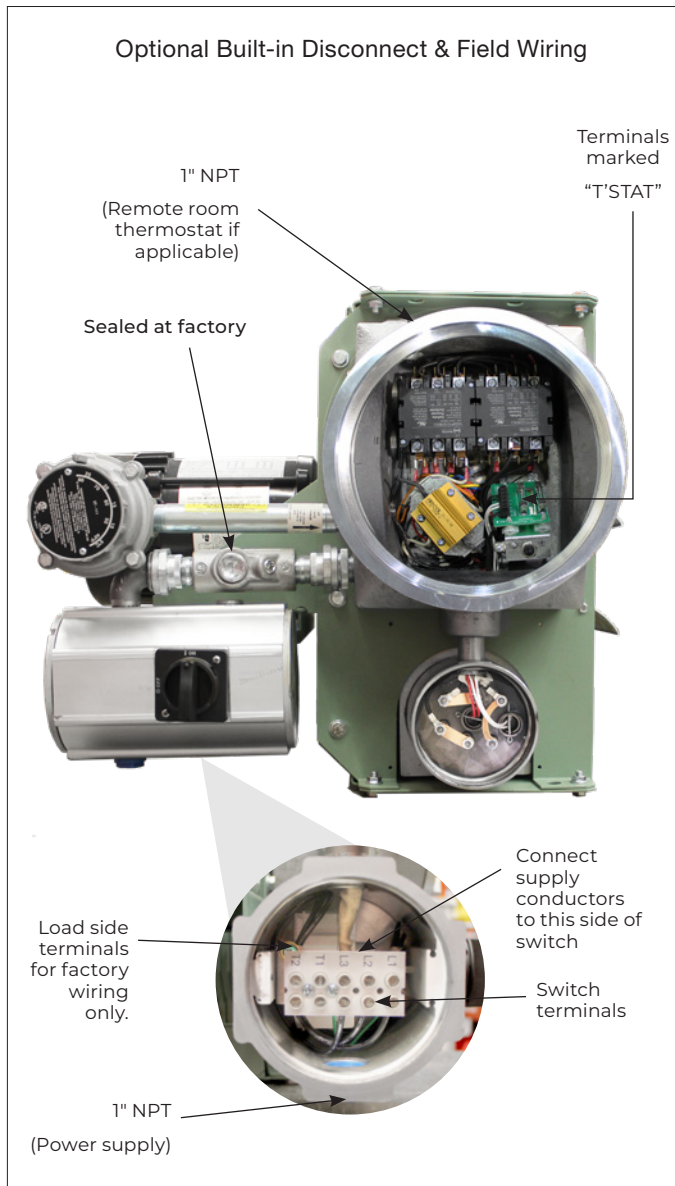


Figure 8

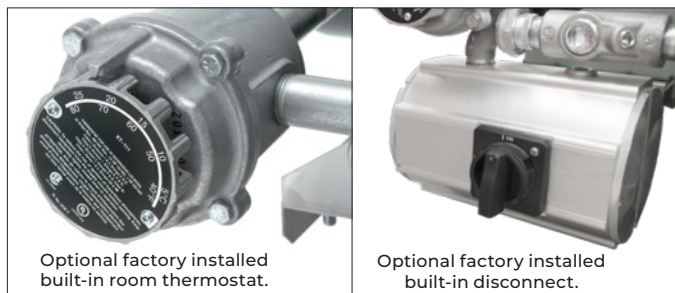


Figure 9

3. Final Inspection

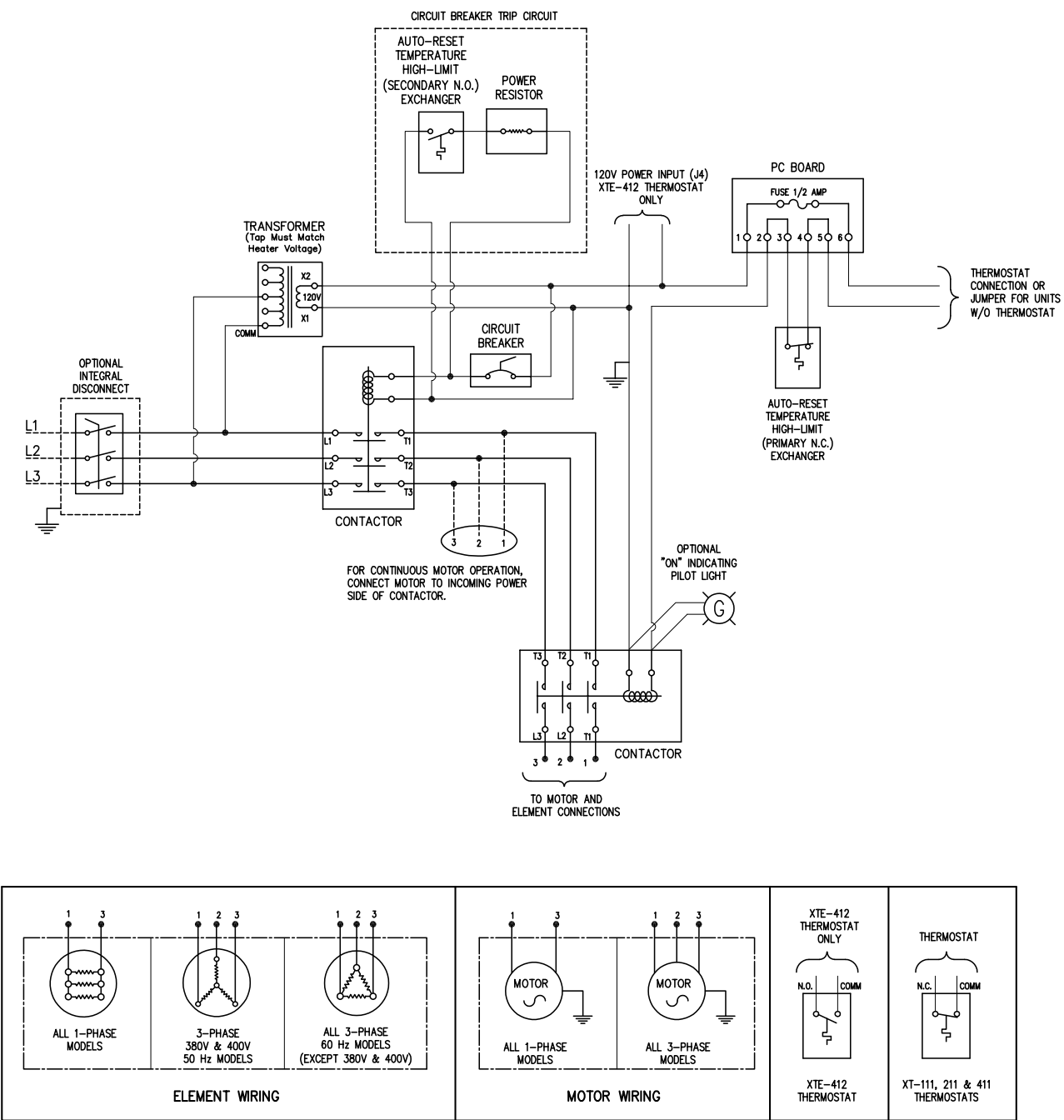
3.1 Before application of electrical power:

- Check that all connections are secured and comply with the applicable wiring diagram (see Wiring Schematics, page 11) and code requirements.
- Confirm that the power supply is compatible with the data plate rating of the heater.
- Remove any foreign objects from the heater.
- Install all covers and verify that all enclosures are well secured.
- Ensure that the fan rotates freely. See Figure 6, page 9 for proper direction of fan rotation.



WARNING. If heater has been stored at temperatures at or below freezing, the heat transfer fluid may become frozen. Under these circumstances it is necessary to cycle power to the heater, 30 seconds on, 30 seconds off for 3 minutes on initial startup.

FX6 WIRING SCHEMATIC



E. FX6 TECHNICAL DATA



E.1 50 Hz Electric Heaters

Model	Air Flow	Voltage	Nominal Wattage	Phase	Max. Motor Nameplate Current	Heater Wattage	Total Current	Minimum Circuit Ampacity	Supply Wire	Maximum Fuse Size	Temperature Rise		Core Kit Part Number	Contactor Part Number
	CFM	V	kW		A	W	A	A	AWG	A	°F	°C		
FX6-220150-025	400	220	2.5	1	4.7	2270	16.1	20.1	10	25	19.8	11.0	12122	13847
FX6-220150-042	400		4.2		4.7	3950	23.8	29.7	10	30	33.2	18.4	12123	
FX6-220150-063	700		6.3		4.7	6050	33.3	41.7	8	45	28.5	15.8	12124	
FX6-220150-084	700		8.4		4.7	8140	42.9	53.6	6	60	37.9	21.1	12125	
FX6-220150-126*	1450		12.6		4.7	12100	62.0	77.5	4	80	27.5	15.3	12126	
FX6-230150-028	400	230	2.8		4.1	2480	16.3	20.3	10	25	22.1	12.3	12127	
FX6-230150-046	400		4.6		4.1	4310	24.1	30.1	8	35	36.4	20.2	12128	
FX6-230150-069	700		6.9		4.1	6610	34.1	42.6	8	45	31.2	17.3	12129	
FX6-230150-138*	1450		13.8		4.1	13200	64.1	80.1	4	90	30.1	16.7	12130	
FX6-380350-025	400	380	2.5	3	1.1	2270	4.9	6.1	14	10	19.8	11.0	12136	
FX6-380350-042	400		4.2		1.1	3950	7.5	9.4	14	10	33.2	18.4	12137	
FX6-380350-063	700		6.3		1.1	6050	10.7	13.4	14	15	28.5	15.8	12138	
FX6-380350-084	700		8.4		1.1	8140	13.9	17.3	12	20	37.9	21.1	12139	
FX6-380350-125	1450		12.5		1.1	12100	20.1	25.1	10	30	27.3	15.1	12140	
FX6-380350-209	3000	400	20.9		1.1	20300	32.9	41.1	8	45	22.0	12.2	12142	
FX6-400350-028	400		2.8		1.1	2480	5.1	6.4	14	10	22.1	12.3	12143	
FX6-400350-046	400		4.6		1.1	4310	7.7	9.7	14	10	36.4	20.2	12144	
FX6-400350-069	700		6.9		1.1	6610	11.1	13.8	14	15	31.2	17.3	12145	
FX6-400350-093	700		9.3		1.1	8900	14.5	18.2	12	20	42.0	23.3	12146	
FX6-400350-139	1450	415	13.9	3	1.1	13200	21.2	26.5	10	30	30.3	16.8	12147	
FX6-400350-185	1450		18.5		1.1	17800	27.8	34.8	8	35	40.3	22.4	12148	
FX6-400350-231	3000		23.1		1.1	22200	34.5	43.1	8	45	24.3	13.5	12149	
FX6-415350-037	400		3.7		1.2	3510	6.4	7.9	14	10	29.3	16.3	12150	
FX6-415350-075	700		7.5		1.2	7240	11.6	14.6	14	15	33.9	18.8	12151	
FX6-415350-149	1450	440	14.9		1.2	14500	22.0	27.4	10	30	32.5	18.1	12152	
FX6-415350-224	3000		22.4		1.2	21800	32.4	40.5	8	45	23.6	13.1	12153	
FX6-440350-042	400		4.2		1.2	3950	6.7	8.4	14	10	33.2	18.4	12154	
FX6-440350-084	700		8.4		1.2	8140	12.2	15.3	12	20	37.9	21.1	12155	
FX6-440350-168	1450		16.8		1.2	16300	23.3	29.1	10	30	36.6	20.4	12156	
FX6-440350-210	3000		20.9		1.2	20300	28.7	35.8	8	40	22.1	12.2	12157	

Notes

* Exceeds the 48 amp circuit limit of NEC 424-22. DS not available for these units.

**480V: 1-phase units are certified for Class I, Div. 1, Group D and Class II, Div. 1 Groups F & G. Heater rated for -20°C to +40°C. Special Order.

1. Minimum conductor size for 86°F (30°C) ambient. Derate conductor for ambient temperature. Use minimum 194°F (90°C) insulation.

2. Heater is functioning normally if at rated voltage the amp draw is within 10% of the value in this table.

3. Operation at lower voltages will result in reduced heat output and amp draw.

4. Add "T" to model number when adding a built-in thermostat.

5. Add "D" to model number when adding a built-in disconnect switch.

E.2 60 Hz Electric Heaters

Model	Voltage	Nominal Wattage	Phase	Max. Motor Nameplate Current	Heater Wattage	Total Current	Minimum Circuit Ampacity	Supply Wire	Maximum Fuse Size	Temperature Rise		Core Kit Part Number	Contactor Part Number
	V	kW			W	A	A	AWG	A	°F	°C		
FX6-208160-030	208	3.0	1	4.1	2700	18.5	23.2	10	25	19.0	10.5	12116	13847
FX6-208160-050		5.0		4.1	4700	28.1	35.2	8	40	31.6	17.6	12117	
FX6-208160-075		7.5		4.1	7200	40.2	50.2	6	60	27.9	15.5	12118	
FX6-208160-100*		10.0		4.1	9690	52.2	65.2	6	70	37.2	20.7	12119	
FX6-208360-030		3.0	3	2.3	2700	10.6	13.3	14	15	11.2	6.2	12116	
FX6-208360-050		5.0		2.3	4700	16.2	20.2	10	25	18.6	10.3	12117	
FX6-208360-075		7.5		2.3	7200	23.1	28.9	10	30	27.9	15.5	12118	
FX6-208360-100		10.0		2.3	9700	30.1	37.6	8	40	37.2	20.7	12119	
FX6-208360-150		15		2.3	14400	44.0	55.0	6	60	27.1	15.1	12120	
FX6-240160-030		3.0	240	4.1	2700	16.6	20.8	10	25	19.0	10.5	12122	
FX6-240160-050		5.0		4.1	4700	24.9	31.2	8	35	31.6	17.6	12123	
FX6-240160-075		7.5		4.1	7200	35.4	44.2	8	45	27.9	15.5	12124	
FX6-240160-100		10.0		4.1	9700	45.8	57.2	6	60	37.2	20.7	12125	
FX6-240160-150*		15.0		4.1	14400	66.6	83.3	4	90	27.1	15.1	12126	
FX6-240360-030		3.0		2.4	2700	9.6	12.0	14	15	19.0	10.5	12122	
FX6-240360-050		5.0		2.4	4700	14.4	18.1	12	20	31.6	17.6	12123	
FX6-240360-075		7.5		2.4	7200	20.5	25.6	10	30	27.9	15.5	12124	
FX6-240360-100		10.0		2.4	9700	26.5	33.1	8	35	37.2	20.7	12125	
FX6-240360-150		15.0		2.4	14400	38.5	48.2	8	50	27.1	15.1	12126	
FX6-480160-030 **	480	3.0	1	0.8	2700	7.1	8.8	14	10	19.0	10.5	12129	
FX6-480160-050 **		5.0		0.8	4700	11.2	14.0	14	15	31.6	17.6	12130	
FX6-480160-075 **		7.5		0.8	7200	16.4	20.5	10	25	27.9	15.5	12131	
FX6-480160-100 **		10.0		0.8	9700	21.6	27.0	10	30	37.2	20.7	12132	
FX6-480160-150 **		15.0		0.8	14400	32.1	40.1	8	45	27.1	15.1	12133	
FX6-480160-200 **		20.0		0.8	19400	42.5	53.1	6	60	36.1	20.1	12134	
FX6-480360-030		3.0	3	1.2	2700	4.8	6.0	14	10	19.0	10.5	12129	
FX6-480360-050		5.0		1.2	4700	7.2	9.0	14	10	31.6	17.6	12130	
FX6-480360-075		7.5		1.2	7200	10.2	12.8	14	15	27.9	15.5	12131	
FX6-480360-100		10.0		1.2	9700	13.2	16.6	12	20	37.2	20.7	12132	
FX6-480360-150		15.0		1.2	14400	19.3	24.1	10	25	27.1	15.1	12133	
FX6-480360-200		20.0		1.2	19400	25.3	31.6	8	35	36.1	20.1	12134	
FX6-480360-250		25.0		1.2	24200	31.3	39.1	8	40	22.0	12.2	12135	
FX6-480360-300		30.0		1.2	29200	37.3	46.7	8	50	26.4	14.6	12136	
FX6-480360-350		35.0		1.2	34200	43.3	54.2	6	60	30.7	17.1	12137	
FX6-600360-030		3.0	600	0.7	2700	3.6	4.5	14	10	19.0	10.5	12138	
FX6-600360-050		5.0		0.7	4700	5.5	6.9	14	10	31.6	17.6	12139	
FX6-600360-075		7.5		0.7	7200	7.9	9.9	14	15	27.9	15.5	12140	
FX6-600360-100		10.0		0.7	9700	10.3	12.9	14	15	18.1	20.7	12141	
FX6-600360-150		15.0		0.7	14400	15.2	18.9	12	20	27.1	15.1	12142	
FX6-600360-200		20.0		0.7	19400	20.0	25.0	10	30	36.1	20.1	12143	
FX6-600360-250		25.0		0.7	24200	24.8	31.0	8	35	45.2	25.1	12144	
FX6-600360-300		30.0		0.7	29200	29.6	37.0	8	40	26.4	14.6	12145	
FX6-600360-350		35.0		0.7	34200	34.4	43.0	8	45	30.7	17.1	12146	

- Add "U" to model number for units with continuous fan option.
- Add "A" to model number for units with stainless steel cabinet.
- Add "L" to model number for large box option.
- Add "P" to model number when adding a built-in pilot light.

F. SPECIFICATIONS

F.1 50 Hz Models

			Nominal kW							
			2.5	3.7 & 4.6	6.3 & 7.5	8.4	12.5 & 12.6	14.9 & 16.7	20.9	22.4
Maximum Altitude	ft		12,000	8,000	10,000	7,000	10,000	7,000	10,000	7,000
	m		3,658	2,438	3,048	2,134	3,048	2,134	3,048	2,134
Air Flow	@ 70°F (CFM)		400		700		1,450		3,000	
	@ 21°C (m³/hr)		679		1,189		2,463		5,096	
Horizontal Air Throw	ft		13		25		35		60	
	m		4.0		7.6		10.7		18.2	
Maximum Mounting Height (to underside)	ft		7		10				20	
	m		2.1		3.0				6.1	
Minimum Motor Power	HP		1/2							
	kW		0.373							
Fan Diameter	in		12				16		20	
	mm		305				406		508	
Net Weight	without DS	lbs	148				177		212	
		kg	67.1				80.2		96.2	
	with DS	lbs	160				189		224	
		kg	82.5				95.6		101.6	
Shipping Weight	without DS	lbs	202				227		263	
		kg	91.6				202.9		119.3	
	with DS	lbs	214				239		275	
		kg	97				108.3		124.7	

Specifications for all 50 Hz and 60 Hz Models

1. Hazardous Location Rating	Class I, Groups C and D; Class II, Groups E, F and G; Temperature Code T3B [329°F (165°C)]*	7. Heating Elements	Three long-life, low watt-density, high grade metal-sheathed elements
2. Enclosures	NEMA Type 7 & 9. For dry, indoor use only. Do not immerse in water. Do not store or use in areas exposed to rain or snow	8. Temperature High-Limit	Automatic reset type, snap-action bimetal, open on temperature rise. Rated 100,000 cycles at 10 amps, handles 0.128 amps
3. Motor Type	Explosion-proof. Thermally protected. Permanently lubricated ball bearings.	9. Backup Temperature High-Limit	Automatic reset type, snap-action bimetal, close on temperature rise. Rated 100,000 cycles at 10 amps, handles 0.128 amps.
4. Fan	Aluminum blade. Steel spider and hub with 5/8" (15.875 mm) bore	10. Control Circuit	120V, 0.128 amps, 15 VA. (Grounded)
5. Fan Guard	Split design with close wire spacing. 1/4" (6.3 mm) diameter probe will not enter	11. Slim Junction Box	10.25" (230 mm) x 8.00" (180 mm) x 6.75" (172 mm)
6. Mounting Holes	Two 9/16". (14.3 mm) diameter holes at top	12. Optional Built-in Thermostat	36°F to 82°F (2°C to 28°C)

Note:

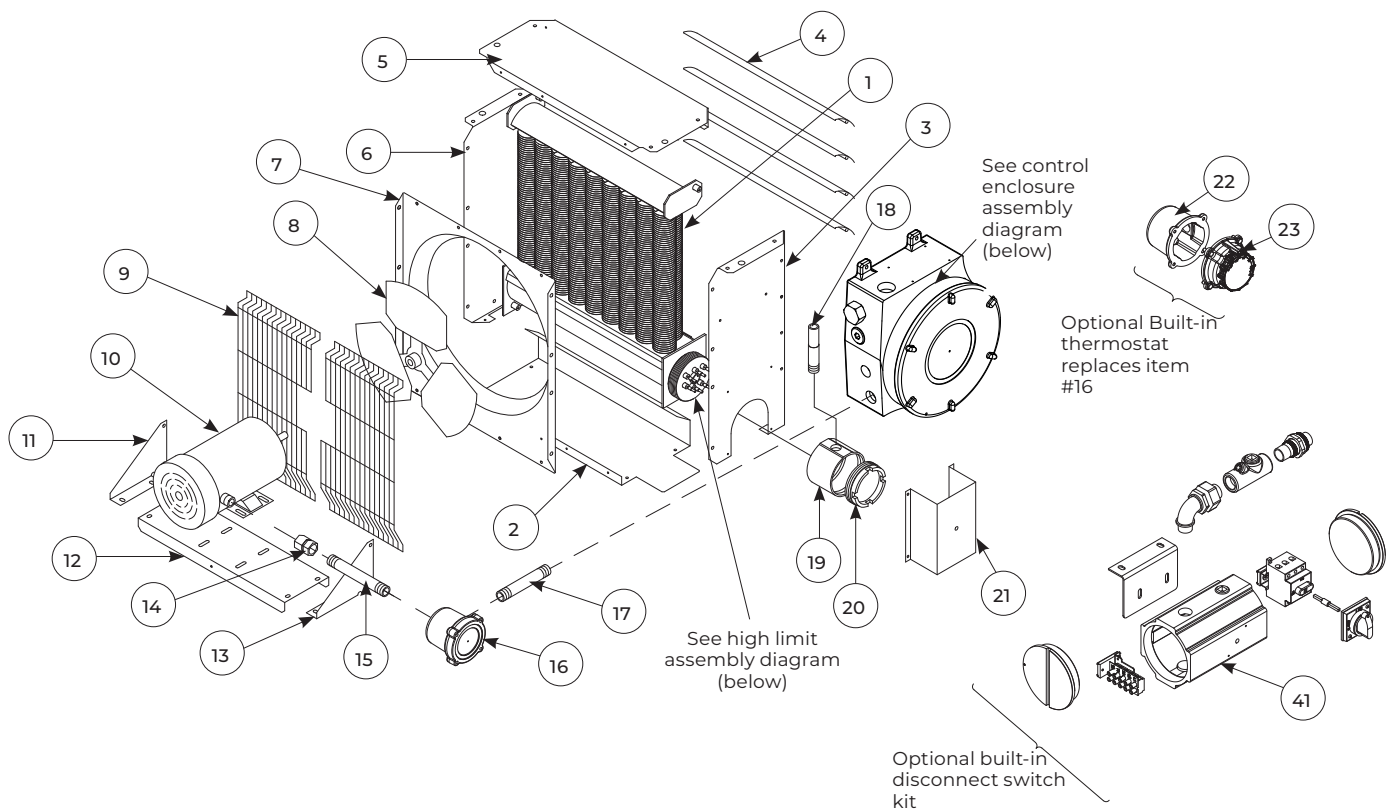
*Some units may be Class I, Div. I, Group D and Class II, Div. I, Group F & G.

F.2 60 Hz Models

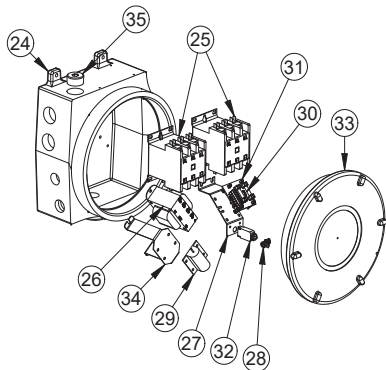
			Nominal kW								
			3	5	7.5	10	15	20	25	30	35
Maximum Altitude	ft		12,000	8,000	10,000	7,000	10,000	7,000	10,000	7,000	6,000
	m		3,658	2,438	3,048	2,134	3,048	2,134	3,048	2,134	1,829
Air Flow	@ 70°F (CFM)		500		850		1750		3600		
	@ 21°C (m ³ /hr)		850		1444		2973		6116		
Horizontal Air Throw	ft		15		30		40		70		
	m		4.6		9.1		12.2		21.3		
Maximum Mounting Height (to underside)	ft		7		10				20		
	m		2.1		3.0				6.1		
Minimum Motor Power	HP		1/2								
	kW		0.373								
Fan Diameter	in		12				16		20		
	mm		305				406		508		
Net Weight	without DS	lbs	148				177		212		
		kg	67.1				80.2		96.2		
	with DS	lbs	160				189		224		
		kg	82.5				95.6		101.6		
Shipping Weight	without DS	lbs	202				227		263		
		kg	91.6				103.9		119.3		
	with DS	lbs	214				239		275		
		kg	97				108.3		124.7		

13. Optional Built-in Disconnect Switch	DS for use only on heaters with total current not exceeding 48 amps. Lockout handle accepts 1/4" diameter padlock shackle	20. Conduit Material	Heavy walled, 0.122" (3.1 mm) steel
14. Control Transformer	Multi-tap primary, 120V secondary, 50 VA	21. Overpressure Protection	Pressure relief device, steel body, no field serviceable parts
15. Optional Pilot Light	Indicates call for heat	22. Backup Overpressure Protection	Single use device, non serviceable.
16. Contactor	75 amps. Rated for 1,000,000 mechanical operations. 120V, 15 VA coil (separately fuse-protected)	23. Operational Temperature Limitations	-58°F to 104°F (-50°C to 40°C)
17. Heat Transfer Fluid	Long life formulated proprietary heat transfer fluid	24. Storage Limitations	-58°F to 176°F (-50°C to 80°C). Do not immerse in water. Do not expose to rain or snow.
18. Cabinet Material	12 ga. (0.104") (2.60 mm) steel. Epoxy coated with five-stage pretreatment, including iron phosphate. Optional stainless steel.		
19. Core	Steel with integral aluminum fins, vacuum charged and hermetically sealed		

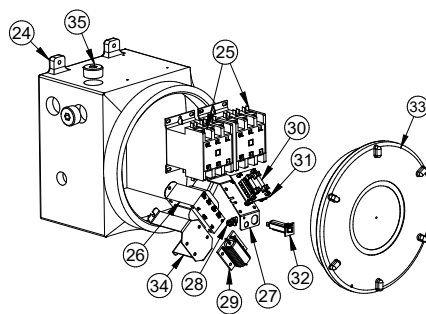
G. PARTS ASSEMBLY DIAGRAM



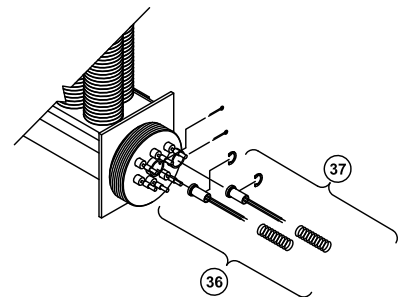
Small Control Enclosure



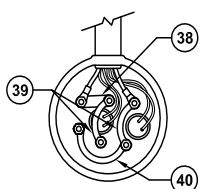
Large Control Enclosure



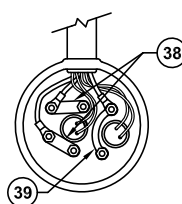
High Limit



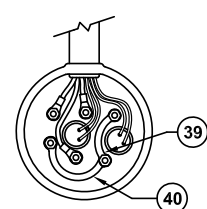
Bus-Bar Configuration
for all 1-Phase Models



Bus-Bar Configuration
for all 3-Phase
(Except 380V & 400V 50 Hz Models)



Bus-Bar Configuration
for all 3-Phase
(380V & 400V 50 Hz Models)



H. PARTS LIST Forced Air Electric Heaters

Please have model and serial number available before calling

Item	Description	2.5 – 4.6 kW		6.3 – 10 kW	12.5 – 20 kW	20.9 – 35 kW
1	Core	**				
2	Panel, Bottom	Painted: 12694-02 S.S.: 12694-03			Painted: 12699-02 S.S.: 12699-03	Painted: 12704-02 S.S.: 12704-03
3	Panel, Left Side	Painted: 12691-02 S.S.: 12691-03			Painted: 12696-02 S.S.: 12696-03	Painted: 12701-02 S.S.: 12701-03
4	Louver Kit, c/w screws	4075			4076	4077
5	Panel, Top	Painted: 12693-02 S.S.: 12693-03			Painted: 12698-02 S.S.: 12698-03	Painted: 12703-02 S.S.: 12703-03
6	Panel, Right	Painted: 12692-02 S.S.: 12692-03			Painted: 12697-02 S.S.: 12697-03	Painted: 12702-02 S.S.: 12702-03
7	Panel, Fan Shroud	Painted: 3782 S.S.: 9212			Painted: 3783 S.S.: 9213	Painted: 3784 S.S.: 9214
8	Fan Blade	4022	4023		4024	4025
9	Fan Guard Kit	Painted: 4078 S.S.: 9504			Painted: 4079 S.S.: 9505	Painted: 4080 S.S.: 9506
10	208/240V 1PH 60 Hz	12215 (US Motors)			10388 (Marathon)	
	220V 1PH 50 Hz					
	480V 1PH 60 Hz	9896 (Baldor)			N/A	
	208/240/480V 3PH 60 Hz	10562 (US Motors)			10387 (Marathon)	
	380/415V 3PH 50 Hz					
	600V 3PH 60 Hz	12216 (US Motors)			10672 (Marathon)	
11	Bracket, Motor Mount Right	Painted: 3789 S.S.: 9112			Painted: 3789 S.S.: 9112	Painted: 3789 S.S.: 9112
12	Channel, Motor Mount	Painted: 3785 S.S.: 9206			Painted: 3786 S.S.: 9207	Painted: 3787 S.S.: 9208
13	Bracket, Motor Mount Left	Painted: 3788 S.S.: 9111			Painted: 3788 S.S.: 9111	Painted: 3788 S.S.: 9111
14	Coupling, Motor	3737 (US Motors) 4590 (Baldor & Marathon Motors)				
15	Conduit, Motor	9500			3813	10389
16	Cover, Thermostat Enclosure	5371				
17	Conduit, Control Enclosure	3813				
18	Conduit, Element Enclosure	Contact Factory				
19	Enclosure, Element	9679				
20	Cover, Element Enclosure	3510				
21	Panel, Element Enclosure Guard	Painted: 12695-02 S.S.: 12695-03			Painted: 12700-02 S.S.: 12700-03	Painted: 12705-02 S.S.: 12705-03
22	Enclosure, Thermostat	4983				
23	Thermostat, Built-in kit	-				
24	Enclosure, Control	-				
25	Contactor	13847				
26	Transformer	12290 (60 Hz)			11295 (50 Hz)	
27	Bracket, Printed Circuit Board	3809				
28	Terminal, 6-14 Ga. Screw Lug	1876				
29	Secondary Thermal Protection Circuit Power Resistor	-				
30	Fuse, Buss MDQ - 1/2 Amp	9357				
31	Assembly, Printed Circuit Board	3514				
32	Secondary Thermal Protection Reset	Contact Factory				
33	Cover, Control Enclosure	11960				
34	Bracket, Above Transformer	-				
35	Plug, 1" NPT Explosion Proof	12169				
36	Temperature High-Limit Kit (N.O.)	-				
37	Temperature High-Limit Kit (N.C.)	-				
38	Bus-Bar, Straight	Provided with Core Kits**				
39	Bus-Bar, Small Curved					
40	Bus-Bar, Large Curved					
41	Kit, DS Assembly	-				
42	Pilot Light Complete	IN-M-PILOT-XLSGS-G				

** See technical data table for part numbers. **Note:** For Items not shown, contact factory.

I. REPAIR & REPLACEMENT



WARNING

Disconnect heater from power supply at integral disconnect or fuse box before opening enclosures or servicing heater.

IF INTEGRAL DISCONNECT IS BEING SERVICED, verify that power has been disconnected at fuse box or main panel.

Lock the switch in the “OFF” (open) position and/or tag the switch to prevent unexpected power application.

This heater should only be serviced by personnel with heating and hazardous location equipment experience.

1. After repairing any component:
 - 1.1 Check that electrical connections are correct and secure (see Figure 9, page 10).
 - 1.2 Remove any foreign material from enclosures
 - 1.3 Install and secure all covers
 - 1.4 Ensure that all fasteners are tight
 - 1.5 Remove all foreign objects from heater
 - 1.6 Ensure air exits through louvers and fan rotates counterclockwise when viewed from rear of heater (see Figure 14, page 19).

The heater core is vacuum charged and not field repairable.

2. Core

For core removal:

- 2.1 Remove cabinet bottom and element enclosure cover.
- 2.2 Disconnect all wires entering element enclosure (see Figure 10, page 18).
- 2.3 Slightly loosen all cabinet bolts shown in Figure 10, page 18, to prevent the core from binding.
- 2.4 With an assistant supporting the weight of the core, remove the 3 core mounting bolts. Carefully lower the core out of the cabinet (see Figure 11, page 18).
- 2.5 To return core to factory, use crate supplied with exchange core to protect the element terminals and plate threads.
- 2.6 To reinstall, lift the core up into cabinet while an assistant guides the element wires into the element enclosure conduit.
- 2.7 Position the core and tighten the 3 core mounting bolts. Tighten the remaining cabinet bolts.

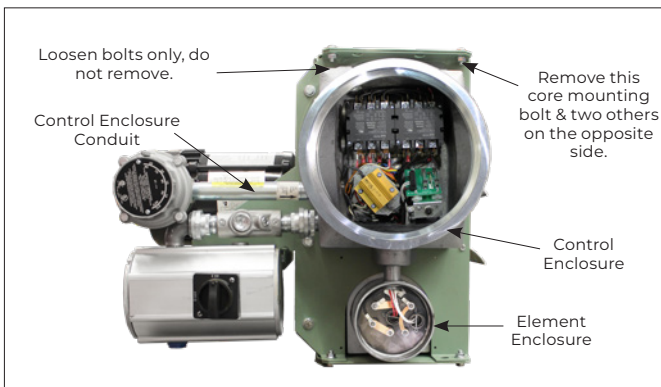


Figure 10

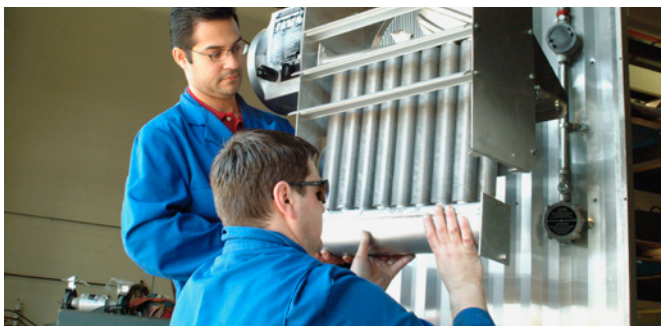


Figure 11

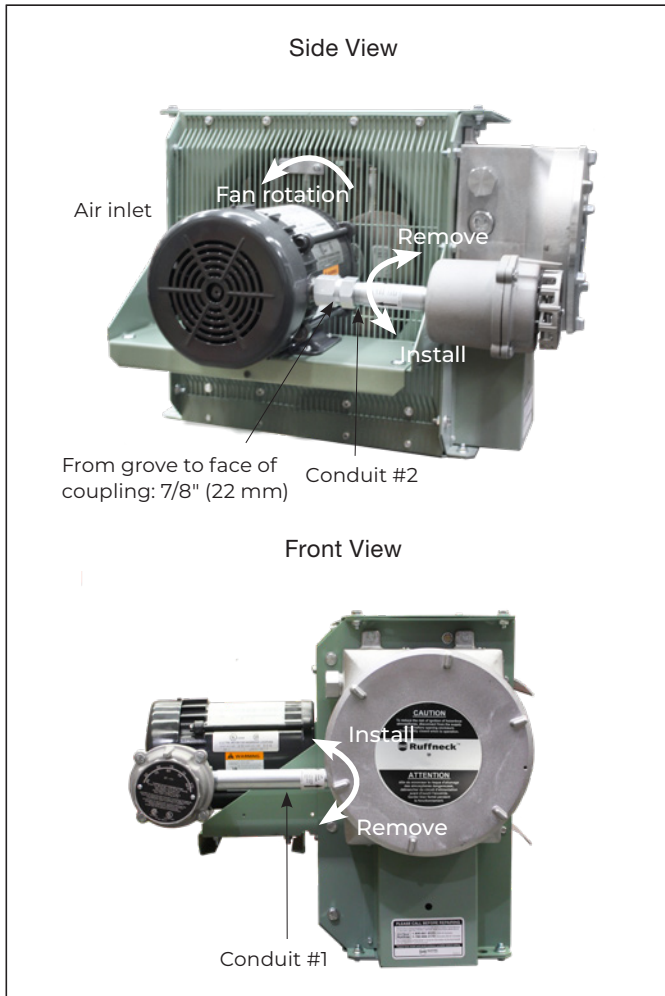


Figure 12



Figure 13



Figure 14

3. Motor, Fan, & Fan Guard
 - 3.1 Remove bolts holding the motor to the motor mount. On units with a built-in thermostat, remove the bolts on the back of the thermostat enclosure.
 - 3.2 Remove conduit #1 located between motor junction box and control enclosure by turning it in the direction illustrated (see Figure 12, page 19). Note that conduits #1 and #2 are not interchangeable and have left hand threads on one end, this end is indicated by a machined groove.
 - 3.3 Remove the two-piece fan guard assembly (see Figure 13, page 19).
 - 3.4 Lift the motor assembly off the motor mount.
 - 3.5 Before removing the fan, measure and record the location of the fan hub on the motor shaft (see Figure 14, page 19). If difficult to remove, use a gear puller on the fan hub.
 - 3.6 To reassemble, place motor assembly onto motor mount and fasten the fan guard to cabinet.
 - 3.7 Simultaneously engage and tighten both ends of conduit #1 into enclosures. Leave a 1/16" to 3/16" (1.6 to 4.8 mm) gap between the motor and fan guard (see Figure 15, page 20). Adjust conduit #2 to center the fan in the shroud.
 - 3.8 To ensure a minimum 5 thread engagement, threaded ends of conduits must protrude a minimum of 1/16" (1.6 mm) into enclosures. The groove on conduit #2 must not be more than 7/8" (22 mm) from motor coupling (see Figure 14, page 19).
 - 3.9 Bolt motor to motor mount. Manually spin the fan blade to ensure fan rotates freely.
 - 3.10 Air must exit through louvers and fan must rotate counterclockwise when viewed from rear of heater (see Figure 12, page 19).
4. Heating Elements
 - 4.1 Heating elements are an integral part of the vacuum charged core. A factory exchange core can be shipped immediately from stock. Refer to 2. Core, page 18 for details.
5. Contactor
 - 5.1 Loosen, but do not remove contactor mounting screws. Slide contactor off mounting screws.
 - 5.2 Replace with a factory supplied contactor of the same rating.
6. Transformer
 - 6.1 Replace with a factory supplied transformer of the same rating.
 - 6.2 On the new transformer, select primary wires to match heater voltage.
 - 6.3 Ensure that the correct transformer secondary lead is grounded (see Figure 9, page 10). Individually terminate all unused wires using closed end connectors.

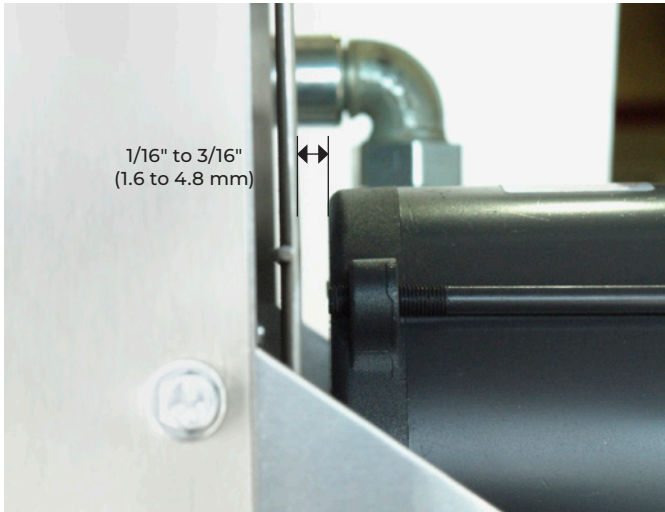


Figure 15

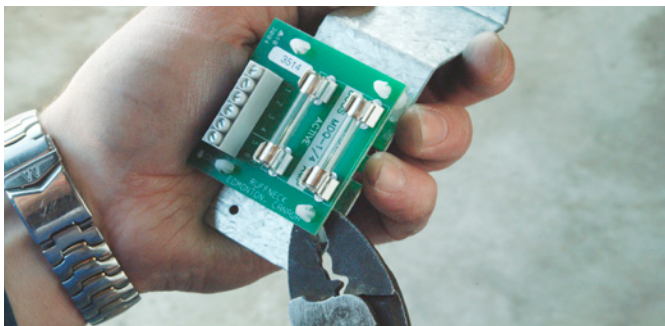
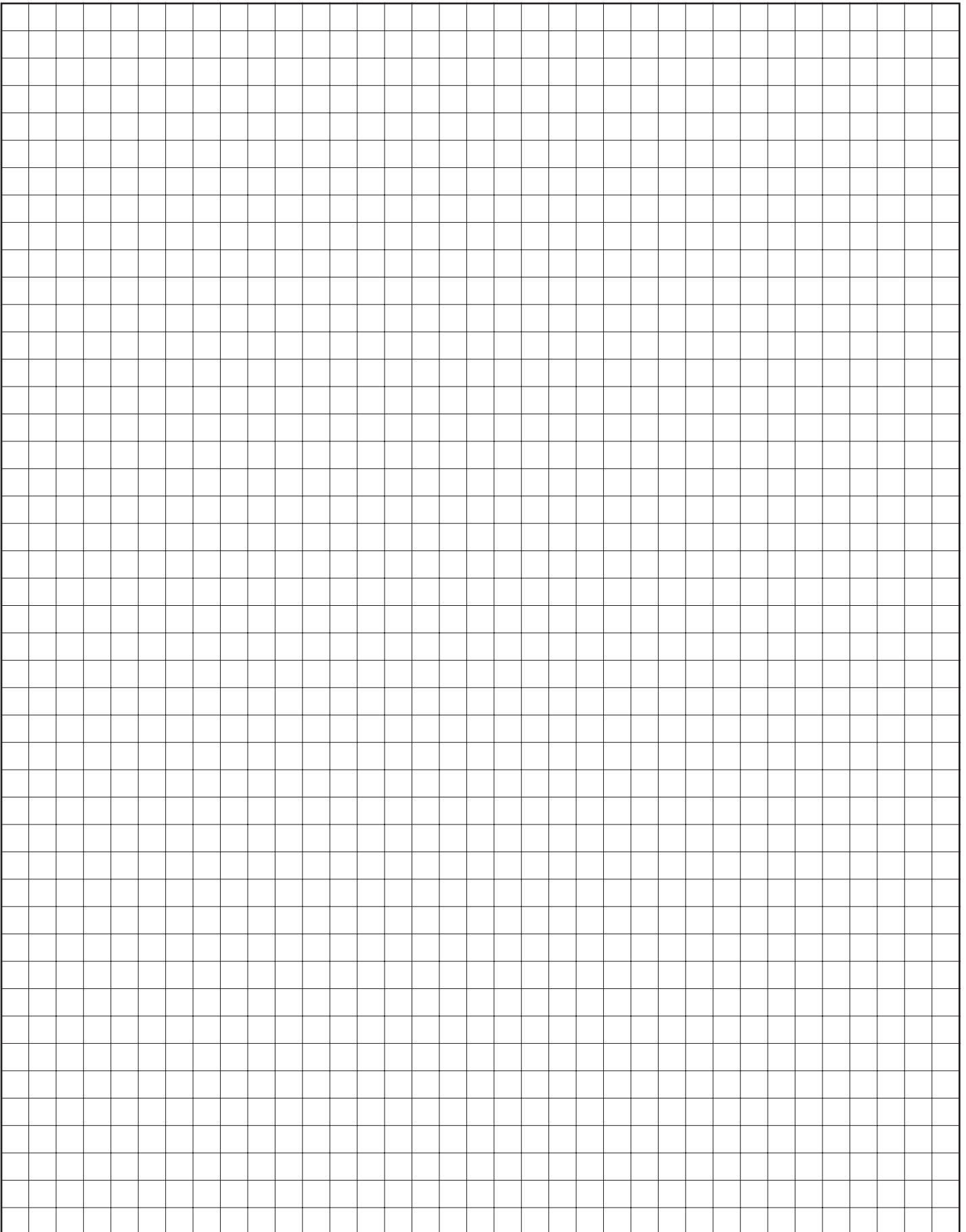


Figure 16

7. Printed Circuit Board
 - 7.1 After removing the printed circuit board (P.C. Board) bracket assembly from the control enclosure, separate the P.C. Board from the bracket by cutting off the plastic spacers (see Figure 9, page 10).
 - 7.2 Reinstall a new factory supplied P.C. Board onto the mounting bracket, using new non-conducting spacers of the same length. Spacers are supplied with a new P.C. Board. Reinstall the control circuit ground wire to the printed circuit board bracket (see Figure 16, page 20).
8. Fuse
 - 8.1 Replace fuse with one of the same type and rating as indicated on P.C. Board or refer to parts list. An extra fuse should be stored in the clips marked "SPARE".
9. Cabinet panels
 - 9.1 Bolt-on cabinet panels are individually replaceable.

NOTES





Ruffneck™

PLEASE ADHERE TO INSTRUCTIONS IN THIS MANUAL

Failure to do so may be dangerous and may void certain provisions of your warranty.

For further assistance, please call 24hr hotline: 1-800-661-8529 (U.S.A. and Canada)

Please have model and serial numbers available before calling.

WARRANTY: Under normal use the Company warrants to the purchaser that defects in material or workmanship will be repaired or replaced without charge for a period of 36 months from date of shipment. Any claim for warranty must be reported to the sales office where the product was purchased for authorized repair or replacement within the terms of this warranty.

Subject to State or Provincial law to the contrary, the Company will not be responsible for any expense for installation, removal from service, transportation, or damages of any type whatsoever, including damages arising from lack of use, business interruptions, or incidental or consequential damages.

The Company cannot anticipate or control the conditions of product usage and therefore accepts no responsibility for the safe application and suitability of its products when used alone or in combination with other products. Tests for the safe application and suitability of the products are the sole responsibility of the user.

This warranty will be void if, in the judgment of the Company, the damage, failure or defect is the result of:

- Vibration, radiation, erosion, corrosion, process contamination, abnormal process conditions, temperature and pressures, unusual surges or pulsation, fouling, ordinary wear and tear, lack of maintenance, incorrectly applied utilities such as voltage, air, gas, water, and others or any combination of the aforementioned causes not specifically allowed for in the design conditions or,
- Any act or omission by the Purchaser, its agents, servants or independent contractors which for greater certainty, but not so as to limit the generality of the foregoing, includes physical, chemical or mechanical abuse, accident, improper installation of the product, improper storage and handling of the product, improper application or the misalignment of parts.

No warranty applies to paint finishes except for manufacturing defects apparent within 30 days from the date of installation.

The Company neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the product(s).

The Purchaser agrees that all warranty work required after the initial commissioning of the product will be provided only if the Company has been paid by the Purchaser in full accordance with the terms and conditions of the contract.

The Purchaser agrees that the Company makes no warranty or guarantee, express, implied or statutory, (including any warranty of merchantability or warranty of fitness for a particular purpose) written or oral, of the Article or incidental labour, except as is expressed or contained in the agreement herein.

LIABILITY: Technical data contained in the catalog or on the website is subject to change without notice. The Company reserves the right to make dimensional and other design changes as required. The Purchaser acknowledges the Company shall not be obligated to modify those articles manufactured before the formulation of the changes in design or improvements of the products by the Company.

The Company shall not be liable to compensate or indemnify the Purchaser, end user or any other party against any actions, claims, liabilities, injury, loss, loss of use, loss of business, damages, indirect or consequential damages, demands, penalties, fines, expenses (including legal expenses), costs, obligations and causes of action of any kind arising wholly or partly from negligence or omission of the user or the misuse, incorrect application, unsafe application, incorrect storage and handling, incorrect installation, lack of maintenance, improper maintenance or improper operation of products furnished by the Company.

Visit www.thermon.com to contact a Thermon representative near you.

HEAD OFFICE: 7171 SOUTHWEST PKWY | BUILDING 300 SUITE 200 | AUSTIN, TX | 78735 | UNITED STATES
RUFFNECK: 5918 ROPER ROAD | EDMONTON, AB | T6B-3E1 | CANADA

AVERTISSEMENT! Lisez tous les avis d'information importants des pages 2 à 4



Appareils de chauffage électriques à air pulsé pour zones dangereuses

Série FX6

Instructions d'installation,
d'utilisation et d'entretien



Codification du modèle

FX6 – 480		3	60 – 350		–	T	
Séries du modèle	Tension du dispositif de chauffage 208 V, 240 V, 480 V, 600 V	Hertz 50, 60	Kilowatts du dispositif de chauffage ÷ 10				
6e génération		Phase 1, 3				T – Thermostat XT-211 avec boîte de jonction fine Thermostat XT-411 avec grande boîte de jonction D – Sectionneur intégré	C – Revêtement Heresite® A – Renceinte en acier inoxydable U – Ventilateur continu L – Grande boîte de jonction P – Témoin lumineux intégré



Emplacements approuvés

Les appareils de chauffage électriques à air pulsé sont certifiés cUL_{US} pour les zones suivantes :
Catégorie I, Division 1 & 2, Groupes C & D; Catégorie II, Division 1, Groupes E, F & G; Catégorie II, Division 2, Groupes F & G; Catégorie I, Zones 1 & 2, Groupes IIA & IIB; Zones 20, 21 & 22;
Température Code T3B 329°F (165°C) (modèles 50 Hz et 60 Hz)

Pour plus de détails sur les zones dangereuses présentant un risque d'explosion, consultez le Code canadien de l'électricité, partie 1, section 18 ou les articles 500 à 516 du Code national de l'électricité.

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AVERTISSEMENT

AVERTISSEMENT. Un réglage, une modification, des vibrations excessives, un service ou un entretien incorrect de l'installation peuvent causer des dommages matériels, des blessures ou la mort. Veuillez lire attentivement les instructions d'installation, d'utilisation et d'entretien avant d'installer, d'utiliser ou d'entretenir cet équipement.



AVERTISSEMENT

AVERTISSEMENT. Ne faites pas fonctionner le radiateur en présence de gaz, vapeurs, poussières ou fibres combustibles à moins que le radiateur ne soit spécifiquement marqué pour l'emplacement dangereux et que la température de fonctionnement du radiateur ne dépasse pas la valeur nominale du code de température. Ne pas le faire peut entraîner une explosion de l'équipement pouvant causer des dommages matériels, des blessures corporelles mortelles, voire la mort.

De plus, le radiateur ne peut pas fonctionner à des tensions supérieures à la valeur nominale spécifiée sur la plaque signalétique. Un fonctionnement à des tensions plus élevées entraînera une augmentation de la consommation en ampères, ce qui entraînera des températures élevées. Une surface exposée à des températures élevées peut provoquer un incendie ou des blessures corporelles.

Le non-respect de ce manuel d'instructions, y compris, mais sans s'y limiter, la procédure d'installation, la procédure de fonctionnement et les exigences de maintenance, peut entraîner une explosion de l'équipement, un incendie et/ou des blessures corporelles.



AVERTISSEMENT

AVERTISSEMENT. Une protection appropriée contre les défauts à la terre, telle qu'un disjoncteur de fuite à la terre ou un GFCI, est requise pour cet équipement, ainsi que le respect de tous les codes et normes électriques applicables. Le fait de ne pas assurer une protection contre la mise à la terre ou la mise à la masse électrique pendant l'utilisation de cet équipement peut entraîner des dommages matériels, des blessures ou la mort.

Remarques spéciales

Les remarques spéciales suivantes mettent en évidence des informations importantes dans les sections d'installation, d'utilisation et d'entretien.



ATTENTION

Ce symbole indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut causer des blessures corporelles ou endommager l'équipement.



ATTENTION

Ce symbole indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, pourrait présenter un risque d'électrocution.



AVERTISSEMENT

Ce symbole indique une situation très dangereuse qui, si elle n'est pas évitée, pourrait causer des blessures graves ou la mort.

A. LISTE DE CONTRÔLE POUR L'ENTRETIEN DE L'APPAREIL DE CHAUFFAGE

Modèle d'appareil de chauffage _____ Date de l'entretien _____

Numéro de série _____ Entretien effectué par _____

Commentaires _____



AVERTISSEMENT

Débrancher l'appareil de chauffage de la source de courant du sectionneur général ou de la boîte à fusibles avant d'ouvrir les boîtiers ou de procéder à son entretien.

SI UN ENTRETIEN EST EFFECTUÉ AU NIVEAU DU SECTIONNEUR GÉNÉRAL, s'assurer que le courant a été coupé à la boîte à fusibles ou au panneau principal.

Bloquer le commutateur à la position « **OFF** » (ouvert), et/ou étiqueter le commutateur pour éviter une mise sous tension imprévue.

Ce dispositif de chauffage doit être entretenu uniquement par un technicien ayant une expérience avec les équipements de chauffage en zones dangereuses.

A.1 Grille d'entretien préventif

Les cellules de la grille avec des cases à cocher à l'intérieur correspondent aux mesures d'entretien minimales à réaliser aux périodes indiquées.

À faire	Description	Entretien régulier				Entretien intensif			
		Démarrage annuel	Mensuel	Tous les 3 mois	Tous les 6 mois	Démarrage annuel	Mensuel	Tous les 3 mois	Tous les 6 mois
Nettoyer	Enlever la poussière à l'aide d'air comprimé. Ne pas pulvériser d'eau ni de solvants. Ne pas plonger dans de l'eau ou des solvants. Nettoyer les éléments suivants : 1. Moteur 2. Grilles d'aération 3. Tubes à ailettes 4. Ventilateur 5. Protecteur du ventilateur	☐		☐		☐		☐	
Contrôler	1. Le fonctionnement sans faille et silencieux du moteur 2. La bonne orientation et l'étanchéité des grilles d'aération 3. L'étanchéité de tous les capots antidéflagrants 4. La présence de fuites dans le limiteur de pression. Consulter Figure 1, page 5 et se référer à A.3 Annuel, page 4 pour des instructions supplémentaires.	☐				☐		☐	
Inspection électrique	1. Inspecter toutes les connexions des bornes et les conducteurs.* Resserrer les raccordements lâches. Remplacer les conducteurs dont l'isolation est endommagée et le câblage effiloché.*	☐			☐	☐		☐	
	2. Inspecter les contacts du contacteur : S'il est très endommagé, brûlé ou obturé par soudage, le remplacer par un contacteur acheté auprès du constructeur.*	☐			☐	☐		☐	
	3. Vérifier les fusibles : Le bon calibre et le type de fusible sont indiqués sur la carte de circuit imprimé. Toujours s'assurer qu'un fusible de secours est disponible sur la carte de circuit imprimé.*	☐			☐	☐		☐	
Inspection mécanique	1. Fuite de liquide : Inspecter l'indicateur de l'étiquette du limiteur de pression (PRD) pour détecter des signes de rupture et de dégradation. Si une fuite de liquide est constatée sur l'appareil de chauffage, le débrancher de l'alimentation électrique et remplacer le noyau immédiatement.*		☐			☐	☐		
	2. Boîtiers : L'intérieur de chaque boîtier doit être propre, sec et sans corps étrangers.*	☐				☐		☐	
	3. Roulement et jeu de l'arbre moteur : Si le fonctionnement du moteur n'est pas silencieux et régulier et qu'il présente un jeu excessif, remplacer le moteur.*	☐				☐		☐	

*Pour les plates-formes de forage, cela doit être fait à chaque déplacement de la plate-forme.

A.2 Périodique (avant et selon les besoins pendant la période de chauffage)

• Nettoyer

- ☐ Moteur
- ☐ Grilles d'aération
- ☐ Tubes à ailettes
- ☐ Ventilateur
- ☐ Protecteur du ventilateur

• Contrôler

- ☐ Le fonctionnement sans faille et silencieux du moteur
- ☐ La bonne orientation et l'étanchéité des grilles d'aération
- ☐ L'étanchéité de tous les capots antidéflagrants
- ☐ La présence de fuites dans le limiteur de pression. Consulter Figure 1, page 5 et se référer à A.3 Annuel, page 4 pour des instructions supplémentaires.

A.3 Annuel (avant la période de chauffage)

• Contrôle mécanique

- ☐ Fuite de liquide. Le noyau de l'appareil de chauffage est chargé sous vide et contient un fluide caloporteur breveté. Inspecter l'indicateur de l'étiquette du limiteur de pression (PRD) pour détecter des signes de rupture et de dégradation. Si le papier est déchiré, désintégré ou altéré, cela indique que du liquide s'est échappé du noyau. Si une fuite de liquide se produit au niveau de l'appareil de chauffage, le déconnecter de l'alimentation électrique et faire remplacer le noyau. Un noyau de rechange fourni par le constructeur peut être expédié directement du stock. Se référer à la Section Repair & Replacement, page 18 pour plus de détails.

- ☐ Tous les boîtiers. L'intérieur des boîtiers doit être propre, sec et sans corps étrangers.

* Les couvercles filetés doivent être installés et serrés à la main.

Remarque : Les jointures des boîtiers sont conçus pour un contact métal à métal. Ne pas utiliser de joint ou de produit d'étanchéité dans les joints. Une graisse est appliquée sur les joints en usine et doit être laissée intacte.

- ☐ Jeu de roulement de l'arbre moteur. Remplacer le moteur si le jeu est excessif ou si le moteur ne fonctionne pas de manière silencieuse et régulière. Les roulements du moteur sont lubrifiés en permanence.
- ☐ Ventilateur. Le remplacer immédiatement s'il est fissuré ou endommagé.
- ☐ Grilles d'aération. Les vis doivent être serrées. Les grilles d'aération ne doivent pas être complètement fermées ni dépasser les butées.
- ☐ Solidité de tout le matériel. Tous les écrous et boulons, y compris le matériel de montage, doivent être serrés.

- ☐ Allumer l'appareil de chauffage pendant au moins cinq minutes. Vérifier si de l'air chaud sort de l'appareil de chauffage par les grilles d'aération. Il est normal que l'appareil émette des craquements ou des bruits de tintement pendant le démarrage.

• Contrôle électrique

- ☐ Toutes les connexions des bornes et les conducteurs. Resserrer les raccordements lâches. Remplacer les conducteurs dont l'isolation est endommagée.
- ☐ Inspecter les contacts du contacteur. S'il est très endommagé, brûlé ou obturé par soudage, le remplacer par un contacteur acheté auprès du constructeur. Pour les conditions d'utilisation rigoureuses, notamment dans les régions arctiques ou sur les plates-formes de forage, Therman recommande de remplacer le contacteur tous les deux ans.
- ☐ Fusibles. Le calibre et le type de fusible sont indiqués sur la carte du circuit imprimé. Le bon fusible doit se trouver dans le porte-fusible actif. Il est recommandé de conserver un fusible de rechange dans le porte-fusible de rechange.
- ☐ Tous les conduits antidéflagrants. Remplacer les conduits endommagés. Tous les raccords de conduit filetés doivent avoir un engagement minimum de 5 tours. Les conduits à filetage droit doivent dépasser d'au moins 1/16 po (1,6 mm) à l'intérieur des boîtiers. Les raccords à filetage conique doivent être serrés à la main.
- ☐ Résistance électrique sur tous les pieds côté charge. La lecture doit être équilibrée ($\pm 5\%$).



Pour obtenir de l'aide, veuillez appeler
Numéro sans frais : 1 800 661-8529 (24 h)
États-Unis et Canada

B. AVIS IMPORTANTS



AVERTISSEMENT. Lire et respecter les consignes suivantes. Le non-respect de ces consignes pourrait causer des blessures graves ou mortelles. LA GARANTIE SERA NULLE.



AVERTISSEMENT. Une protection appropriée contre les défauts de mise à la terre, tel qu'un disjoncteur de fuite à la terre (DDFT), doit être utilisé avec cet équipement. Le fait de ne pas assurer la protection contre la mise à la terre ou la liaison électrique pendant l'utilisation de cet équipement peut entraîner des dommages matériels, des blessures corporelles ou la mort. En outre, cet équipement doit être correctement mis à la terre, conformément à tous les codes et normes électriques applicables.

1. Lire et respecter toutes les instructions de ce manuel.
2. L'appareil de chauffage doit être utilisé uniquement dans des environnements dont la température d'allumage est supérieure à la température de fonctionnement nominale maximale de l'appareil, comme indiqué sur la plaque signalétique de l'appareil. Se référer aux codes électriques applicables pour des informations supplémentaires.
3. L'appareil de chauffage doit être utilisé uniquement dans les zones dangereuses indiquées sur la plaque signalétique de l'appareil.
4. L'appareil de chauffage doit être utilisé à l'intérieur, au sec, uniquement. Ne pas le plonger dans de l'eau. Ne pas l'entreposer ou l'utiliser dans des endroits exposés à la pluie ou à la neige.
5. L'appareil de chauffage doit être raccordé et entretenu uniquement par un électricien qualifié et doté d'une bonne expérience en matière d'équipement pour zones dangereuses.
6. L'installation et le câblage de l'appareil de chauffage doivent respecter tous les codes applicables.
7. Débrancher l'appareil de chauffage de la source de courant au sectionneur général ou à la boîte à fusibles avant d'ouvrir les boîtiers ou de procéder à son entretien. SI UN ENTRETIEN EST EFFECTUÉ AU NIVEAU DU SECTIONNEUR GÉNÉRAL, s'assurer que le courant a été coupé à la boîte à fusibles ou au panneau principal. Bloquer le commutateur à la position « OFF » (ouvert), et/ou étiqueter le commutateur pour éviter une mise sous tension imprévue.
8. Cet appareil de chauffage est équipé d'une limite haute de surchauffe bimétallique. Il est de type à réinitialisation automatique et, par conséquent, l'appareil peut redémarrer sans avertissement. L'appareil est équipé d'une limite haute secondaire qui déclenchera un disjoncteur interne en cas de surchauffe. Si la limite haute secondaire s'active, l'appareil doit être inspecté par un personnel autorisé. L'appareil ne doit pas être utilisé si l'un des dispositifs de protection contre les surchauffes est désactivé ou contourné.
9. La pression de purge du limiteur de pression (PRD) est réglée en usine. Ne pas toucher à l'écrou de blocage. (Voir Figure 1, page 5.)
10. Ne pas toucher ou enlever l'étiquette d'avertissement sur le PRV.
11. L'appareil de chauffage est équipé d'un dispositif de secours de décharge de surpression. Il s'agit d'un dispositif à usage unique. S'il est activé, ne pas contourner ce dispositif pour faire fonctionner l'appareil. L'activation de ce dispositif nécessite la mise hors service immédiate de l'appareil pour contrôle.
12. Ne faire fonctionner l'appareil que lorsqu'il est monté de manière permanente en position verticale. Se référer à Section D. Installation, page 7 pour plus de détails.
13. L'appareil de chauffage doit être maintenu propre. Si l'appareil fonctionne dans un environnement sale, nettoyer régulièrement les tubes à ailettes, le ventilateur et la grille de protection du ventilateur. Respecter les procédures d'entretien recommandées. Se référer à Section A. Liste de contrôle pour l'appareil de chauffage, page 3 pour plus de détails.
14. Le noyau de l'appareil de chauffage est chargé sous vide et contient un fluide caloporteur breveté. Si une fuite de liquide se produit au niveau de l'appareil de chauffage, le débrancher de l'alimentation électrique et remplacer le noyau par un noyau fourni par le constructeur. Se référer à Section I. Réparation et remplacement, page 18 pour plus de détails.
15. Ne pas faire fonctionner l'appareil si l'une des grilles d'aération est complètement fermée ou si elle a dépassé sa butée.
16. Ne pas faire fonctionner l'appareil dans des environnements corrosifs pour l'acier ou l'aluminium.
17. Ne pas faire fonctionner l'appareil de chauffage dans des températures ambiantes supérieures à 104 °F (40 °C).
18. Utiliser uniquement des pièces de rechange approuvées par le constructeur.
19. Se reporter aux codes électriques applicables pour les exigences d'étanchéité des conduits installés sur place. Les conduits installés en usine ne nécessitent aucune autre étanchéité.
20. Lors du démarrage, des bruits de craquement ou de tintement peuvent se produire dans le noyau de l'appareil de chauffage. Ceci est normal.
21. L'air évacué près de la partie inférieure de l'appareil de chauffage peut être plus chaud que la partie supérieure. Ceci est normal.
22. Pour toute question ou préoccupation concernant l'appareil de chauffage, contacter le constructeur. Se référer à la couverture arrière de ce manuel pour plus de détails.

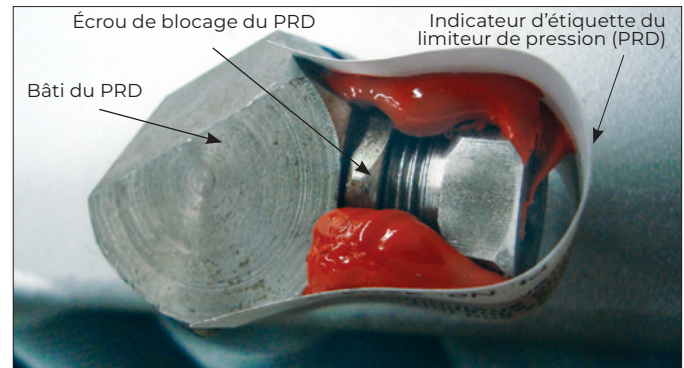


Figure 1

C. CONSEILS DE DÉPANNAGE

1. L'appareil de chauffage ne fonctionne pas.
 - 1.1 Vérifier tous les fusibles dans le boîtier de commande de l'appareil de chauffage.
 - 1.2 Vérifier le sectionneur à distance et le disjoncteur.
 - 1.3 Vérifier la tension fournie à l'appareil de chauffage. Se reporter à la plaque signalétique pour connaître les exigences relatives à la tension.
 - 1.4 Vérifier le thermostat en le tournant et vérifier la continuité avec un multimètre.
 - 1.5 Vérifier l'état de l'interrupteur sectionneur si l'appareil en est équipé. Mesurer la continuité à travers le sectionneur en enclenchant l'interrupteur.
 - 1.6 Vérifier la présence d'un fil de liaison entre les bornes 5 et 6 du bornier situé dans le boîtier de commande.
 - 1.7 Vérifier que le disjoncteur interne n'est pas déclenché. S'il est déclenché, c'est une indication qu'une surchauffe s'est produite. L'appareil de chauffage doit être soigneusement contrôlé par un personnel qualifié pour s'assurer qu'il est en bon état de marche avant de réinitialiser ce dispositif.
2. Le contacteur fait du bruit.
 - 2.1 Vérifier la tension d'alimentation.
 - 2.2 Vérifier les raccordements. Resserrer tous les raccordements électriques lâches.
 - 2.3 Vérifier la continuité du thermostat (Voir 1.4, page 6). Si le thermostat n'interrompt pas la continuité, remplacer le thermostat.
3. Le contacteur est brûlé ou soudé.
 - 3.1 Vérifier s'il y a des traces de brûlure ou un noircissement sur le contacteur. Remplacer le contacteur.
 - 3.2 Vérifier l'alimentation entrante dans l'appareil de chauffage pour s'assurer qu'il n'y a pas de fluctuation de tension.
4. L'échangeur de chaleur est sale.
 - 4.1 Nettoyer l'échangeur de chaleur à l'aide d'air comprimé.
5. Limiteurs de pression.
 - 5.1 Si des signes indiquent que le limiteur de pression a libéré du liquide, que l'indicateur du limiteur de pression est cassé, que le trou de sortie du limiteur de pression est noirci ou que des taches de liquide sont visibles sur la grille d'aération supérieure, arrêter immédiatement l'appareil. L'activation nécessite que l'appareil soit mis hors service pour être inspecté par du personnel autorisé. Ne pas contourner les dispositifs de surpression pour faire fonctionner l'appareil. Verrouiller et étiqueter l'appareil conformément aux procédures du site.
 - 5.2 Vérifier si le débit d'air est restreint, si le moteur est défectueux, si le thermostat est cassé ou si la limite haute fonctionne mal.
 - 5.3 Il existe un limiteur de pression secondaire pour assurer la sécurité de l'appareil.
 - 5.4 Si le limiteur de pression secondaire est ouvert, mettre immédiatement l'appareil hors service. Il s'agit d'un dispositif à usage unique. L'activation nécessite que l'appareil soit mis hors service pour être inspecté par du personnel autorisé. Ne pas contourner le dispositif de surpression pour faire fonctionner l'appareil. Verrouiller et étiqueter l'appareil conformément aux procédures du site.
6. L'appareil de chauffage est froid en haut et chaud en bas.
 - 6.1 Il est possible que le noyau ne soit plus sous vide. Vérifier les limiteurs de pression pour déceler des signes de perte de liquide et vérifier que l'indicateur de l'étiquette des limiteurs de pression n'est pas endommagé. Si les limiteurs de pression se sont relâchés, envoyer l'appareil en réparation ou remplacer le noyau.
 - 6.2 Si le limiteur de pression n'indique pas de perte de liquide, l'appareil de chauffage devrait fonctionner normalement.
 - 6.3 La température ambiante peut être trop basse. Si la température ambiante est très froide, il est normal que le haut du noyau soit plus froid que le bas.
7. Les cycles de l'appareil se font à limite haute; l'appareil se met en marche et s'arrête en moins de 5 minutes.
 - 7.1 Vérifier si les limiteurs de pression ont relâché du liquide. Le noyau peut avoir perdu la majorité ou la totalité de son liquide. Si le limiteur de pression s'est relâché, l'appareil doit être inspecté par du personnel autorisé.
 - 7.2 Le noyau peut être sale, le ventilateur peut ne pas fonctionner ou tourner dans le mauvais sens (le ventilateur doit tourner dans le sens des aiguilles d'une montre vu de l'avant de l'appareil); des objets peuvent être coincés dans l'échangeur de chaleur pour le séchage ou le réchauffement; retirer tout objet de l'échangeur.
8. Le disjoncteur différentiel de fuite à la terre (DDFT) se déclenche sur le panneau principal ou l'appareil de chauffage brûle les fusibles.
 - 8.1 Vérifier si vous avez un fusible de la bonne intensité nominale.
 - 8.2 Vérifier le limiteur de pression pour déceler des signes de perte de liquide et vérifier que l'étiquette du limiteur de pression n'est pas endommagée.
 - 8.3 Si rien n'est observable, envoyer l'appareil de chauffage pour réparation.
 - 8.4 L'échangeur de chaleur doit refroidir pour que l'interrupteur se mette en position « **ON** » (marche).
 - 8.5 Contacter le constructeur si une assistance supplémentaire est requise.
9. Le ventilateur tourne, mais très peu d'air sort du devant de l'appareil de chauffage.
 - 9.1 Vérifier la rotation du ventilateur et s'assurer que le ventilateur tourne dans le sens des aiguilles d'une montre quand on le regarde du devant de l'appareil de chauffage. Se référer à la section Installation ci-dessous pour plus d'informations.
 - 9.2 Vérifier la résistance aérodynamique du moteur et s'assurer qu'elle est dans la limite de tolérance.
 - 9.3 Vérifier les vis de l'ensemble de pales du ventilateur pour s'assurer que les pales sont fixées solidement à l'arbre du moteur et qu'elles ne sont pas desserrées.

D. INSTALLATION Recommandations générales pour l'installation et le câblage

Tous les codes applicables doivent être respectés. Pour un fonctionnement optimal, l'appareil de chauffage doit être installé de la façon suivante :

D.1 Mécanique

1. Emplacement

- 1.1 Il n'y a pas d'obstructions qui pourraient entraver l'entrée ou l'évacuation d'air de l'appareil.
- 1.2 L'évacuation d'air est dirigée vers des zones ouvertes et non vers les occupants.
- 1.3 L'évacuation d'air n'est pas dirigée vers un thermostat.
- 1.4 L'évacuation d'air est dirigée vers des zones de perte de chaleur, comme les portes et les fenêtres (voir Figure 2, page 7).
- 1.5 L'évacuation d'air est dirigée le long des murs extérieurs avec un léger angle (voir Figure 2, page 7).
- 1.6 S'il est important de protéger l'équipement contre le gel, diriger l'évacuation vers l'équipement.
- 1.7 Les courants d'évacuation d'air sont reliés entre eux et créent un flux d'air circulaire. Il n'est pas nécessaire que le jet d'air de l'appareil de chauffage atteigne le suivant (voir Figure 2, page 7).

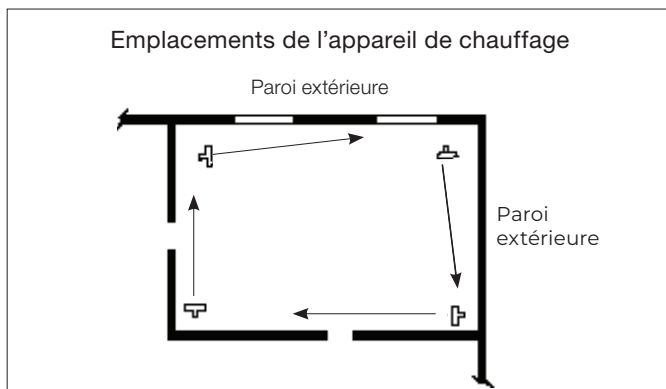


Figure 2

2. Montage

- 2.1 L'appareil de chauffage doit être monté en permanence en position verticale et à niveau pour pouvoir fonctionner. Voir Figure 3, Figure 4 et Figure 5 à la page 7 and 8 pour les angles d'inclinaison maximum, les dégagements d'installation et les dimensions physiques. Pour faciliter l'installation, divers kits de montage sont disponibles en usine.
- 2.2 La structure de montage doit être assez solide pour :
 - Supporter le poids de l'appareil de chauffage (se référer à Section F. Spécifications, page 14).
 - Offrir suffisamment de rigidité pour empêcher la vibration.
 - Résister aux situations difficiles telles que les installations transportables.

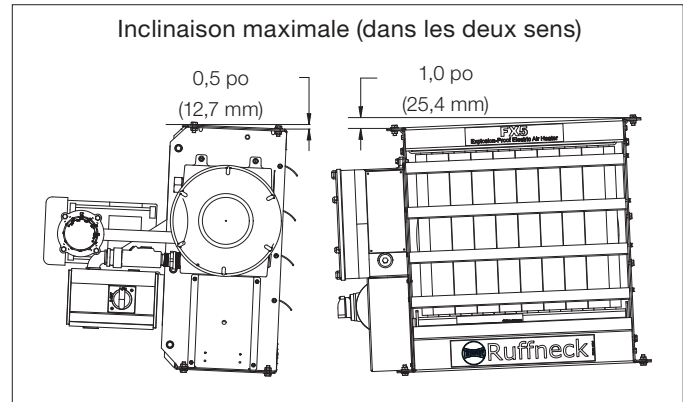


Figure 3

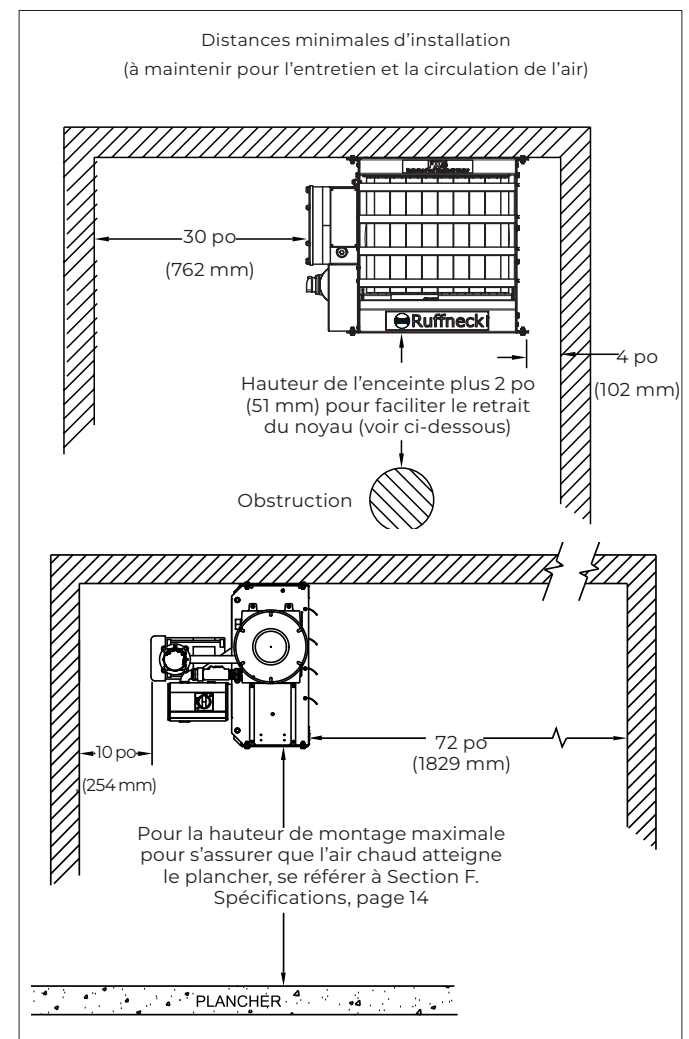
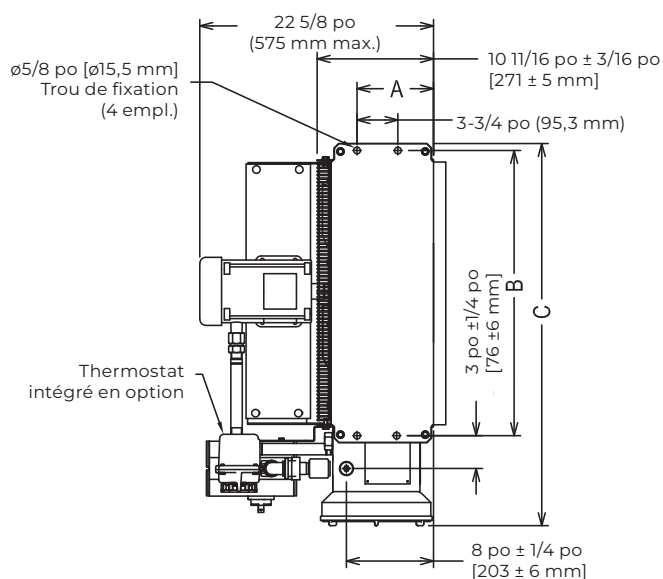


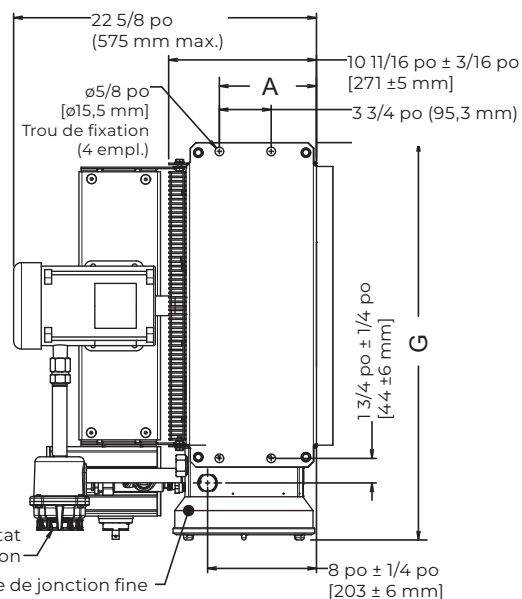
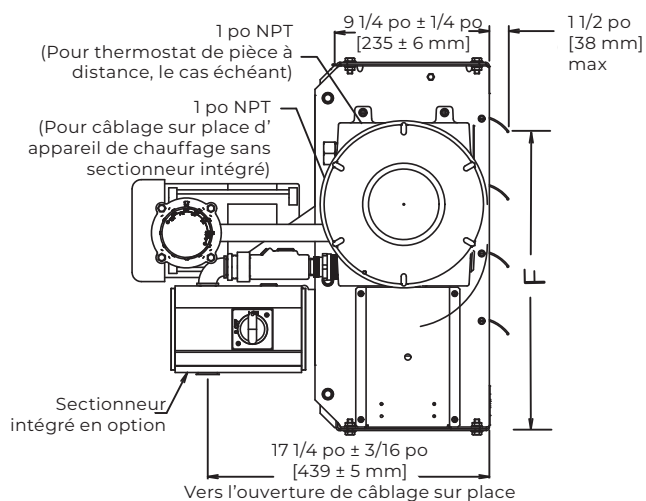
Figure 4

Tolérances sur les dimensions $\pm 1/8$ po [± 3 mm]
Sauf indication contraire.

DIM.	kW	2,5–10	12,5–20	20,9–35	DIM. TOL. $\pm$
A	po	7	7	7	1/8
	mm	178	178	178	3
B	po	18–3/16	22–5/16	26–1/4	1/8
	mm	462	566	667	3
C	po	27	31	35	3/16
	mm	686	787	889	4
D	po	19	23	27	1/8
	mm	484	586	688	3
E	po	19–7/16	23–7/16	27–7/16	3/8
	mm	492	596	697	10
F	po	17–1/2	19–1/2	21–13/16	5/16
	mm	444	495	554	8
G	po	24–5/8	28–5/8	32–5/8	3/16
	mm	625	727	828	4



Grand boîtier de commande



Boîtier de commande fin

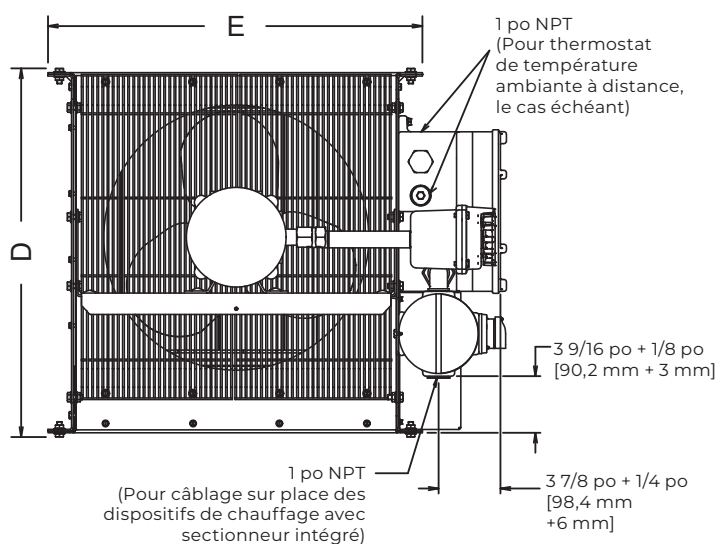


Figure 5



AVERTISSEMENT

AVERTISSEMENT. Débrancher l'appareil de chauffage de la source de courant du sectionneur général ou de la boîte à fusibles avant d'ouvrir les boîtiers ou de procéder à son entretien. SI UN ENTRETIEN EST EFFECTUÉ AU NIVEAU DU SECTIONNEUR GÉNÉRAL, s'assurer que le courant a été coupé à la boîte à fusibles ou au panneau principal. Bloquer le commutateur à la position « OFF » (ouvert), et/ou étiqueter le commutateur pour éviter une mise sous tension inattendue. L'installation et le câblage de l'appareil de chauffage doivent respecter tous les codes applicables.

1. Généralités

- 1.1 Utiliser uniquement des conducteurs en cuivre et des méthodes de câblage antidéflagrantes approuvées lors de l'installation. Se référer à la section E. Données techniques du FX6, page 12 to 13 et à la plaque signalétique de l'appareil de chauffage pour connaître le calibre des conducteurs.
- 1.2 Une protection externe contre les surtensions est requise. Se référer à la section E. Données techniques du FX6, page 12 to 13 et à la plaque signalétique de l'appareil de chauffage pour connaître le calibre des conducteurs. La tension d'alimentation doit se situer dans une fourchette de 10 % de la tension indiquée sur la plaque signalétique.
- 1.3 L'appareil de chauffage doit être installé par du personnel qualifié dans le strict respect des codes de l'électricité.
- 1.4 Tous les chauffages sont livrés précâblés en usine et prêts à être raccordés directement aux câbles d'alimentation électrique.
- 1.5 L'appareil doit être équipé de fusibles individuels, de préférence des fusibles à retardement de classe J pour une sécurité maximale. Sauf indication contraire dans votre code local, la taille du fusible doit être de 125 % du courant de ligne ou de la taille supérieure suivante.

2. Câblage sur place

- 2.1 Les conducteurs d'alimentation, le conducteur de terre et les conducteurs du thermostat de pièce (voir D.3 Schéma de câblage, page 11) passent tous par l'ouverture 1 po NPT (voir Figure 6, page 9) et doivent être câblés dans le boîtier de commande (voir Figure 7, page 9).

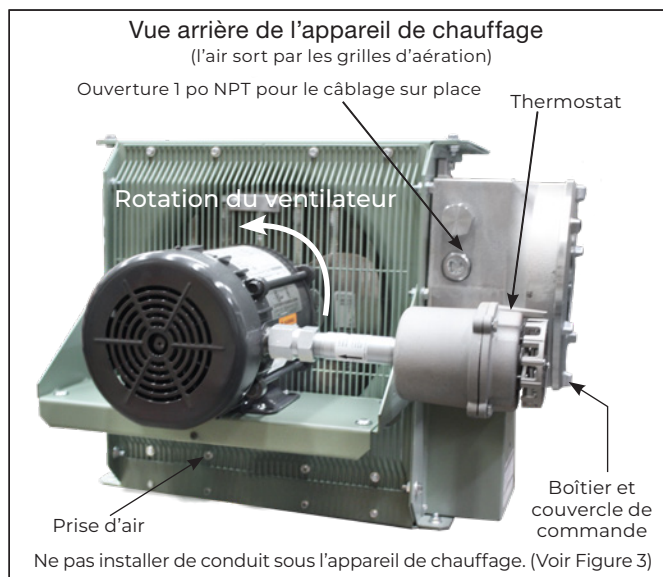


Figure 6

- 2.2 L'appareil de chauffage peut être livré avec un thermostat de pièce intégré installé en usine (voir Figure 8, page 10). Sur les appareils de chauffage non équipés de cette option, il est recommandé d'utiliser un thermostat de pièce à distance. Raccorder les conducteurs du thermostat de pièce à distance au bornier de la carte de circuit imprimé marqué « TSTAT ». Le thermostat utilisé avec cet appareil de chauffage doit :
 - Être de type antidéflagrant
 - Être classé 125 V minimum
 - Avoir une capacité minimale de 2 ampères
 - S'ouvrir lorsque la température augmente

- 2.3 L'appareil de chauffage peut être livré avec un sectionneur général intégré installé en usine. (Voir Figure 8, page 10)

Câblage sur place pour sectionneur général :

- Les conducteurs d'alimentation et le conducteur de terre passent par l'ouverture 1 po NPT du boîtier du sectionneur (voir Figure 8, page 10). Les conducteurs d'alimentation doivent être câblés à l'intérieur du sectionneur. Le conducteur de mise à la terre doit être câblé à la cosse de mise à la terre fixée à l'intérieur du boîtier du sectionneur.
- Le cas échéant, les conducteurs du thermostat de pièce à distance passent par l'ouverture 1 po NPT (voir Figure 8, page 10) et doivent être câblés aux bornes de la carte de circuit imprimé marquées « T'STAT ».
- Pour réduire le risque d'incendie dans des atmosphères dangereuses, les conduits doivent être munis d'un raccord étanche relié à 18 po (457 mm).

- 2.4 Les conduits installés en usine ne nécessitent aucune autre étanchéité. Le sectionneur intégré est scellé en usine.
 - La borne de mise à la terre interne du boîtier de commande (ou du boîtier du sectionneur intégré lorsque cette option est fournie) doit être utilisée comme moyen de mise à la terre de l'équipement. Une borne de mise à la masse externe est prévue pour une connexion de mise à la masse supplémentaire lorsque les autorités locales autorisent ou exigent une telle connexion.

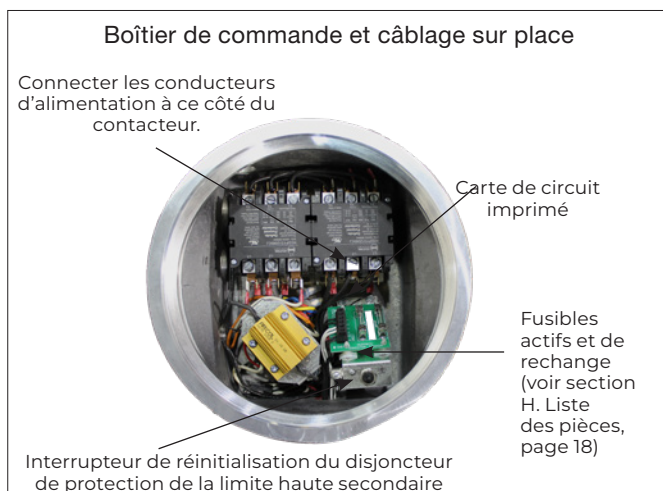


Figure 7

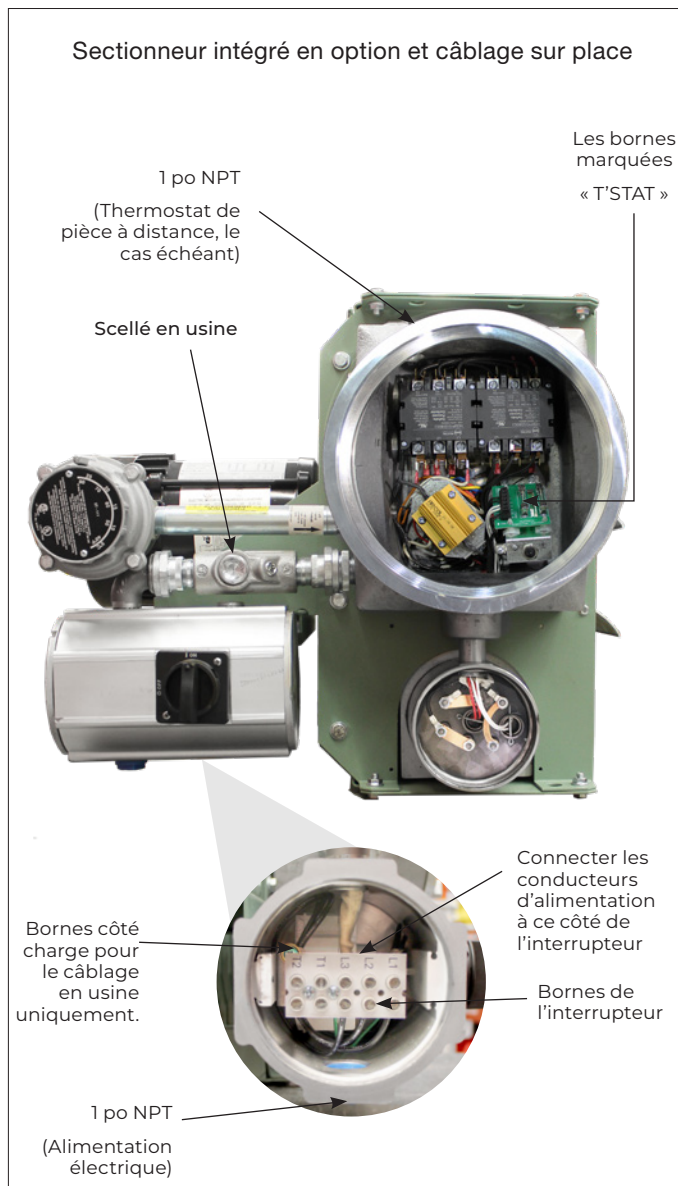


Figure 8

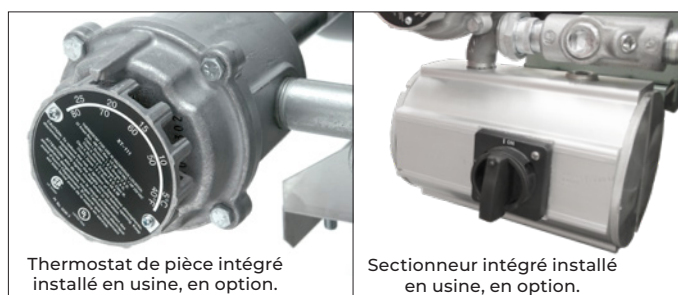


Figure 9

3. Inspection finale

3.1 Avant d'appliquer l'alimentation électrique :

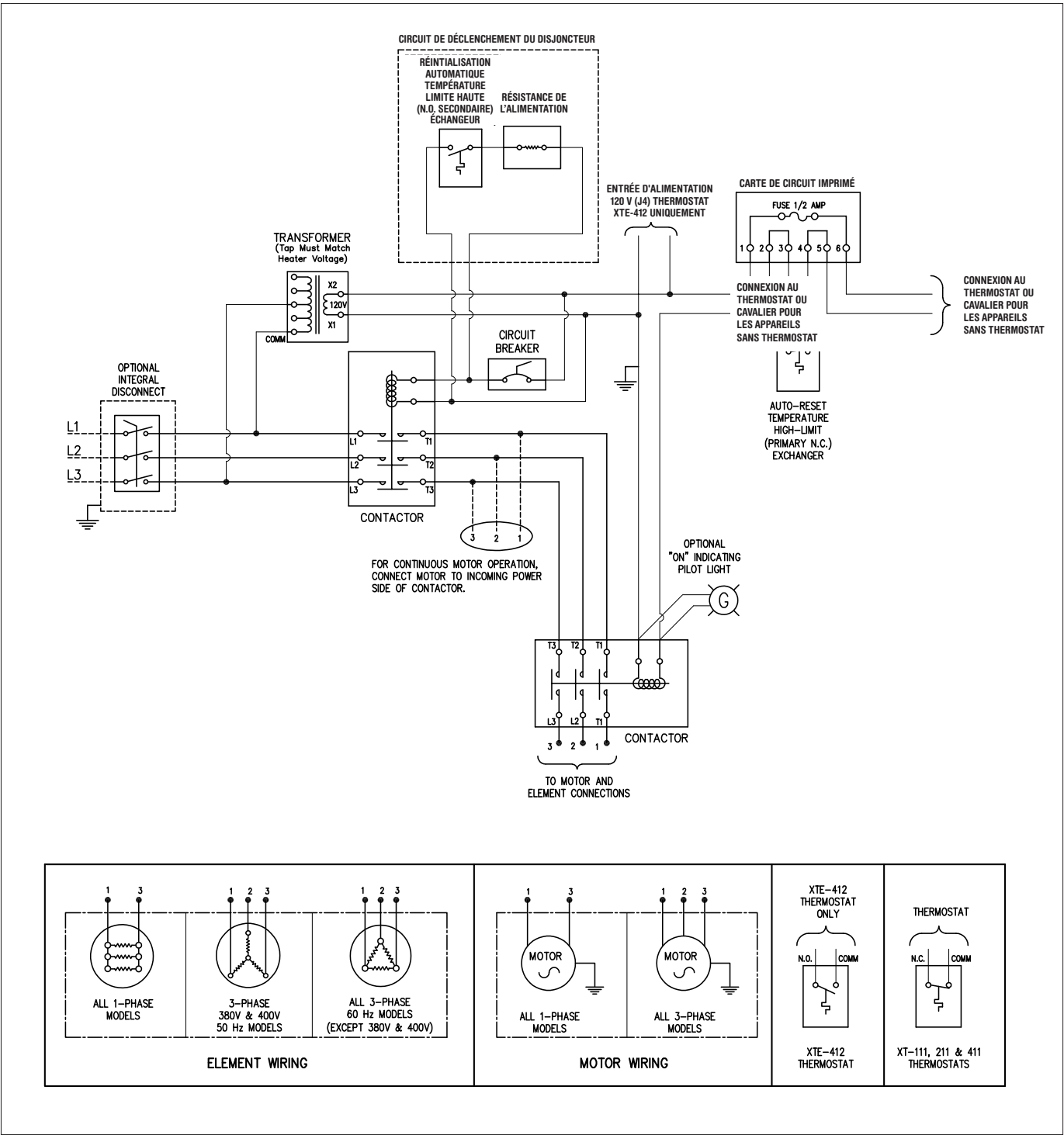
- S'assurer que tous les raccordements sont bien sûrs et qu'ils respectent les exigences du schéma de câblage (voir Schéma de câblage, page 11) et des codes applicables.
- Vérifier si l'alimentation est compatible avec les données de la plaque signalétique de l'appareil de chauffage.
- Enlever tout corps étranger de l'appareil de chauffage.
- Installer tous les couvercles et vérifier que tous les boîtiers sont bien fixés.
- S'assurer que le ventilateur tourne librement. Voir Figure 6, page 9 pour le bon sens de rotation du ventilateur.



AVERTISSEMENT

AVERTISSEMENT. Si l'appareil de chauffage a été entreposé à des températures égales ou inférieures au point de congélation, le fluide caloporteur peut geler. Dans ces circonstances, un cycle d'alimentation de l'appareil de chauffage est nécessaire, soit 30 secondes sous tension, 30 secondes hors tension pendant 3 minutes lors du démarrage initial.

SCHÉMA DE CÂBLAGE DU FX6



E. DONNÉES TECHNIQUES DU FX6

E.1 Modules de chauffage électriques 50 Hz

Modèle	Débit d'air	Tension	Puissance électrique nominale	Phase	Courant nominal max. du moteur	Puissance électrique de l'appareil de chauffage	Courant total	Intensité minimale du circuit	Câble d'alimentation	Taille maximale du fusible	Hausse de la température		Numéro de pièce du kit de noyau	Numéro de pièce du contacteur
	CFM	V	kW			W	A	A	AWG	A	°F	°C		
FX6-220150-025	400	220	2,5	1	4,7	2270	16,1	20,1	10	25	19,8	11,0	12122	13847
FX6-220150-042	400		4,2		4,7	3950	23,8	29,7	10	30	33,2	18,4	12123	
FX6-220150-063	700		6,3		4,7	6050	33,3	41,7	8	45	28,5	15,8	12124	
FX6-220150-084	700		8,4		4,7	8140	42,9	53,6	6	60	37,9	21,1	12125	
FX6-220150-126*	1450	230	12,6	1	4,7	12100	62,0	77,5	4	80	27,5	15,3	12126	
FX6-230150-028	400		2,8		4,1	2480	16,3	20,3	10	25	22,1	12,3	12127	
FX6-230150-046	400		4,6		4,1	4310	24,1	30,1	8	35	36,4	20,2	12128	
FX6-230150-069	700		6,9		4,1	6610	34,1	42,6	8	45	31,2	17,3	12129	
FX6-230150-138*	1450	380	13,8	1	4,1	13200	64,1	80,1	4	90	30,1	16,7	12130	
FX6-380350-025	400		2,5		1,1	2270	4,9	6,1	14	10	19,8	11,0	12136	
FX6-380350-042	400		4,2		1,1	3950	7,5	9,4	14	10	33,2	18,4	12137	
FX6-380350-063	700		6,3		1,1	6050	10,7	13,4	14	15	28,5	15,8	12138	
FX6-380350-084	700		8,4		1,1	8140	13,9	17,3	12	20	37,9	21,1	12139	
FX6-380350-125	1450	400	12,5	3	1,1	12100	20,1	25,1	10	30	27,3	15,1	12140	
FX6-380350-209	3000		20,9		1,1	20300	32,9	41,1	8	45	22,0	12,2	12142	
FX6-400350-028	400		2,8		1,1	2480	5,1	6,4	14	10	22,1	12,3	12143	
FX6-400350-046	400		4,6		1,1	4310	7,7	9,7	14	10	36,4	20,2	12144	
FX6-400350-069	700	415	6,9		1,1	6610	11,1	13,8	14	15	31,2	17,3	12145	
FX6-400350-093	700		9,3		1,1	8900	14,5	18,2	12	20	42,0	23,3	12146	
FX6-400350-139	1450		13,9		1,1	13200	21,2	26,5	10	30	30,3	16,8	12147	
FX6-400350-185	1450		18,5		1,1	17800	27,8	34,8	8	35	40,3	22,4	12148	
FX6-400350-231	3000	440	23,1		1,1	22200	34,5	43,1	8	45	24,3	13,5	12149	
FX6-415350-037	400		3,7	1	1,2	3510	6,4	7,9	14	10	29,3	16,3	12150	
FX6-415350-075	700		7,5		1,2	7240	11,6	14,6	14	15	33,9	18,8	12151	
FX6-415350-149	1450		14,9		1,2	14500	22,0	27,4	10	30	32,5	18,1	12152	
FX6-415350-224	3000		22,4		1,2	21800	32,4	40,5	8	45	23,6	13,1	12153	
FX6-440350-042	400	440	4,2	1	1,2	3950	6,7	8,4	14	10	33,2	18,4	12154	
FX6-440350-084	700		8,4		1,2	8140	12,2	15,3	12	20	37,9	21,1	12155	
FX6-440350-168	1450		16,8		1,2	16300	23,3	29,1	10	30	36,6	20,4	12156	
FX6-440350-210	3000		20,9		1,2	20300	28,7	35,8	8	40	22,1	12,2	12157	

Remarques

* Dépasse la limite du circuit de 48 ampères du NEC 424-22. DS non disponible pour ces unités.

**480 V : Les unités monophasées sont certifiées pour la Catégorie I, Div. 1, Groupe D et Catégorie II, Div. 1 Groupes F et G. Résistance chauffante de -20°C à +40°C. Commande spéciale.

1. Taille minimale du conducteur pour une température ambiante de 86°F (30°C). Adapter le conducteur à la température ambiante. Utiliser une isolation minimale de 194 °F (90 °C).

- L'appareil fonctionne normalement si, à la tension nominale, l'intensité se situe dans une fourchette de 10 % de la valeur indiquée dans ce tableau.
- Le fonctionnement à des tensions inférieures entraînera une baisse de la production de chaleur et de l'intensité.
- Ajouter « T » au numéro de modèle lors de l'ajout d'un thermostat intégré.
- Ajouter « D » au numéro de modèle lors de l'ajout d'un sectionneur intégré.

E.2 Modules de chauffage électriques 60 Hz

Modèle	Tension	Puissance électrique nominale	Phase	Courant nominal max. du moteur	Puissance électrique de l'appareil de chauffage	Courant total	Intensité minimale du circuit	Câble d'alimentation	Taille maximale du fusible	Hausse de la température		Numéro de pièce du kit de noyau	Numéro de pièce du contacteur
	V	kW			W	A	A	AWG	A	°F	°C		
FX6-208160-030	208	3,0	1	4,1	2700	18,5	23,2	10	25	19,0	10,5	12116	13847
FX6-208160-050		5,0		4,1	4700	28,1	35,2	8	40	31,6	17,6	12117	
FX6-208160-075		7,5		4,1	7200	40,2	50,2	6	60	27,9	15,5	12118	
FX6-208160-100*		10,0		4,1	9690	52,2	65,2	6	70	37,2	20,7	12119	
FX6-208360-030		3,0	3	2,3	2700	10,6	13,3	14	15	11,2	6,2	12116	
FX6-208360-050		5,0		2,3	4700	16,2	20,2	10	25	18,6	10,3	12117	
FX6-208360-075		7,5		2,3	7200	23,1	28,9	10	30	27,9	15,5	12118	
FX6-208360-100		10,0		2,3	9700	30,1	37,6	8	40	37,2	20,7	12119	
FX6-208360-150		15		2,3	14400	44,0	55,0	6	60	27,1	15,1	12120	
FX6-240160-030	240	3,0	1	4,1	2700	16,6	20,8	10	25	19,0	10,5	12122	
FX6-240160-050		5,0		4,1	4700	24,9	31,2	8	35	31,6	17,6	12123	
FX6-240160-075		7,5		4,1	7200	35,4	44,2	8	45	27,9	15,5	12124	
FX6-240160-100		10,0		4,1	9700	45,8	57,2	6	60	37,2	20,7	12125	
FX6-240160-150*		15,0	3	4,1	14400	66,6	83,3	4	90	27,1	15,1	12126	
FX6-240360-030		3,0		2,4	2700	9,6	12,0	14	15	19,0	10,5	12122	
FX6-240360-050		5,0		2,4	4700	14,4	18,1	12	20	31,6	17,6	12123	
FX6-240360-075		7,5		2,4	7200	20,5	25,6	10	30	27,9	15,5	12124	
FX6-240360-100		10,0		2,4	9700	26,5	33,1	8	35	37,2	20,7	12125	
FX6-240360-150		15,0		2,4	14400	38,5	48,2	8	50	27,1	15,1	12126	
FX6-480160-030 **	480	3,0	1	0,8	2700	7,1	8,8	14	10	19,0	10,5	12129	
FX6-480160-050 **		5,0		0,8	4700	11,2	14,0	14	15	31,6	17,6	12130	
FX6-480160-075 **		7,5		0,8	7200	16,4	20,5	10	25	27,9	15,5	12131	
FX6-480160-100 **		10,0		0,8	9700	21,6	27,0	10	30	37,2	20,7	12132	
FX6-480160-150 **		15,0		0,8	14400	32,1	40,1	8	45	27,1	15,1	12133	
FX6-480160-200 **		20,0	3	0,8	19400	42,5	53,1	6	60	36,1	20,1	12134	
FX6-480360-030		3,0		1,2	2700	4,8	6,0	14	10	19,0	10,5	12129	
FX6-480360-050		5,0		1,2	4700	7,2	9,0	14	10	31,6	17,6	12130	
FX6-480360-075		7,5		1,2	7200	10,2	12,8	14	15	27,9	15,5	12131	
FX6-480360-100		10,0		1,2	9700	13,2	16,6	12	20	37,2	20,7	12132	
FX6-480360-150		15,0		1,2	14400	19,3	24,1	10	25	27,1	15,1	12133	
FX6-480360-200		20,0		1,2	19400	25,3	31,6	8	35	36,1	20,1	12134	
FX6-480360-250		25,0		1,2	24200	31,3	39,1	8	40	22,0	12,2	12135	
FX6-480360-300		30,0		1,2	29200	37,3	46,7	8	50	26,4	14,6	12136	
FX6-480360-350		35,0		1,2	34200	43,3	54,2	6	60	30,7	17,1	12137	
FX6-600360-030	600	3,0	3	0,7	2700	3,6	4,5	14	10	19,0	10,5	12138	
FX6-600360-050		5,0		0,7	4700	5,5	6,9	14	10	31,6	17,6	12139	
FX6-600360-075		7,5		0,7	7200	7,9	9,9	14	15	27,9	15,5	12140	
FX6-600360-100		10,0		0,7	9700	10,3	12,9	14	15	18,1	20,7	12141	
FX6-600360-150		15,0		0,7	14400	15,2	18,9	12	20	27,1	15,1	12142	
FX6-600360-200		20,0		0,7	19400	20,0	25,0	10	30	36,1	20,1	12143	
FX6-600360-250		25,0		0,7	24200	24,8	31,0	8	35	45,2	25,1	12144	
FX6-600360-300		30,0		0,7	29200	29,6	37,0	8	40	26,4	14,6	12145	
FX6-600360-350		35,0		0,7	34200	34,4	43,0	8	45	30,7	17,1	12146	

- Ajouter « U » au numéro de modèle pour les unités avec option de ventilateur continu.
- Ajouter « A » au numéro de modèle pour les unités avec une enceinte en acier inoxydable.
- Ajouter « L » au numéro de modèle pour l'option grande boîte.
- Ajouter « P » au numéro de modèle lors de l'ajout d'un témoin lumineux intégré.

F. SPÉCIFICATIONS



F.1 Modèles 50 Hz

			kW nominal							
			2,5	3,7 et 4,6	6,3 et 7,5	8,4	12,5 et 12,6	14,9 et 16,7	20,9	22,4
Altitude maximale	pi		12 000	8 000	10 000	7 000	10 000	7 000	10 000	7 000
	m		3 658	2 438	3 048	2 134	3 048	2 134	3 048	2 134
Débit d'air	à 70 °F (CFM)		400		700		1,450		3,000	
	à 21 °C (m ³ /h)		679		1 189		2 463		5 096	
Jet d'air horizontal	pi		13		25		35		60	
	m		4,0		7,6		10,7		18,2	
Hauteur maximale de montage (jusqu'à la face inférieure)	pi		7		10				20	
	m		2,1		3,0				6,1	
Puissance minimale du moteur	HP		1/2							
	kW		0,373							
Diamètre du ventilateur	po		12				16		20	
	mm		305				406		508	
Poids net	sans DS	lb	148				177		212	
		kg	67,1				80,2		96,2	
	avec DS	lb	160				189		224	
		kg	82,5				95,6		101,6	
Poids à l'expédition	sans DS	lb	202				227		263	
		kg	91,6				202,9		119,3	
	avec DS	lb	214				239		275	
		kg	97				108,3		124,7	

Spécifications pour tous les modèles 50 Hz et 60 Hz

1. Classement des emplacements dangereux	Catégorie I, Groupes C et D; Catégorie II, Groupes E, F et G; Code température T3B [329 °F (165 °C)]*	7. Éléments chauffants	Trois éléments à longue durée de vie, à faible consommation et de haute qualité métallique.
2. Boîtiers	NEMA Type 7 et 9. Pour utilisation à l'intérieur, au sec, uniquement. Ne pas le plonger dans de l'eau. Ne pas l'entreposer ou l'utiliser dans des endroits exposés à la pluie ou à la neige.	8. Limite haute de température	Type à réinitialisation automatique, bimétallique à action rapide, activé par la hausse de température. Classé 100 000 cycles à 10 ampères, gère 0,128 ampère.
3. Type de moteur	Antidéflagrant. Avec protection thermique. Roulements à billes lubrifiés en permanence.	9. Limite haute de la température de secours	Type à réinitialisation automatique, bimétallique à action rapide, désactivé par la hausse de température. Classé 100 000 cycles à 10 ampères, gère 0,128 ampère.
4. Ventilateur	Pale en aluminium. Segment et moyeu en acier avec alésage de 5/8 po (15,875 mm)	10. Circuit de commande	120 V, 0,128 A, 15 VA. (mis à la terre)
5. Protecteur du ventilateur	Conception en deux parties avec un espacement étroit entre les fils. Une sonde de diamètre 1/4" (6,3 mm) ne rentrera pas	11. Boîte de jonction fine	10,25 po (230 mm) x 8,00 po (180 mm) x 6,75 po (172 mm)
6. Trous de montage	Deux trous de 9/16 po. (14,3 mm) de diamètre sur la partie supérieure	12. Thermostat intégré en option	36 °F à 82 °F (2 °C à 28 °C)

Remarque :

* Certains appareils peuvent être de catégorie I, Div. I, groupe D et de catégorie II, Div. 1, groupes F et G.

F.2 Modèles 60 Hz

			kW nominal								
			3	5	7,5	10	15	20	25	30	35
Altitude maximale	pi		12 000	8 000	10 000	7 000	10 000	7 000	10 000	7 000	6 000
	m		3 658	2 438	3 048	2 134	3 048	2 134	3 048	2 134	1 829
Débit d'air	à 70 °F (CFM)		500		850		1750		3600		
	à 21 °C (m ³ /h)		850		1444		2973		6116		
Jet d'air horizontal	pi		15		30		40		70		
	m		4,6		9,1		12,2		21,3		
Hauteur maximale de montage (jusqu'à la face inférieure)	pi		7		10				20		
	m		2,1		3,0				6,1		
Puissance minimale du moteur	HP		1/2								
	kW		0,373								
Diamètre du ventilateur	po		12				16		20		
	mm		305				406		508		
Poids net	sans DS	lb	148				177		212		
		kg	67,1				80,2		96,2		
	avec DS	lb	160				189		224		
		kg	82,5				95,6		101,6		
Poids à l'expédition	sans DS	lb	202				227		263		
		kg	91,6				103,9		119,3		
	avec DS	lb	214				239		275		
		kg	97				108,3		124,7		

13. Sectionneur intégré en option DS à utiliser uniquement sur des appareils de chauffage dont la puissance totale ne dépasse pas 48 ampères. La poignée verrouillable intègre un arceau de 1/4 po de diamètre.

14. Transformateur de commande Principal multiprise, 120 V secondaire, 50 VA

15. Témoin lumineux en option Indique un besoin de chauffage

16. Contacteur 75 amp. Capacité de 1 000 000 d'opérations mécaniques. 120 V, bobine de 15 VA (protégée par un fusible séparé)

17. Fluide caloporteur Fluide caloporteur breveté de longue durée

18. Matériau de l'enceinte 12 ga. (0,104 po) (2,60 mm) d'acier. Revêtement époxy avec un prétraitement en cinq étapes, dont le phosphate de fer. Acier inoxydable en option.

19. Noyau Acier avec ailettes intégrales en aluminium, chargé sous vide et scellé hermétiquement.

20. Matériau du conduit Acier à paroi épaisse, 0,122 po (3,1 mm)

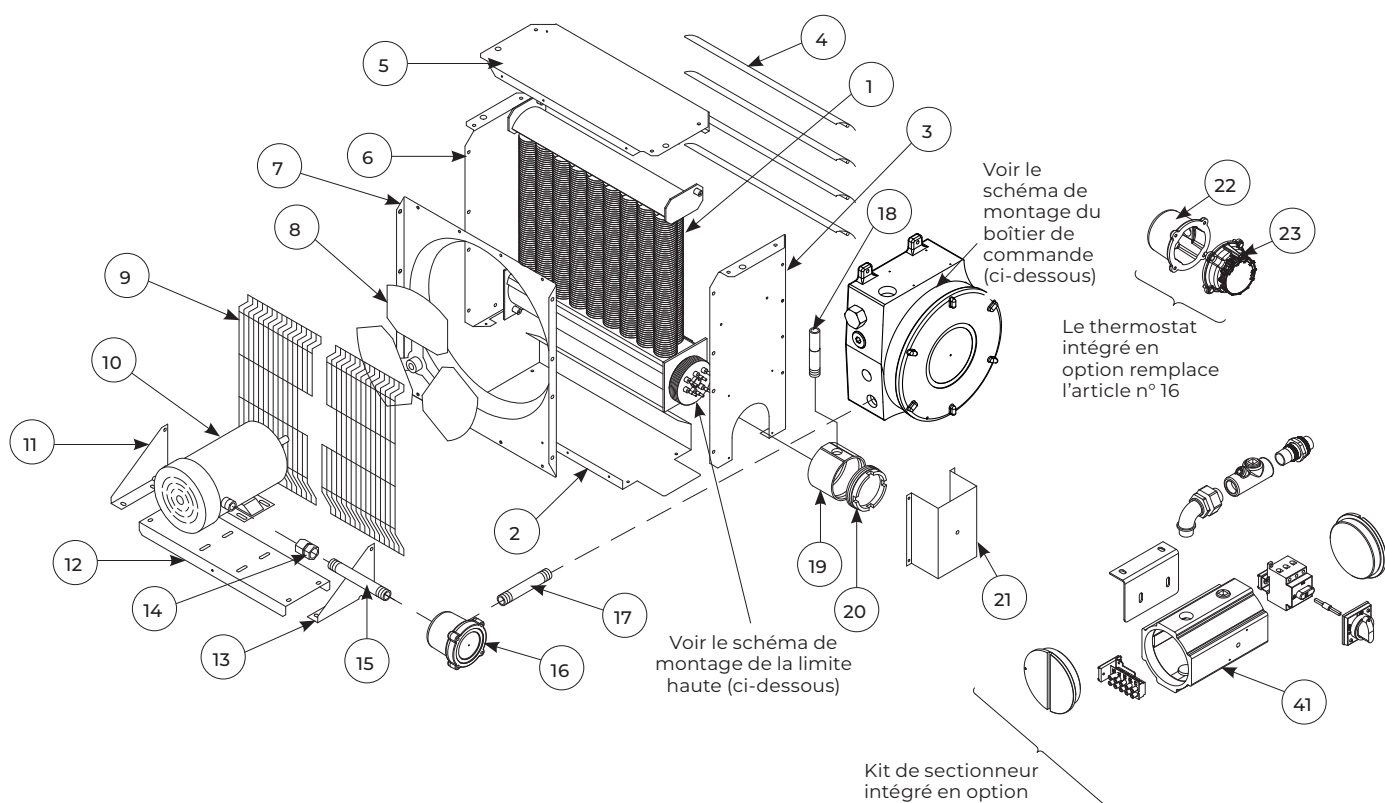
21. Protection contre les surpressions Limiteur de pression, structure en acier, pas de pièces à réparer sur place

22. Protection de secours contre les surpressions Dispositif à usage unique, non réparable.

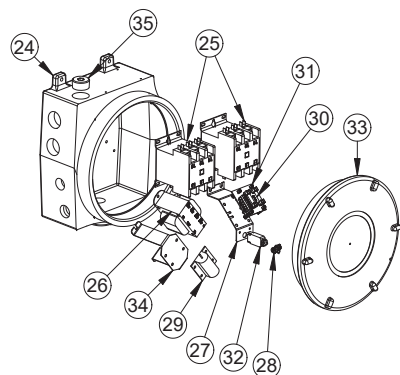
23. Limites de température de fonctionnement -58 °F à 104 °F (-50 °C à 40 °C)

24. Limites d'entreposage -58 °F à 176 °F (-50 °C à 80 °C). Ne pas le plonger dans de l'eau. Ne pas exposer à la pluie ou à la neige.

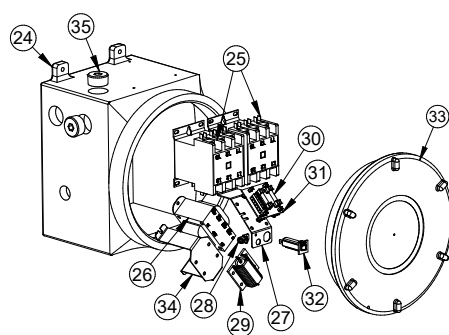
G. SCHÉMA DE MONTAGE DES PIÈCES



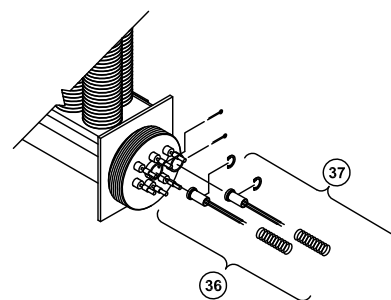
Petit Boîtier de commande



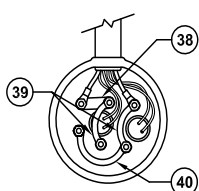
Grand Boîtier de commande



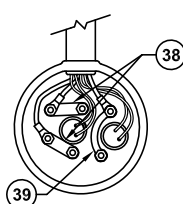
Limite haute



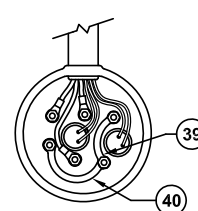
Configuration de la barre collectrice pour tous les systèmes monophasés



Configuration de la barre collectrice pour tous les systèmes triphasés (exceptés les modèles 380 V et 400 V 50 Hz)



Configuration de la barre collectrice pour tous les systèmes triphasés (modèles 380 V et 400 V 50 Hz)



H. LISTE DES PIÈCES Modules de chauffage électriques à air pulsé

Veuillez avoir les numéros de modèle et de série à portée de main avant de téléphoner

Article	Description	2,5 – 4,6 kW	6,3 – 10 kW	12,5 – 20 kW	20,9 – 35 kW
1	Noyau	**			
2	Panneau, partie inférieure	Peinture : 12694-02 AI : 12694-03		Peinture : 12699-02 AI : 12699-03	Peinture : 12704-02 AI : 12704-03
3	Panneau, côté gauche	Peinture : 12691-02 AI : 12691-03		Peinture : 12696-02 AI : 12696-03	Peinture : 12701-02 AI : 12701-03
4	Kit grille d'aération, avec vis	4075		4076	4077
5	Panneau, partie supérieure	Peinture : 12693-02 AI : 12693-03		Peinture : 12698-02 AI : 12698-03	Peinture : 12703-02 AI : 12703-03
6	Panneau, côté droit	Peinture : 12692-02 AI : 12692-03		Peinture : 12697-02 AI : 12697-03	Peinture : 12702-02 AI : 12702-03
7	Panneau, capot de ventilateur	Peinture : 3782 AI : 9212		Peinture : 3783 AI : 9213	Peinture : 3784 AI : 9214
8	Pale de ventilateur	4022	4023	4024	4025
9	Kit de protection du ventilateur	Peinture : 4078 AI : 9504		Peinture : 4079 AI : 9505	Peinture : 4080 AI : 9506
10	208/240 V 1PH 60 Hz	12216 (moteurs américains) 10388 (marathon)			
	220 V 1PH 50 Hz				
	480 V 1PH 60 Hz	9896 (Baldor)			S.O.
	208/240/480 V 3PH 60 Hz	10562 (moteurs américains) 10387 (Marathon)			
	380/415 V 3PH 50 Hz				
	600 V 3PH 60 Hz	2433 (moteurs américains)		10672 (Marathon)	
11	Support de montage du moteur, côté droit	Peinture : 3789 AI : 9112		Peinture : 3789 AI : 9112	Peinture : 3789 AI : 9112
12	Rail, support moteur	Peinture : 3785 AI : 9206		Peinture : 3786 AI : 9207	Peinture : 3787 AI : 9208
13	Support de montage du moteur, côté gauche	Peinture : 3788 AI : 9111		Peinture : 3788 AI : 9111	Peinture : 3788 AI : 9111
14	Attelage, moteur	3737 (moteurs américains) 4590 (moteurs Baldor et Marathon)			
15	Conduit, Moteur	9500		3813	10389
16	Couvercle, boîtier du thermostat	5371			
17	Conduit, boîtier de commande	3813			
18	Conduit, boîtier de l'élément	Contacter l'usine			
19	Boîtier, élément	9679			
20	Couvercle, boîtier de l'élément	3510			
21	Panneau, protection du boîtier de l'élément	Peinture : 12695-02 AI : 12695-03		Peinture : 12700-02 AI : 12700-03	Peinture : 12705-02 AI : 12705-03
22	Boîtier, thermostat	4983			
23	Thermostat, kit intégré	–			
24	Boîtier, commande	–			
25	Contacteur	13847			
26	Transformateur	12290 (60 Hz)		11295 (50 Hz)	
27	Support, carte de circuit imprimé	3809			
28	Borne, 6-14 Ga. Cosse à vis	1876			
29	Résistance de puissance du circuit de protection thermique secondaire	–			
30	Fusible, bus MDQ – 1/2 Amp	9357			
31	Assemblage, carte de circuit imprimé	3514			
32	Réinitialisation de la protection thermique secondaire	Contacter l'usine			
33	Couvercle, boîtier de commande	11960			
34	Support, au-dessus du transformateur	–			
35	Prise, 1" NPT antidéflagrante	12169			
36	Kit Limite haute de température (N.O.)	–			
37	Kit Limite haute de température (N.C.)	–			
38	Barre collectrice, droite	Fournie avec kits pour noyau**			
39	Barre collectrice, petite courbe				
40	Barre collectrice, large courbe				
41	Kit, assemblage DS	–			
42	Pilot Light Complète	IN-M-PILOT-XLSGS-G			

** Voir le tableau des données techniques pour les numéros de pièces. **Remarque :** Pour les articles non illustrés, contacter le constructeur.

I. RÉPARATION ET REMPLACEMENT



AVERTISSEMENT

AVERTISSEMENT

Débrancher l'appareil de chauffage de la source de courant du sectionneur général ou de la boîte à fusibles avant d'ouvrir les boîtiers ou de procéder à son entretien.

SI UN ENTRETIEN EST EFFECTUÉ AU NIVEAU DU SECTIONNEUR GÉNÉRAL, s'assurer que le courant a été coupé à la boîte à fusibles ou au panneau principal.

Bloquer le commutateur à la position « OFF » (ouvert), et/ou étiqueter le commutateur pour éviter une mise sous tension imprévue.

Ce dispositif de chauffage doit être entretenu uniquement par un technicien ayant une expérience avec les équipements de chauffage en zones dangereuses.

1. Après la réparation d'un composant :
 - 1.1 Vérifier que les connexions électriques sont correctes et sécurisées (voir Figure 9, page 10).
 - 1.2 Enlever toute corps étranger des boîtiers
 - 1.3 Installer et fixer tous les couvercles
 - 1.4 S'assurer que toutes les fixations sont bien serrées
 - 1.5 Retirer tout objet étranger de l'appareil de chauffage
 - 1.6 S'assurer que l'air sort par les grilles d'aération et que le ventilateur tourne dans le sens inverse des aiguilles d'une montre lorsqu'il est vu de l'arrière de l'appareil de chauffage (voir Figure 14, page 19).

Le noyau de l'appareil de chauffage est chargé sous vide et ne peut pas être réparé sur place.

2. Noyau

Pour le retrait du noyau :

- 2.1 Retirer la partie inférieure de l'enceinte et le couvercle du boîtier de l'élément.
- 2.2 Débrancher tous les fils pénétrant dans le boîtier de l'élément (voir Figure 10, page 18)
- 2.3 Desserrer légèrement tous les boulons de l'enceinte illustrés à la Figure 10, page 18, pour empêcher le noyau de se coincer.
- 2.4 Avec l'aide d'un assistant supportant le poids du noyau, retirer les 3 boulons de montage du noyau. Faire descendre délicatement le noyau hors de l'enceinte (voir Figure 11, page 18).
- 2.5 Pour renvoyer le noyau à l'usine, utiliser la caisse fournie avec le noyau de rechange pour protéger les bornes de l'élément et les filets de la plaque.
- 2.6 Pour le réinstaller, soulever le noyau dans l'enceinte pendant qu'un assistant guide les fils de l'élément dans le conduit du boîtier de l'élément.
- 2.7 Positionner le noyau et serrer les 3 boulons de montage du noyau. Serrez les autres boulons de l'enceinte.

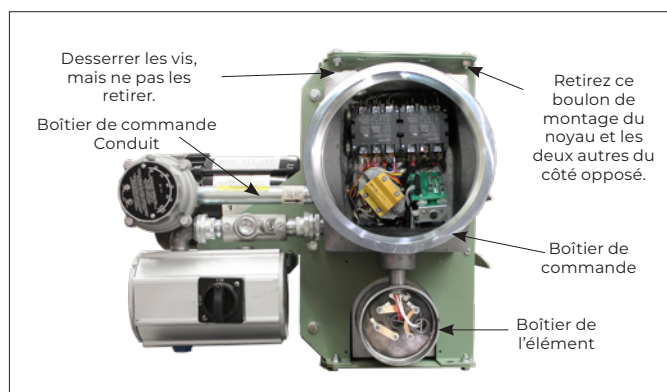


Figure 10

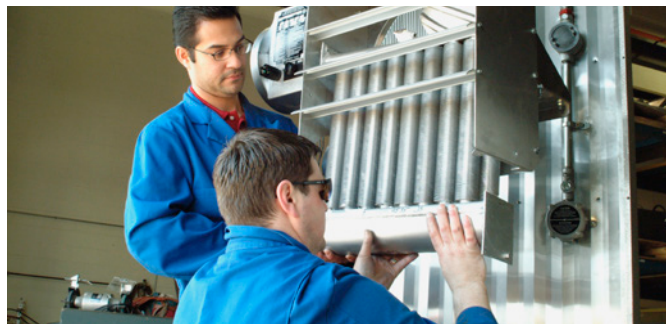


Figure 11

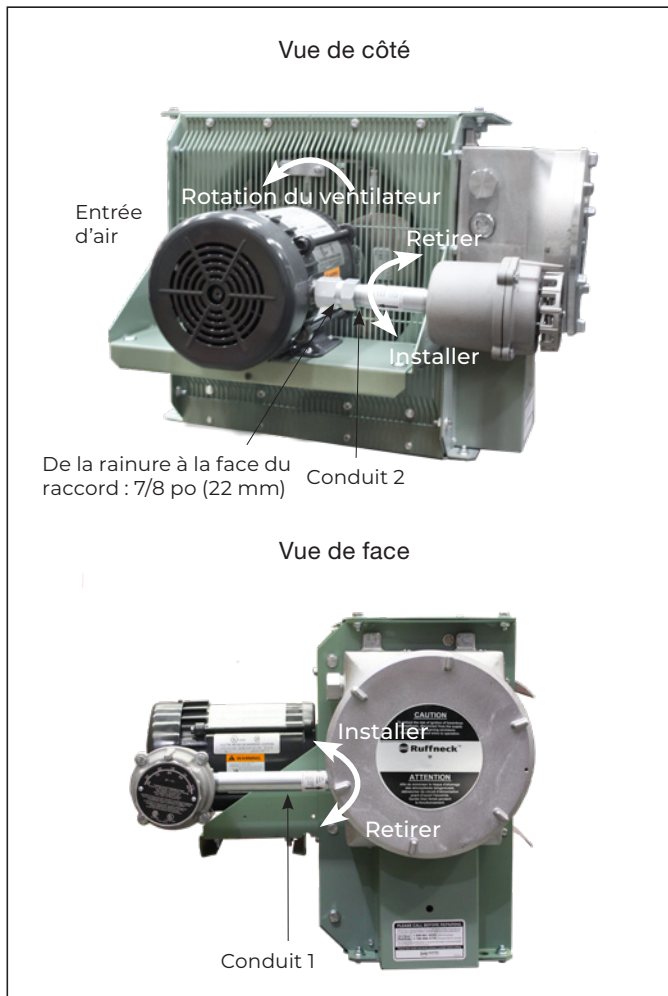


Figure 12



Figure 13



Figure 14

3. Moteur, ventilateur et protecteur du ventilateur
 - 3.1 Retirer les boulons de fixation du moteur à son support. Sur les appareils dotés d'un thermostat intégré, retirer les boulons situés à l'arrière du boîtier du thermostat.
 - 3.2 Enlever le conduit 1 situé entre la boîte de jonction du moteur et le boîtier de commande en le tournant dans la direction illustrée (voir Figure 12, page 19). Remarque : Les conduits 1 et 2 ne sont pas interchangeables et ont un filetage à gauche à une extrémité, cette extrémité est indiquée par une rainure usinée.
 - 3.3 Retirer les deux pièces formant le protecteur du ventilateur (voir Figure 13, page 19).
 - 3.4 Soulever l'ensemble du moteur pour le retirer de son support.
 - 3.5 Avant de déposer le ventilateur, mesurer et noter l'emplacement du moyeu du ventilateur sur l'arbre du moteur (voir Figure 14, page 19). S'il est difficile à retirer, utiliser un extracteur d'engrenages sur le moyeu du ventilateur.
 - 3.6 Pour le remonter, placer l'ensemble du moteur sur le support du moteur et fixer le protecteur du ventilateur à l'enceinte.
 - 3.7 Engager et serrer simultanément les deux extrémités du conduit 1 dans les boîtiers. Laisser un espace de 1/16 po à 3/16 po (1,6 à 4,8 mm) entre le moteur et le protecteur du ventilateur (voir Figure 15, page 20). Ajuster le conduit 2 pour centrer le ventilateur dans le capot.
 - 3.8 Pour assurer un recouvrement minimal des 5 filetages, les extrémités des conduits à filetage doivent dépasser d'au moins 1/16" (1,6 mm) à l'intérieur des boîtiers. La rainure du conduit 2 ne doit pas se trouver à plus de 7/8 po (22 mm) de l'attelage moteur (voir Figure 14, page 19).
 - 3.9 Visser le moteur à son support. Faire tourner manuellement les pales du ventilateur pour s'assurer que le ventilateur tourne librement.
 - 3.10 L'air doit sortir par les grilles d'aération et le ventilateur doit tourner dans le sens inverse des aiguilles d'une montre lorsqu'il est vu de l'arrière de l'appareil de chauffage (voir Figure 12, page 19).
4. Éléments chauffants
 - 4.1 Les éléments chauffants font partie intégrante du noyau chargé sous vide. Un noyau échangé en usine peut être expédié immédiatement à partir du stock. Se référer à 2. Core, page 18 pour plus de détails.
5. Contacteur
 - 5.1 Desserrer, mais ne pas retirer les vis de montage du contacteur. Faire glisser le contacteur hors des vis de montage.
 - 5.2 Remplacer par un contacteur de même valeur nominale fourni par le constructeur.
6. Transformateur
 - 6.1 Remplacer par un transformateur de même puissance fourni par le constructeur.
 - 6.2 Sur le nouveau transformateur, sélectionner les fils principaux en fonction de la tension de l'appareil de chauffage.
 - 6.3 S'assurer que le bon fil secondaire du transformateur est mis à la terre (voir Figure 9, page 10). Isoler individuellement tous les fils non utilisés à l'aide de connecteurs à extrémité fermée.



Figure 15

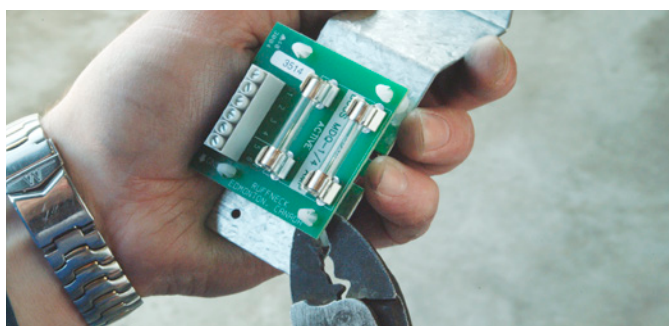
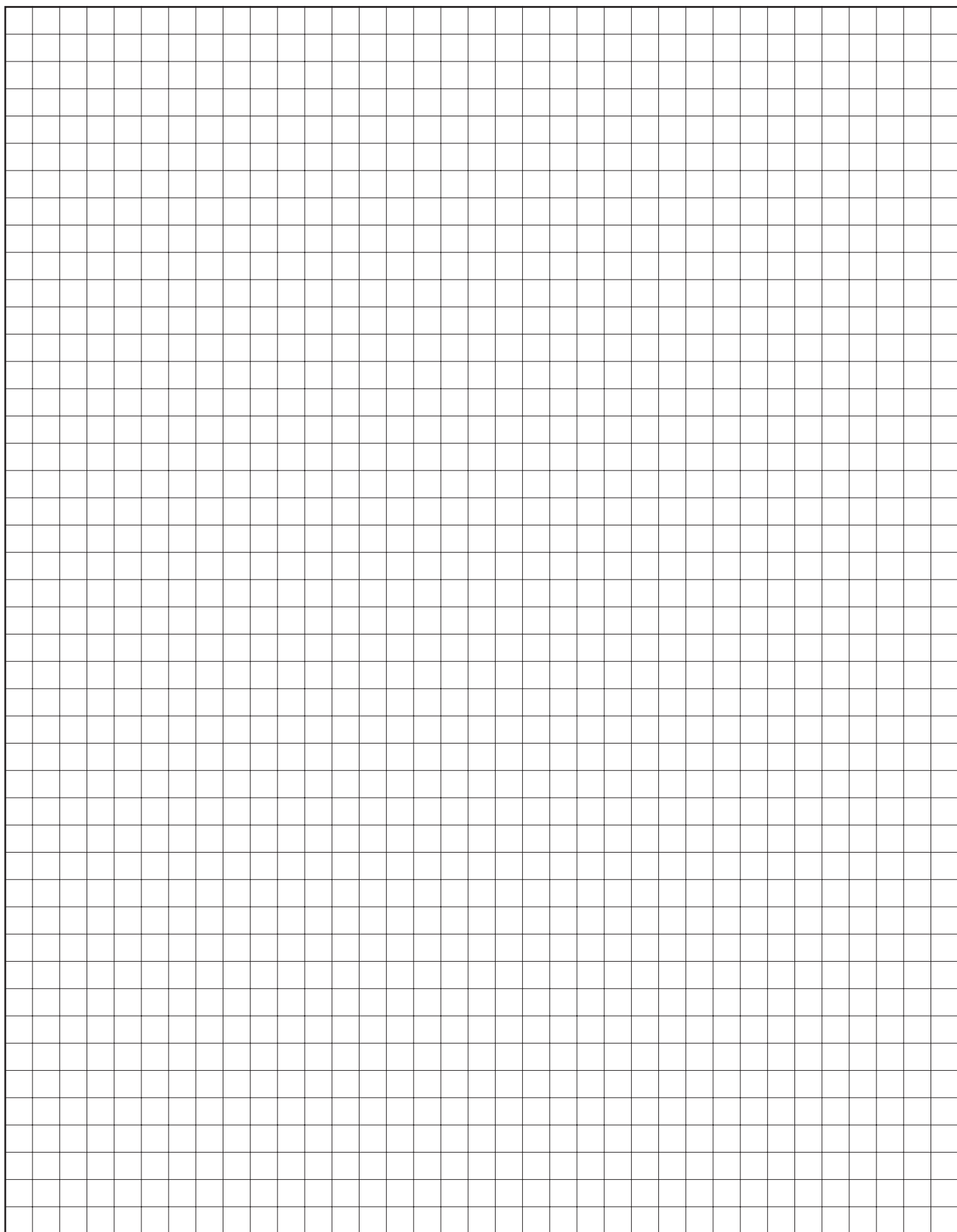


Figure 16

7. Carte de circuit imprimé
 - 7.1 Après avoir retiré le support de la carte de circuit imprimé (CCI) du boîtier de commande, séparer la carte de circuit imprimé du support en coupant les entretoises en plastique (voir Figure 9, page 10).
 - 7.2 Réinstaller la nouvelle CCI fournie par le constructeur sur le support de montage, en utilisant de nouvelles entretoises non conductrices de la même longueur. Les entretoises sont fournies avec une nouvelle CCI. Remettre en place le fil de terre du circuit de commande sur le support de la carte de circuit imprimé (voir Figure 16, page 20).
8. Fusible
 - 8.1 Remplacer le fusible par un fusible de même type et de même calibre que celui indiqué sur la CCI ou consulter la liste de pièces. Un fusible supplémentaire doit être rangé dans les attaches marquées « SPARE » (PIÈCE DE RECHANGE).
9. Panneaux de l'enceinte
 - 9.1 Les panneaux de l'enceinte sont remplaçables individuellement.

NOTES





PLEASE ADHERE TO INSTRUCTIONS IN THIS MANUAL

Failure to do so may be dangerous and may void certain provisions of your warranty.

Pour obtenir de l'aide, veuillez composer le numéro sans frais 1 800 661-8529 (États-Unis et Canada).
Veuillez avoir les numéros de modèle et de série à portée de main avant de téléphoner.

GARANTIE : Dans des conditions normales d'utilisation, la Société garantit à l'acheteur que les produits ayant des défauts matériels ou de fabrication seront réparés ou remplacés sans frais pour une période de 36 mois de à compter de la date d'expédition, selon la date qui arrive à expiration la première. Toute réclamation dans le cadre de la garantie doit être adressée à l'agence commerciale dans laquelle le produit a été acheté afin d'obtenir une réparation ou un remplacement selon les termes de cette garantie.

Sous réserve de toute loi étatique ou provinciale contraire, la société ne sera pas responsable des frais d'installation, de mise hors service, de transport ou de dommages de quelque nature que ce soit, y compris les dommages résultant d'un manque d'utilisation, d'une interruption des activités ou de dommages accessoires ou indirects.

La société ne peut anticiper ou contrôler les conditions d'utilisation des produits et décline par conséquent toute responsabilité liée à la sécurité d'application et à l'adéquation de ses produits lorsqu'ils sont utilisés seuls ou associés à d'autres produits. Les essais relatifs à la sécurité d'application et à l'adéquation des produits incombent exclusivement à l'utilisateur.

La présente garantie devient nulle et non avenue si, de l'avis de la société, le dommage, la défaillance ou le défaut est le résultat de :

- Vibrations, radiations, l'érosion, la corrosion, la contamination du processus, de conditions anormales de température et de pression du processus, de surtensions ou pulsations inhabituelles, l'encrassement, l'usure ordinaire, le manque d'entretien, la mauvaise configuration d'éléments tels que la tension, l'air, le gaz, l'eau et autres, ou toute combinaison des causes susmentionnées qui ne sont pas spécifiquement prévues dans les conditions de conception ou,
- Tout acte ou omission de la part de l'acheteur, de ses employés, agents ou entrepreneurs indépendants qui, pour plus de précision, mais sans restreindre la portée générale de ce qui précède, comprend un endommagement physique, chimique ou mécanique, un accident, une installation inadéquate du produit, un entreposage et une manipulation inadéquats du produit, une application inadéquate ou un mauvais alignement des pièces.

Aucune garantie ne s'applique aux finitions de peinture, sauf pour les défauts de fabrication apparents dans les 30 jours suivant la date d'installation.

La société n'assume ni n'autorise personne à assumer pour elle toute autre obligation ou responsabilité en rapport avec le(s) produit(s).

L'acheteur convient que tous les travaux de garantie requis après la mise en service initiale du produit seront fournis uniquement si la société a été payée par l'acheteur conformément aux conditions générales du contrat.

L'acheteur comprend que la société ne donne aucune garantie, expresse, implicite ou statutaire (y compris toute garantie de qualité marchande ou d'adéquation à un usage particulier), écrite ou orale, relative à l'article ou aux travaux accessoires, exception faite de ce qui est expressément prévu ou contenu dans le présent contrat.

RESPONSABILITÉ : Les données techniques contenues dans le catalogue ou sur le site Internet sont modifiables sans préavis. La société se réserve le droit de modifier les dimensions et d'autres aspects de la conception le cas échéant. L'acheteur reconnaît que la société n'est pas tenue de modifier les articles fabriqués antérieurement aux modifications de conception ou aux améliorations apportées aux produits par la société.

La société ne sera pas tenue de compenser ou d'indemniser l'acheteur, l'utilisateur final ou toute autre partie contre les actions, réclamations, responsabilités, blessures, pertes, pertes d'utilisation, pertes commerciales, dommages, dommages indirects ou consécutifs, demandes, pénalités, amendes, dépenses (y compris les frais juridiques), coûts, obligations et causes d'action de toute nature résultant entièrement ou partiellement d'une négligence ou d'une omission de l'utilisateur ou d'une mauvaise utilisation, d'une application incorrecte ou dangereuse, d'un entreposage et d'une manipulation inadéquats, d'une installation incorrecte, d'un manque d'entretien, du mauvais entretien ou d'une utilisation inappropriée des produits fournis par la société.

Visitez www.thermon.com pour contacter un représentant Thermon près de chez vous.

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Section 3

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Enerflex

Drawings

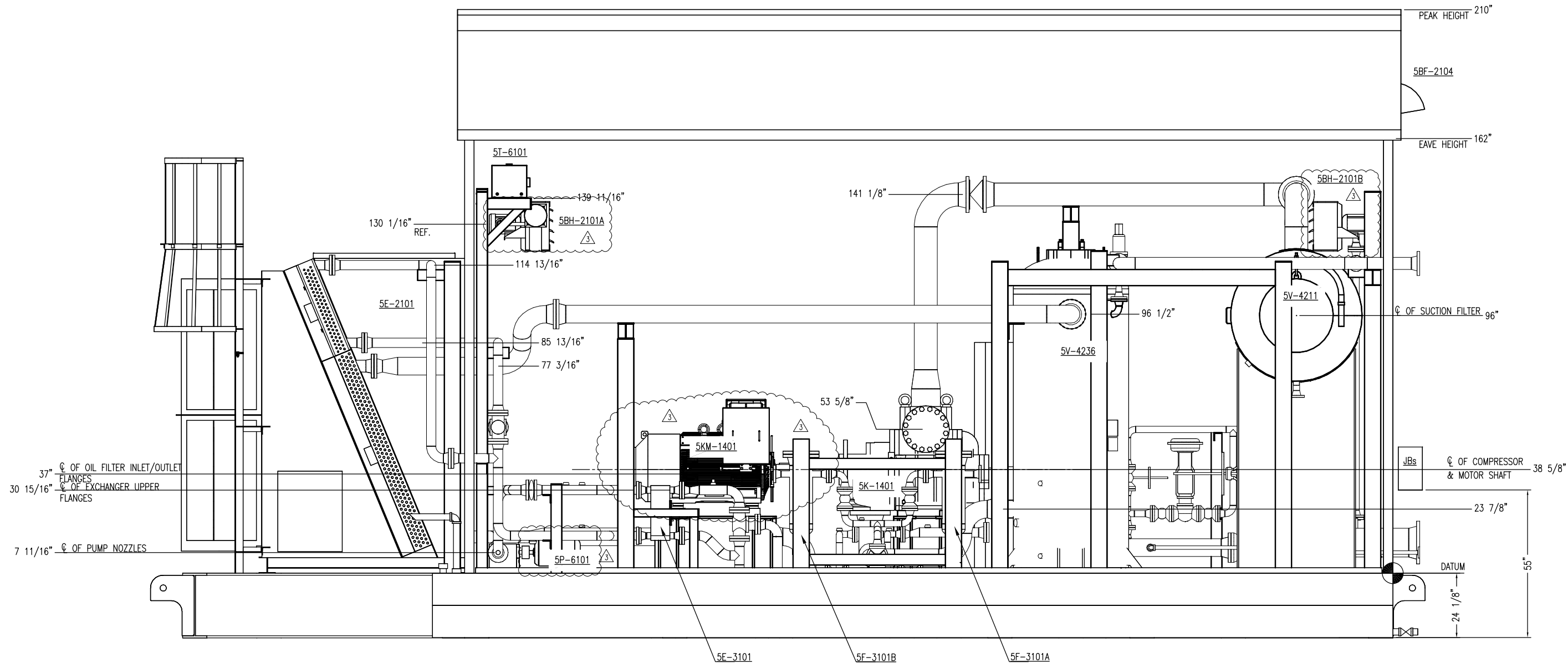
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GA, Elevations & 3D Views

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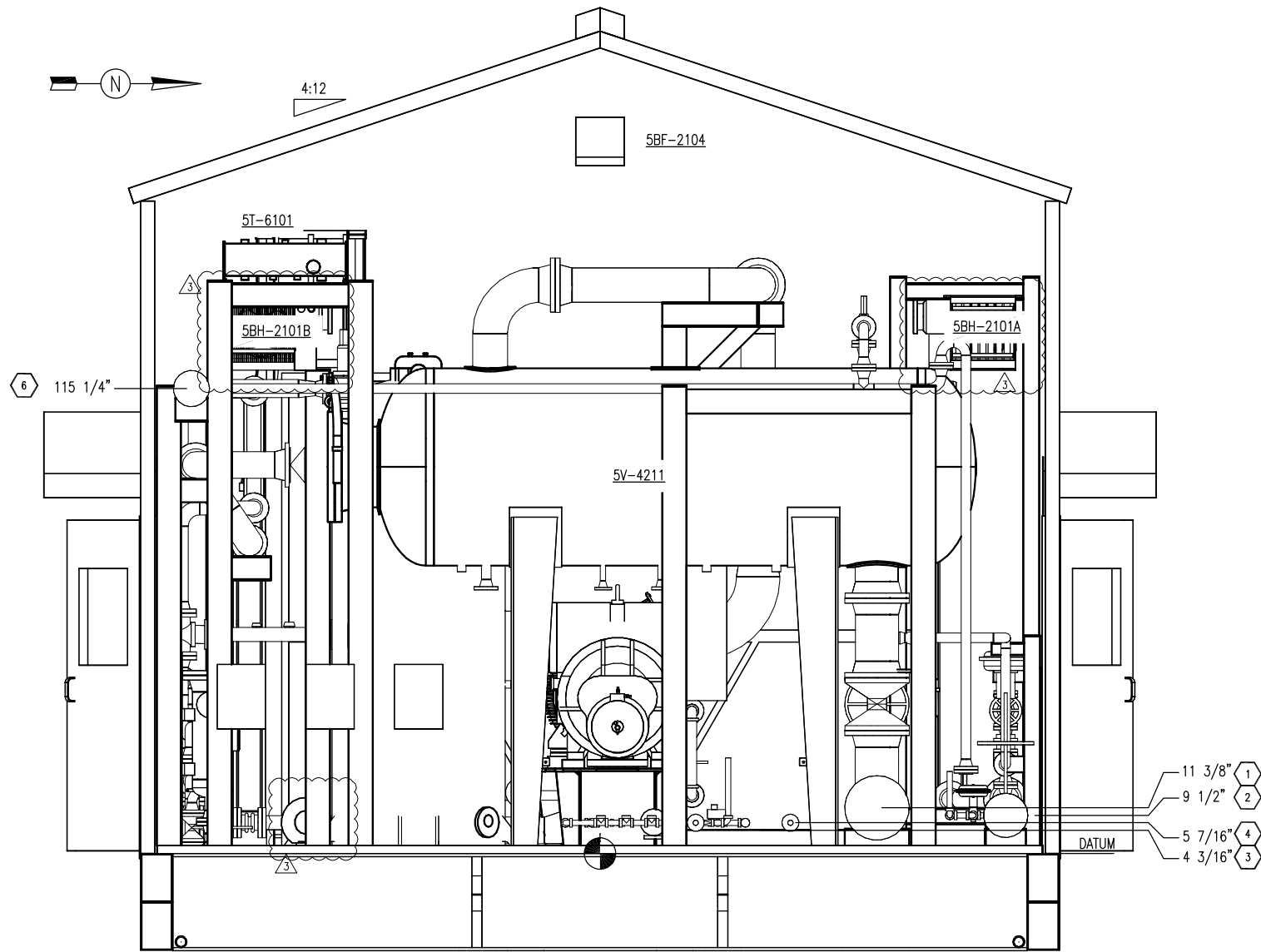
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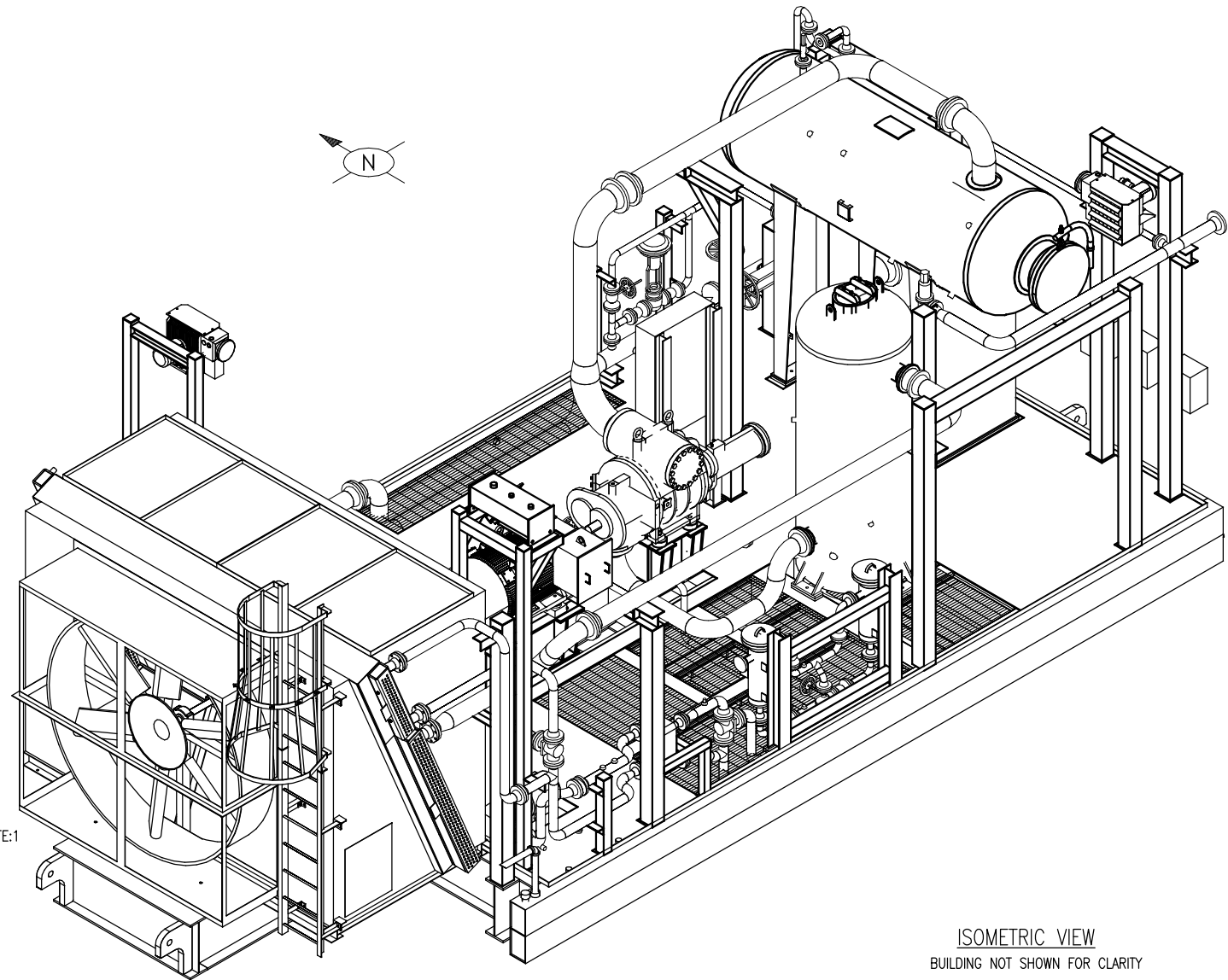
A-A ELEVATION VIEW

FOR APPROVAL
PLEASE SUBMIT ONE SET OF
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NAME: T. SABISTON DATE: NOV 26/24

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	3	AS PER SOLD RETROFIT SCOPE (IFA)	NOV 26/24	TS	RS	DRAWN BY	H.SUN	CHECKED BY	K.OXFORD				APPROVED BY	N.REZAEYAN
	2	AS BUILT	MAR 26/15	HS	NR	PROJECT MANAGER	B.LANGER	PROJECT ENGINEER	N.REZAEYAN					
	1	CORRECTED DRAWING AS PER CUSTOMER'S MARK-UP	JAN 12/15	HS	NR	CUST PO							N/A	
	0	ISSUED FOR CONSTRUCTION	DEC 02/14	HS	NR	APEGGA PERMIT No:							P8651	OPER. CODE
	REV	DESCRIPTION	DATE	BY	APR									



B-B ELEVATION VIEW



ISOMETRIC VIEW

BUILDING NOT SHOWN FOR CLARITY

NOTE:1 COOLER BUG SCREEN NOT SHOWN FOR CLARITY

FOR APPROVAL
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APPROVED DRAWINGS BY
NAME: T. SABISTON DATE: NOV 26/24

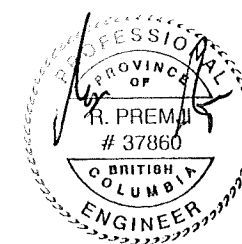
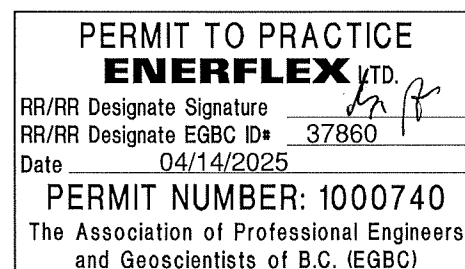
				DATE: JUL 04/14		SCALE: NTS		FUELLED ENERGY LOCATION: TBA LSD: TBA		ENERFLEX Calgary, Alberta, Canada		GENERAL ARRANGEMENT B-B & 3D VIEW	
3	AS PER SOLD RETROFIT SCOPE (IFA)	NOV 26/24	TS	RS	DRAWN BY: H.SUN	CHECKED BY: K.OXFORD	APPROVED BY: N.REZAEYAN						
2	AS BUILT	MAR 26/15	HS	NR	PROJECT MANAGER: B.LANGER	PROJECT ENGINEER: N.REZAEYAN							
1	CORRECTED DRAWING AS PER CUSTOMER'S MARK-UP	JAN 12/15	HS	NR	CUST PO: N/A								
0	ISSUED FOR CONSTRUCTION	DEC 02/14	HS	NR	APEGGA PERMIT No: P8651		OPER. CODE: 198/298/490/511/591	RETROFIT JOB #:	E005063-01	DWG NO:	E001123-01-201	SHT: 3	REV: 3
REV	DESCRIPTION	DATE	BY	APR									



Process Flow Drawings / Diagrams

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CLOW
GLYCOL COOLER SECTION
MAWP: 14 PSIG @ 300°F
MDMT: -20°F @ 14 PSIG
SN: 144811.1



2025-04-14

P & I DIAGRAM
COOLING SYSTEM
CLOW COOLER SECTION

SHT	1	REV	4
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5K-1401
SCREW GAS COMPRESSOR
MFG: FRICK
MODEL: SCC2821
OPERATING SPEED: 3600 RPM

5T-3104
MECHANICAL SEAL DRAIN POT
MFG: EFX
SIZE: 1 US GALLON

5F-3101 A/B
LUBE OIL FILTER
MFG: EFX
SIZE: 8 5/8" OD X 26" S/F
MAWP: 460 PSIG @ 650°F
MDWT: -20°F @ 460 PSIG
CA: 1/16"
ELEMENT: (1) MODEL 1833C10 10 MICRON
MAT'L: CARBON STEEL
SN: E001123014241A/B
CRN: R9886.2

5T-3105
WASTE OIL STORAGE TANK
MFG: EFX
CAPACITY: 260 US GALLON

5E-3101
COMPRESSOR OIL COOLER (OIL SIDE)
MFG: GEA
MODEL: FPA10X20-70-UM
PLATES: S.S.
MAWP OIL SIDE: 400 PSIG @ 250°F
MDMT: -20°F @ 400 PSIG
DESIGN HEAT LOAD: 779,000 BTU/HR
SN: 5200034973-0001
CRN: M9684.5123469870

PERMIT TO PRACTICE ENERFLEX LTD.

RR/RR Designate Signature

RR/RR Designate EGBC ID#

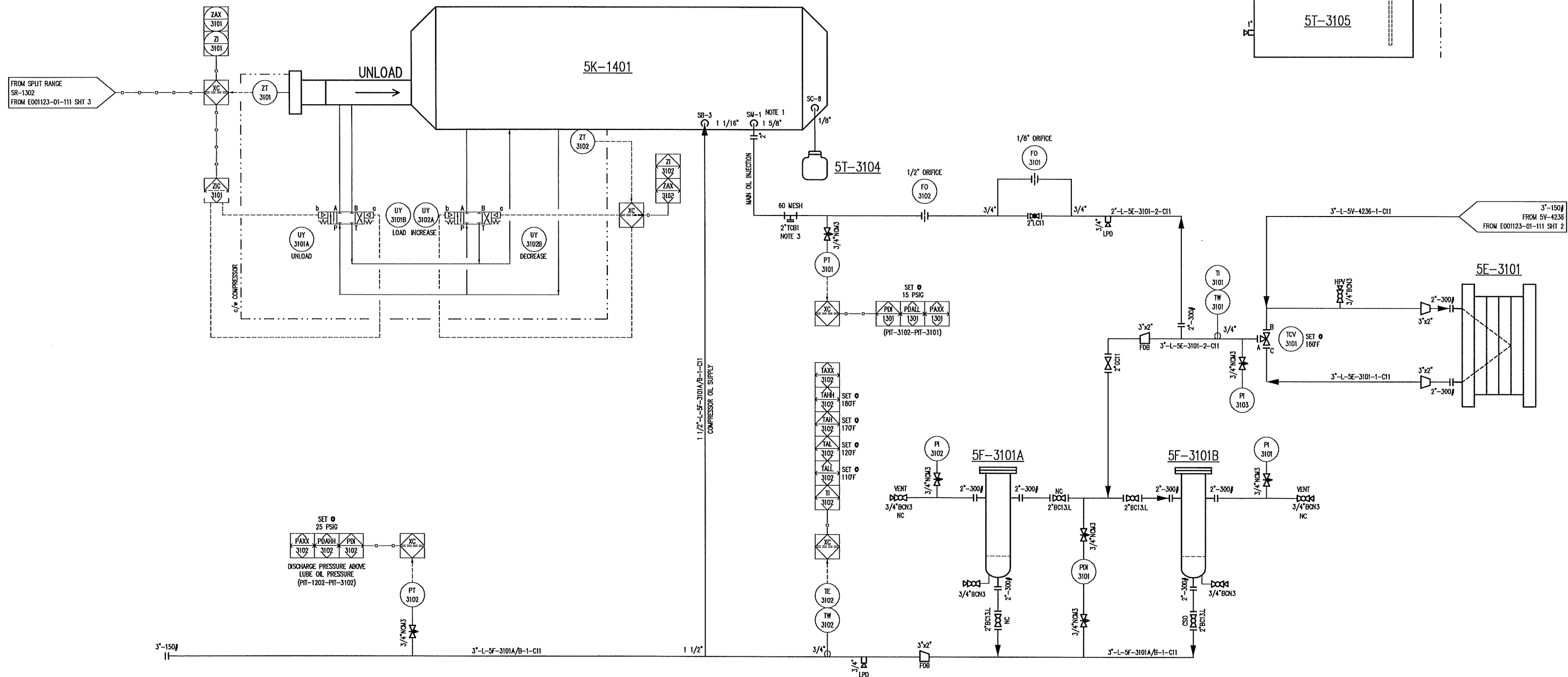
Date

PERMIT NUMBER: 1000740

The Association of Professional Engineers
and Geoscientists of B.C. (EGBC)



2025-04-14



ISSUED FOR
CONSTRUCTION

NAME: L. WILTON DATE: DEC. 16/24

- NOTES:
- ORIFICE TO BE REMOVED FROM COMPRESSOR AND DISCARDED.
 - ALL VALVES ARE NORMALLY OPEN UNLESS NOTED OTHERWISE.
 - REFRIGERATION SPECIALTIES STRAINER.

5	AS PER RETROFIT SOLD SCOPE (IFC)	DEC 16/24	LW	RS	DATE	FEB 11/14	SCALE	NTS
4	AS PER RETROFIT SOLD SCOPE (IFA)	DEC 05/24	LW	RS	DRAWN BY	A. TRAN	CHECKED BY	N. REZAEEYAN
3	AS BUILT	MAY 05/15	SJ	NR	PROJECT MANAGER	J. HORVATH	PROJECT ENGINEER	R. SUTRAVE
2	ISSUED FOR CONSTRUCTION- LINE # CHANGE	FEB 18/15	SJ	NR	CUST PO			
1	ISSUED FOR CONSTRUCTION	JAN 13/15	TR	NR	APCA PERMIT No:	P865P8651	OPER CODE	490 511 591
0	ISSUED FOR CONSTRUCTION	NOV 27/14	SJ	NR	RETRO FIT JOB#	E005063-01		
REV	DESCRIPTION	DATE	BY	APR				

FUELED ENERGY
MARKETING INC.
SURPLUS COMPRESSOR
RETROFIT.
UNIT: E-001123

ENERFLEX
Calgary, Alberta,
Canada

P & I DIAGRAM
PROCESS GAS

DWG NO E001123-01-113

SHT 1

REV 5

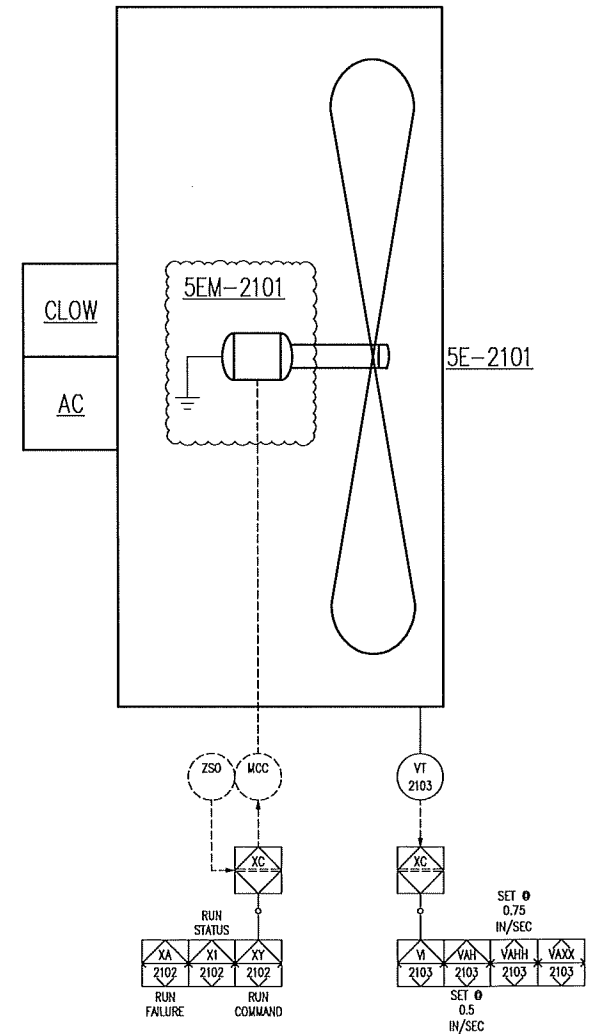
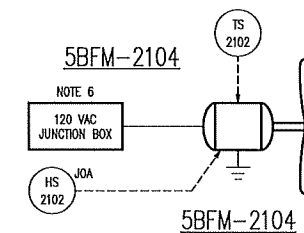
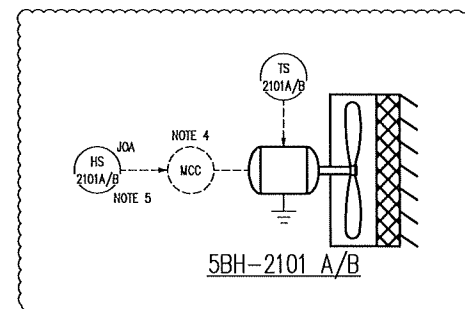
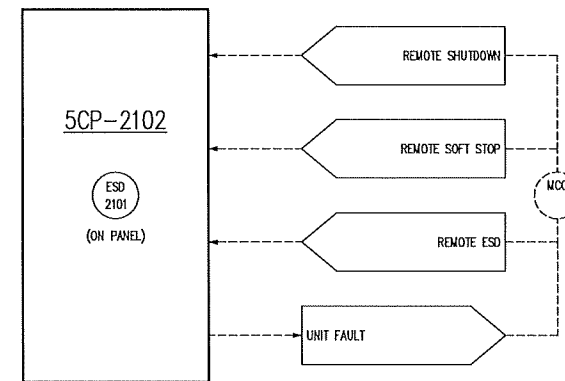
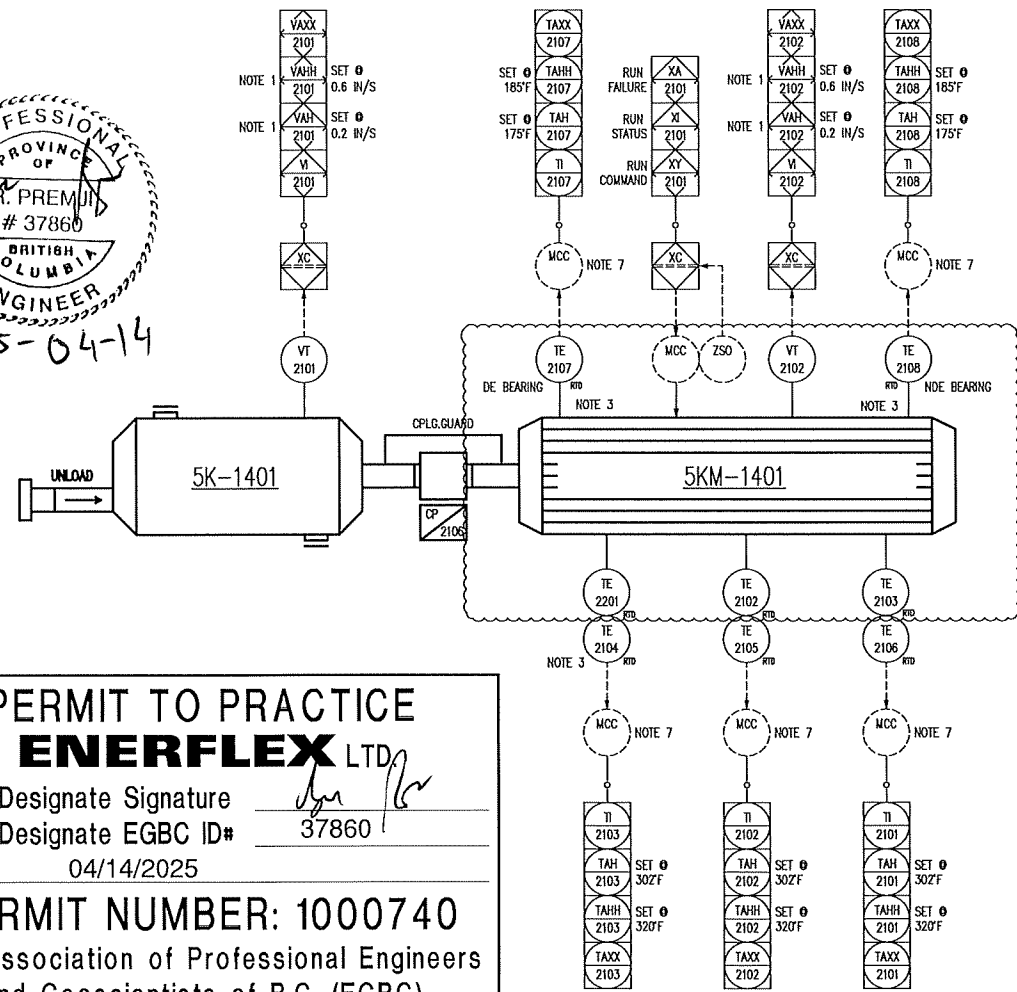
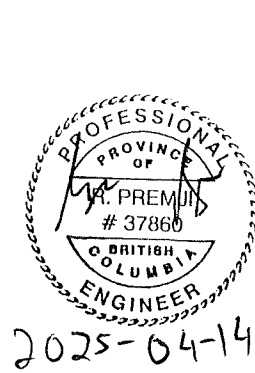
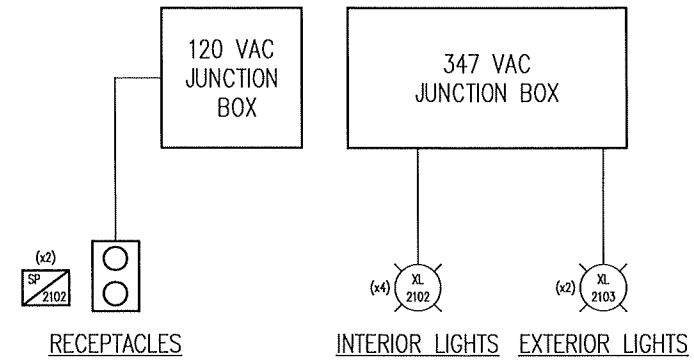
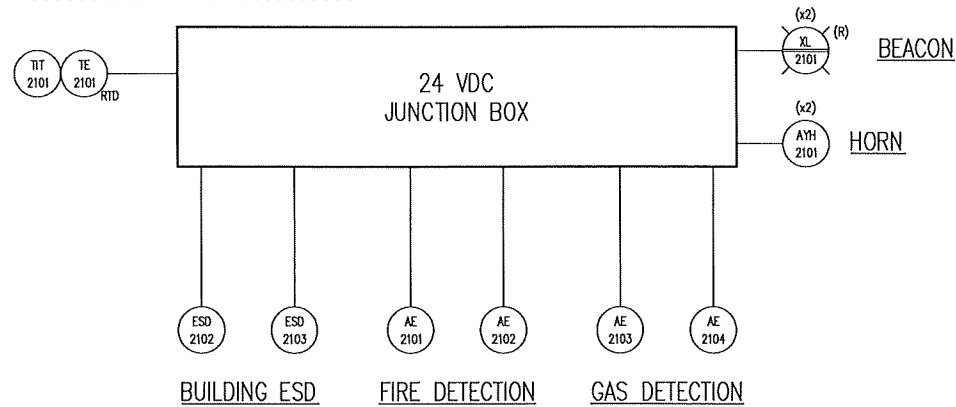
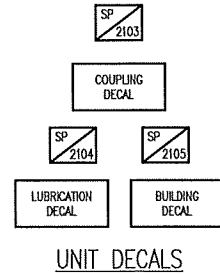
5KM-1401
COMPRESSOR MOTOR
MFG: TECO
FRAME: 5009B
ENCLOSURE: TEFC
POWER: 400 HP @ 1800 RPM
460V/3PH/60HZ
CLASS I, DIV. 2, GROUPS B/C/D/
CLASS I, ZONE 2, GROUPS IIB+H2, IIB & IIA
SN: RFLZ1446751-1

5BFM-2104
BUILDING FAN MOTOR
SUPPLIED WITH BUILDING
POWER: 1/4 HP
120VAC/1PH/60HZ
CLASS I, ZONE 1

5BH-2101 A/B
BUILDING HEATER
MFG: RUFFNECK
MODEL: FX5-480360-100-T
RATING: 10KW
480V/3PH/60HZ
CLASS I, ZONE 2

5E-2101
PACKAGE COOLER
MFG: AIR-X-LIMITED
MODEL: 96AEF
TYPE: FORCED DRAFT
FAN TYPE: MOORE 10K-36VT, 96" DIA X 6 BLADES
FAN POWER: 18 HP @ 1800 RPM
FAN BLADE PITCH: 19.5 DEGREES
AMBIENT AIR: 90°F

5EM-2101
PACKAGE COOLER MOTOR
POWER: 25 HP @ 1800 RPM
460V/3PH/60HZ
TEFC, 284T FRAME
CLASS I, DIV 2 & CLASS I, ZONE 2
SN: 144811



PERMIT NUMBER: 1000740
The Association of Professional Engineers
and Geoscientists of B.C. (EGBC)

NAME L. WILTON DATE DEC. 16/24

NOTES:

1. SET POINTS TO BE SET AND VERIFIED IN THE FIELD.
2. DETECTOR TO BE SHIPPED LOOSE AND INSTALLED ON SITE BY OTHERS.
3. RTD'S SUPPLIED WITH MOTOR. 3 SPARES AVAILABLE FOR WINDING RTD'S.
4. WIRING FROM MCC TO HEATER BY OTHERS.
5. SHIPPED LOOSE, INSTALLATION AND WIRING BE OTHERS
6. FAN IS WIRED TO 120 VAC JUNCTION BOX.
7. WIRING RTD'S TO MCC BY OTHERS

5	AS PER RETROFIT SOLD SCOPE (IFC)	DEC 16/24	LW	RS	DATE	FEB 11/14	SCALE	NTS
4	AS PER RETROFIT SOLD SCOPE (IFA)	DEC 05/24	LW	RS	DRAWN BY	A. TRAN	CHECKED BY	R. PREMJ
3	AS BUILT	MAY 05/15	SJ	NR	PROJECT MANAGER	J. HORVATH	PROJECT ENGINEER	R. SUTRAVE
2	ISSUED FOR CONSTRUCTION- LINE # CHANGE	FEB 18/15	SJ	NR	CUST PO	---		
1	ISSUED FOR CONSTRUCTION	JAN 13/15	TR	NR				
0	ISSUED FOR CONSTRUCTION	NOV 27/14	SJ	NR	APGA PERMIT No:	P865P8651		
REV	DESCRIPTION	DATE	BY	APP			OFER	490 5

FUELLED ENERGY
MARKETING INC.
SURPLUS COMPRESSOR
RETROFIT.
UNIT: E-001123

ENERFLEX
Calgary, Alberta,
Canada

P & I DIAGRAM
DRIVE TRAIN /CONTROL PANEL
BUILDING SYSYEMS

DWG NO	E001123-01-112
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SHT	1	REV	5
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AC
PROCESS GAS COOLER SECTION

MFG: AIR-X-LIMITED
MODEL: 96AEF
MAWP: 230 PSIG @ 300°F
MDMT: -20°F @ 230 PSIG
CA: 1/16"
DESIGN HEAT LOAD: 1,532,200 BTU/HR
SN: 144811.2
CRN: W0810.2

PERMIT TO PRACTICE
ENERFLEX LTD.

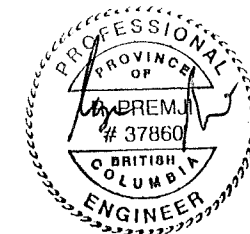
RR/RR Designate Signature *R. Premji*

RR/RR Designate EGBC ID# 37860

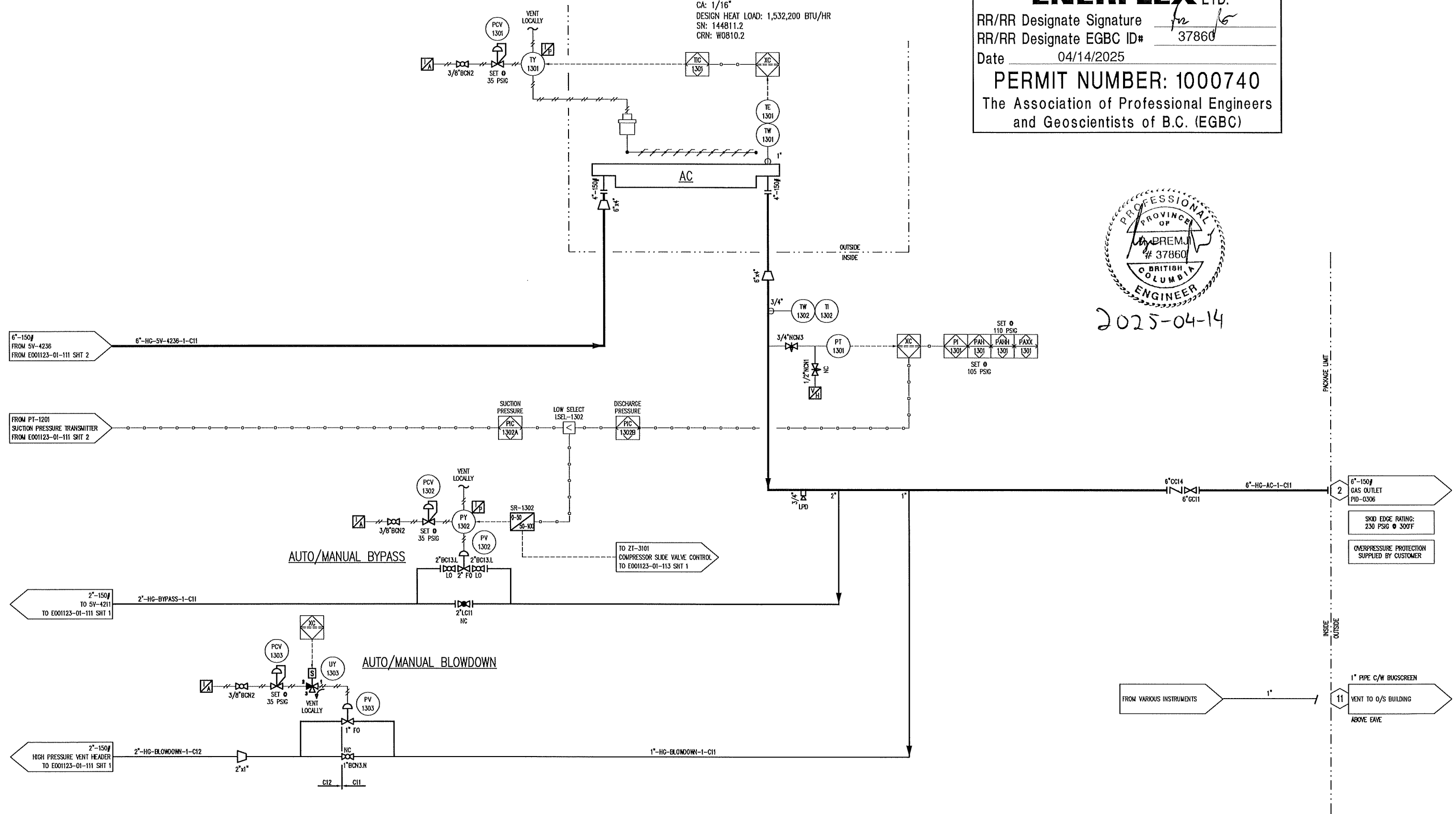
Date 04/14/2025

PERMIT NUMBER: 1000740

The Association of Professional Engineers
and Geoscientists of B.C. (EGBC)



2025-04-14



ISSUED FOR
CONSTRUCTION

NAME L. WILTON DATE DEC. 16/24

NOTES:
1. ALL VALVES ARE NORMALLY OPEN UNLESS NOTED OTHERWISE.

5	AS PER RETROFIT SOLD SCOPE (IFC)	DEC 16/24	LW	RS	DATE	FEB 11/14	SCALE	NTS	FUELLED ENERGY MARKETING INC. SURPLUS COMPRESSOR RETROFIT. UNIT: E-001123	ENERFLEX Calgary, Alberta, Canada	P & I DIAGRAM PROCESS GAS					
4	AS PER RETROFIT SOLD SCOPE (IFA)	DEC 05/24	LW	RS	DRAWN BY	A. TRAN	CHECKED BY	N. REZAEYAN				APPROVED BY	R. PREMJI			
3	AS BUILT	MAY 05/15	SJ	NR	PROJECT MANAGER	J. HORVATH	PROJECT ENGINEER	R. SUTRAVE								
2	ISSUED FOR CONSTRUCTION-- LINE # CHANGE	FEB 18/15	SJ	NR	CUST PO	---										
1	ISSUED FOR CONSTRUCTION	JAN 13/15	TR	NR												
0	ISSUED FOR CONSTRUCTION	NOV 27/14	SJ	NR												
REV	DESCRIPTION	DATE	BY	APR	APEGA PERMIT No:	P865P8651	OPER. CODE	490 511 591	RETRO FIT JOB#	E005063-01	DWG NO	E001123-01-111	SHT	3	REV	5

PLOT 29 Jan. 2025-9:26am. Inition THE INFORMATION CONTAINED HEREIN IS THE CONFIDENTIAL PROPERTY OF ENERFLEX LTD. AND IS NOT FOR PUBLICATION, AND NO PART THEREOF SHALL BE COPIED OR COMMUNICATED TO A THIRD PARTY WITHOUT AUTHORIZATION FROM ENERFLEX, LTD.

5K-1401
SCREW GAS COMPRESSOR

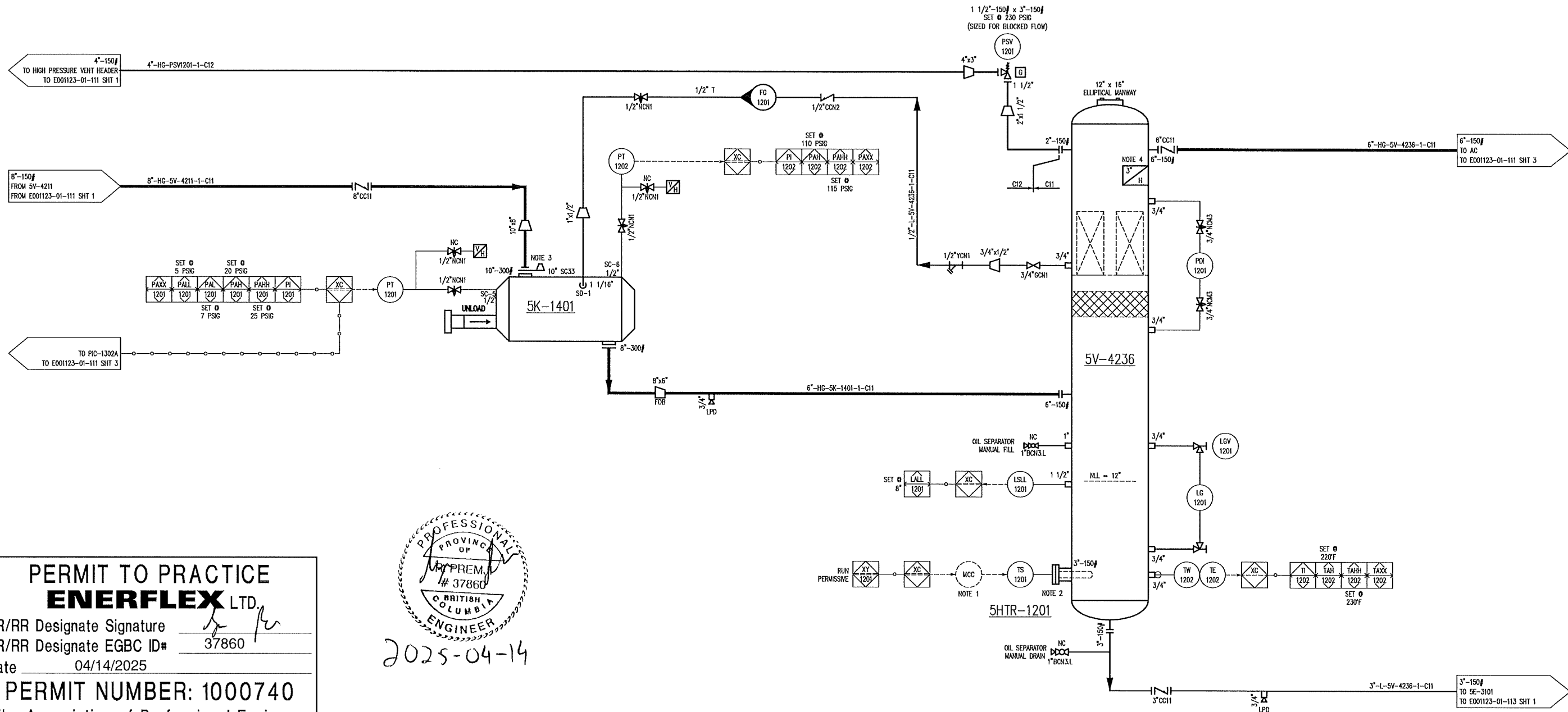
MFG: FRICK
MODEL: SGC-2821
OPERATING SPEED: 3585 RPM
DESIGN CAPACITY: 4.725 MMSCRD
DESIGN DIFFERENTIAL PRESSURE: 90 PSIG

5HTR-1201
IMMERSION HEATER

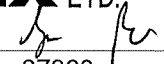
MAKE: CALORITECH
MODEL: CXFT303F332X-00SM
POWER: 3KW, 460V/3PH/60HZ
WATT DENSITY: 14 W/in²
BUILT IN THERMOSTAT

5V-4236
OIL SEPARATOR

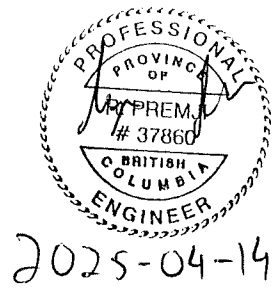
MFG: EFX
SIZE: 36" ID X 102" S/S
MAWP: 230 PSIG @ 300°F
MDMT: -20°F @ 230 PSIG
CA: 1/16"
MAT'L: SA-516-70N
SN: E001123014236
CRN: W8114.2



PERMIT TO PRACTICE
ENERFLEX LTD.

RR/RR Designate Signature 
RR/RR Designate EGBC ID# 37860
Date 04/14/2025

PERMIT NUMBER: 1000740
The Association of Professional Engineers
and Geoscientists of B.C. (EGBC)

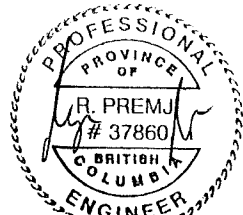
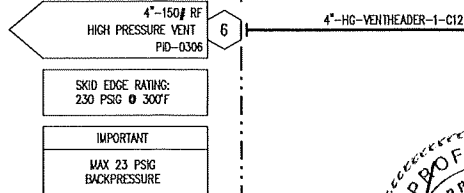
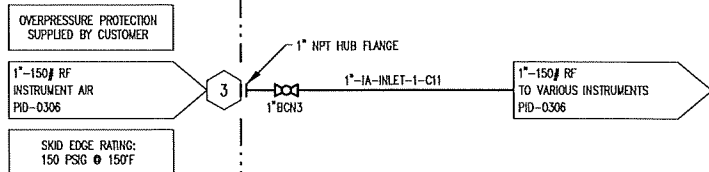


ISSUED FOR
CONSTRUCTION
NAME L. WILSON DATE DEC. 16/24

- NOTES:
1. WIRING FROM MCC TO HEATER BY OTHERS.
 2. SET @ MINIMUM HEIGHT ABOVE SEAM.
 3. CONE STRAINER C/W COMPRESSOR.
 4. INSULATION MATERIAL IS MINERAL WOOL.
 5. ALL VALVES ARE NORMALLY OPENED UNLESS NOTED OTHERWISE.

	5	AS PER RETROFIT SOLD SCOPE (IFC)	DEC 16/24	LW	RS	DATE	FEB 11/14	SCALE	NTS	FUELLED ENERGY MARKETING INC. SURPLUS COMPRESSOR RETROFIT. UNIT: E-001123	ENERFLEX Calgary, Alberta, Canada	P & I DIAGRAM PROCESS GAS					
	4	AS PER RETROFIT SOLD SCOPE (IFA)	DEC 05/24	LW	RS	DRAWN BY	A. TRAN	CHECKED BY	N. REZAEYAN						APPROVED BY	R. PREMJI	
	3	AS BUILT	MAY 05/15	SJ	NR	PROJECT MANAGER	J. HORVATH	PROJECT ENGINEER	R. SUITRAVE								
	2	ISSUED FOR CONSTRUCTION- LINE # CHANGE	FEB 18/15	SJ	NR												
	1	ISSUED FOR CONSTRUCTION	JAN 13/15	TR	NR	CUST PO	-										
	0	ISSUED FOR CONSTRUCTION	NOV 27/14	SJ	NR												
	REV	DESCRIPTION	DATE	BY	APR	APEGA PERMIT No:	P865P8651	OPER. CODE	490 511 591	RETRO FIT JOB#	E005063-01	DWG NO	E001123-01-111	SHT	2	REV	5

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2025-04-14

PERMIT TO PRACTICE ENERFLEX LTD.

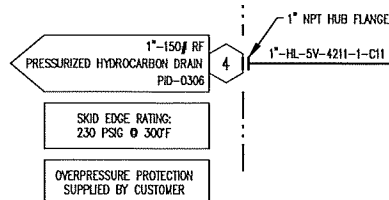
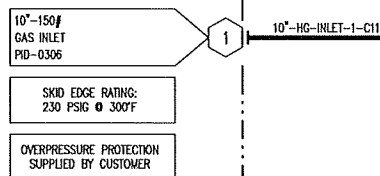
RR/RR Designate Signature

RR/RR Designate EGBC ID#

Date 04/14/2025

PERMIT NUMBER: 1000740

The Association of Professional Engineers
and Geoscientists of B.C. (EGBC)



5PM-1101
FILTER DRAIN PUMP MOTOR
MFG: TECO
POWER: 1.5 HP @ 1800 RPM
460V/3PH/60HZ
EXPLOSION PROOF
CLASS I, ZONE 1

5P-1101
SUCTION FILTER DRAIN PUMP
MFG: HYDRA-CELL
MODEL: D10
FLOW: 8.4 US GPM
C/W ELECTRIC MOTOR

5V-4211
SUCTION FILTER
MFG: EFX
SIZE: 48" ID X 120" S/S
MAWP: 230 PSIG @ 300°F
MDMT: -20°F @ 230 PSIG
CA: 1/16"
MAT'L: SA-516-70N
SN: E001123014211
CRN: W8008.2

PURGE
CONNECTION

NC

3/4" BCH3

10" GC11

1" BCH3

1" YCN1

1" BCH3

1" CCN2

3/4"

1" YCN1

1" BCH3

1" CCN2

3/4"

1" YCN1

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TUBING SPECIFICATIONS

PROCESS TUBING		UTILITY TUBING	
TUBING SPECIFICATION	ENERFLEX: G-S04-CSZ-CS-S16-375	TUBING SPECIFICATION	ENERFLEX: G-S04-CSZ-CS-S16-375
TUBING MATERIAL	304SS	TUBING MATERIAL	304SS
FITTING MATERIAL	ZINC PLATED CARBON STEEL C/W SS BACK FERRULE	FITTING MATERIAL	ZINC PLATED CARBON STEEL C/W SS BACK FERRULE
OUTSIDE DIAMETER	MINIMUM WALL THICKNESS	OUTSIDE DIAMETER	MINIMUM WALL THICKNESS
1/4"	0.035"	1/4"	0.035"
3/8"	0.035"	3/8"	0.035"
1/2"	0.049"	1/2"	0.049"
-	-	3/4"	0.065"
-	-	1"	0.083"

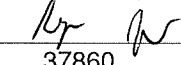
SMALL BORE NPT & SW PIPING & FITTINGS

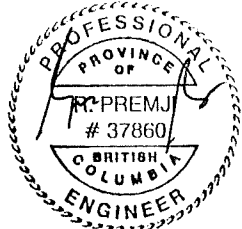
PROCESS & SCREW PIPING SPECIFICATIONS

SWEET SERVICE (-20-650°F,1/16"CA)							
EFX PIPE SPECIFICATION		PIPING				FITTINGS	
		NPT		SW		NPT & THREADOLET	SW & SOCKOLET
C11	150#	1/2"	160	1/2"-1 1/2"	XS	1/2"-2" 3000#	
		3/4"-2"	XS	2"	STD		

UTILITY PIPING SPECIFICATIONS

SMALL BORE NPT & SW PIPING & FITTINGS						
LOW PRESSURE UTILITY SERVICE						
EFX PIPE SPECIFICATION	PIPING				FITTINGS	
	NPT		SW		NPT & THREDOLET	SW & SOCKOLET
C01 NON-CODE	1/2"-3/4"	160	1/2"-1 1/2"	XS	1/2"-2" 3000#	1/2"-2" 3000#
	1"-2"	XS	2"	STD		

PERMIT TO PRACTICE
ENERFLEX LTD.
RR/RR Designate Signature 
RR/RR Designate EGBC ID# 37860
Date 04/14/2025
PERMIT NUMBER: 1000740
The Association of Professional Engineers
and Geoscientists of B.C. (EGBC)



2025-04-14

ISSUED FOR
CONSTRUCTION
NAME L.WILTON DATE DEC. 16/24

	4	AS PER RETROFIT SOLD SCOPE (IFC)	DEC 16/24	LW	RS	DATE FEB 12/14	SCALE NTS	FUELLED ENERGY MARKETING INC. SURPLUS COMPRESSOR RETROFIT. UNIT: E-001123	ENERFLEX Calgary, Alberta, Canada	P & I DIAGRAM PROJECT DESCRIPTION & OVERVIEW		
	3	AS PER RETROFIT SOLD SCOPE (IFA)	DEC 05/24	LW	RS	DRAWN BY A. TRAN	CHECKED BY N. REZAEYAN				APPROVED BY R. PREMJI	
	2	AS BUILT	MAY 05/15	SJ	NR	PROJECT MANAGER J. HORVATH	PROJECT ENGINEER R. SUTRAVE					
	1	ISSUED FOR CONSTRUCTION	JAN 13/15	TR	NR	CUST PO	--					
	0	ISSUED FOR CONSTRUCTION	NOV 27/14	SJ	NR							
	8	ISSUED FOR APPROVAL	OCT 09/14	TW	NR							
	REV	DESCRIPTION	DATE	BY	APR	APEGA PERMIT No: P865P8651		OPER CODE 490 511 591	RETRO FIT JOB# E005063-01	DWG NO E001123-01-099	SHT 2	REV 4



Section 4

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Enerflex

Quality Control

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Enerflex

Data

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(ALTERNATIVE FORM FOR SINGLE CHAMBER, COMPLETELY SHOP OR FIELD FABRICATED VESSELS ONLY)

AS REQUIRED BY THE PROVISIONS OF THE ASME BOILER AND PRESSURE VESSEL CODE RULES, SECTION VIII, DIVISION 1

1. Manufactured and certified by: AXH air-coolers, LLC - 401 EAST LOWRY ROAD - CLAREMORE, OKLAHOMA 74017
(Name and address of manufacturer)

2. Manufactured for: ENERFLEX LTD. (BARLOW), 3615 - 34TH STREET NORTHEAST, CALGARY, ALBERTA, CANADA T1Y 6Z8

3. Location of installation: UNKNOWN
(Name and address)

4. Type HORZ. H. EXCHANGER 144811.2 X0950.21 144811-HDR-AC R0 & 144811-HDR-AC R0 30368 2014
(Horizontal, or vertical, tank) (Manufacturer's serial no.) (CRN) (Drawing number) (National Board number) (Year built)

5. ASME CODE, SECTION VIII, DIVISION 1 2013 EDITION / NONE
(Edition and Addenda, if applicable (date)) (Code Case numbers) [Special service per UG-120(D)]

6. Shell TUBE/PLUG: SA-516-70 FR & BK 7/8" .0625" FR & BK 6 1/4" x 5 3/4" 6' 6 5/8"
(Material spec. number, grade) (Nominal thickness) (Corr. Allow.) (Inner diameter) [Length (overall)]

Body Flanges on Shells										Bolting			
No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material	
-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	

7. Seams CORNER JOINT SEE REMARKS 1.0 NONE NONE - - - - - - - *2
[Long. (welded, dbl., sngl., lap, butt)] [R.T. (spot or Full)] (Eff., %) (H.T. temp. °F) (Time, hr) [Girth (welded, dbl., sngl., lap, butt)] [R.T. (spot or full)] (Eff., %) (No. of courses)

8. Heads (a) Material WRAPPERS: SA-516-70 (b) Material ENDS: SA-516-70
(Spec. no., grade) (Spec. no., grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	WRAPPERS	1/2"	.0625"	-	-	-	-	-	**	FLAT
(b)	ENDS	3/8"	.0625"	-	-	-	-	-	***	FLAT

Body Flanges on Heads										Bolting			
	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material	
(a)	-	-	-	-	-	-	-	-	-	-	-	-	
(b)	-	-	-	-	-	-	-	-	-	-	-	-	

9. MAWP 230 psi. N/A at max. temp. 300 °F N/A
(Internal) (External) (Internal) (External)

Min. design metal temp. -20 °F at 230 psi. Hydro., pneu. or comb. test pressure 299 psi.

Proof test NONE

10. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, Drain)	No.	Diameter or size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
INLET/OUTLET	2	4"-150#	PIPE/RFWN	SA-106-B	SA-105	S/80	.0625"	NONE	UW-16(a)	UW-12(1)	HEADER
INSTRUMENT	1	1"	CPLG	SA-105	-	6000#	.0625"	NONE	UW-16(a)	-	HEADER
PLUGS	380	7/8"-14	UNF	SA-105	-	-	-	-	-	-	HEADER

11. Supports: Skirt NO Lugs N/A Legs N/A Other STRUCTURE Attached BOLTED
(Yes or no) (Number) (Number) (Describe) (Where and How)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: _____
(Name of part, item number, Manufacturer's name and identifying stamp)

*2 HEADERS, ONE AT EACH END. **WRAPPERS FLAT DIA. 6 1/4" X 6' 6 5/8". ***ENDS FLAT DIA. 6 1/4" X 5 3/4".

190 TUBES SA-179 3/4" O.D. X .065 MW 14' 0" LG. RADIOGRAPH PER CUSTOMER SPECIFICATION'S.

IMPACTS EXEMPT PER UG-20(f). PRESSURE RELIEF DEVICE BY OTHERS. CONSTRUCTED IN ACCORDANCE WITH APPENDIX 28.

AC HEADER VOLUME: 2799 CU. IN. PER HEADER. ENERFLEX TAG# E001123-01

FORM U-1A (Back)

CERTIFICATE OF SHOP / FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. "U" Certificate of Authorization Number 34,950 expires 02/07/2026

Date 5/02/2025 Co. name AXH air-coolers, LLC. Signed *Roland Schumbecker*
(Manufacturer) (Representative)

CERTIFICATE OF SHOP / FIELD INSPECTION

Vessel constructed by AXH air-coolers, LLC. at 401 E. LOWRY ROAD - CLAREMORE, OKLAHOMA 74017

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and employed by

have inspected the component described in this Manufacturer's Data Report on 9-9-14, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 5-2-25 Signed *[Signature]* Commissions *NB/2461*
(Authorized Inspector) [National Board (incl. endorsements)]

ATTN: ANGEL PIOTTER -
AXH AIR COOLERS
401 E LOWRY ROAD**Date:** 06-Mar-2025
TSBC Account #: 062092
TSBC Admin Number: 116132
Canadian Registration Number: X0950.21**Re: Application for Design Registration**

The design, as detailed in your Design Portal application 144811-HDR-AC for a Heat Exchanger is registered with the following notes and considerations:

Registered To: AXH AIR COOLERS
Project Name: 144811-HDR-AC
Site Location: LSD: 10-19-87-23W6 Longitude: 56.72 Latitude: 10-19-87-23W6
Serial No.: 144811.2
Drawing No.: 144811-HDR-AC
Drawing Revision: 0

Design Details Summary:

	MAWP (kpag)	MAWT (deg C)	MDMT (deg C)
Side A	1586	149	-29
Side B	N/A	N/A	N/A

Conditions of Registration:

1- This registration is "unit specific", "site specific" and applies to the used vessel identified below, based on the following understanding and conditions, per your confirmation of Feb 27, 2025:

A- That the vessel is in the as-new condition, has never been in service, used or altered, since built, and there is no evidence of internal or external erosion or damage such as corrosion, thinning, dents, cracking, overheating or as any other kind to the vessel.

B- The Alberta CRN W0810.2 was improperly applied to the vessel nameplate, which will be amended accordingly to reflect CRN X0950.21, per your conformation.

C- The installation site Technical Safety BC Boiler Safety Officer shall be notified before pressure vessel being placed in service.

Manufacturer: AHH air-coolers, Claremore, Oklahoma, USA
Serial No.: 144811.2
Year Built: 2014
Code: ASME Sec. VIII Div.1, 2013 Ed.
CRN on MDR: W0810.2.2
Nat'l Bd No.: 30368

2- Alberta issued CRN X0950.2 on February 27, 2025.

3- Notes per ABSA acceptance letter also apply to this CRN.

Full details of this submission including the scope of registration, design conditions, fabrication details, and calculations pertaining to this design are located in the above Admin Number on the Design Portal. For all other enquiries, please contact eim@technicalsaftybc.ca.

The Engineering Information Management Team



the pressure equipment safety authority

9410 - 20 Ave N.W.

Edmonton, Alberta, Canada T6N 0A4

Tel: (780) 437-9100 / Fax: (780) 437-7787

February 27, 2025

Certificate of Design Registration

To attest that subject design is registered in accordance with section 40 of the Safety Codes Act and recorded in the information system maintained pursuant to section 58 of the Safety Codes Act.

See Appendix A to this Certificate

AXH AIR-COOLERS
401 E. LOWRY ROAD
CLAREMORE, OK 74017

Attention: Angel Piotter

The design submission, Tracking Number 2025-01195, originally received on February 24, 2025 was surveyed and accepted for registration as follows:

CRN : X0950.2

Accepted on: February 27, 2025

Reg Type: USED EQUIPMENT IMPORTED TO ALBERTA

Drawing No. : 144811-HDR-AC sht.1 Rev 0

S/N: 144811.2

NB#: 30368

Description	MAWP	Design Temperature	MDMT
TS Internal Pressure	1586kPa	149 °C	-29 °C

The registration is conditional on your compliance with the following notes:

- The registration applies to this specific Air Cooled Heat Exchanger (Mfr. S/N: 144811.2, NB#: 30368) and does not imply that additional units of this design can be manufactured under this CRN. Neither can additional units of the same original design be put into operation in Alberta without the express written acceptance of the Alberta Boilers Safety Association.
- The Air Cooled Heat Exchanger is also subject to ABSA's local SCO (Inspector) inspection and acceptance prior to being placed in service in Alberta.

An invoice covering survey and registration fees will be forwarded from our Revenue Accounts.

If you have any question don't hesitate to contact me by phone at (587) 686-9358 or fax (780) 437-7787 or e-mail Onshchenko@absa.ca.

TETYANA ONSHCENKO, P. Eng.
DOP Cert. No. D00010125

Appendix A: List Of Files And Documents

The design registered under this Certificate of Design Registration and CRN is described in the electronic files listed below. These files include plans, diagrams, drawings, specifications, and other pertinent documents related to the pressure equipment or procedure subject to this registration.

Document Description	File name
Certificate of Design Registration	2025-01195 Certificate.pdf
Drawing	144811-HDR-AC.PDF

2025-01195	ABSA
SAFETY CODES ACT - PROVINCE OF ALBERTA	
ACCEPTED: X0950 . 2	
See This Certificate of Design Registration for Conditions and remarks	
Date: 2025-02-27	
Registered By:	
TETYANA ONSHCENKO P. Eng. DOP:D00010125	
FOR USED EQUIPMENT NB#30368	

This stamp and signature have been affixed electronically to this registered design as required by Section 19(1) of the Pressure Equipment Safety Regulation, in accordance with the Electronic Transactions Act.

January 12, 2015

Attention: Ruben Lara
ENERFLEX LTD
SERVICE DIVISION
4700 47 STREET SE
CALGARY, AB

The design submission, tracking number 2014-09773, originally received on November 21, 2014 was surveyed and accepted for registration as follows:

CRN : W8008.2

Accepted on: January 12, 2015

Reg Type: New Design

Drawing No. : E001123-01-4211 SHTS 1-2 Rev 1

Description	MAWP	Design Temperature	MDMT
Internal Pressure	1586kPa	149 °C	-29 °C

An invoice covering survey and registration fees will be forwarded from our Revenue Accounts.

If you have any question don't hesitate to contact me by phone at (780) 433-0281 ext 3358 or fax (780) 437-7787 or e-mail nakevski@absa.ca.

Sincerely,



NAKEVSKI, ANGEL



the pressure equipment safety authority

**Celebrating 20 years
1995 – 2015**

**9410 - 20 Ave N.W.
Edmonton, Alberta, Canada T6N 0A4
Tel: (780) 437-9100 / Fax: (780) 437-7787**

January 19, 2015

Attention: Ruben Lara
ENERFLEX LTD
SERVICE DIVISION
4700 47 STREET SE
CALGARY, AB

The design submission, tracking number 2015-00133, originally received on January 12, 2015 was surveyed and accepted for registration as follows:

CRN : W8114.2

Accepted on: January 19, 2015

Reg Type: New Design

Drawing No. : E001123-01-4236 SHTS 1/2 Rev 0

Description	MAWP	Design Temperature	MDMT
Internal Pressure	1586kPa	149 °C	-29 °C

An invoice covering survey and registration fees will be forwarded from our Revenue Accounts.

If you have any question don't hesitate to contact me by phone at (780) 433-0281 ext 3358 or fax (780) 437-7787 or e-mail nakevski@absa.ca.

Sincerely,

NAKEVSKI, ANGEL

ATTN: STEVE WU ENERFLEX LTD.
ENERFLEX LTD.
4700 47 ST SE
CALGARY AB T2B 3R1

Date: 14-Jan-2025
TSBC Account #: 757643
TSBC Admin Number: 114744
Canadian Registration Number: W8008.21

Re: Application for Design Registration

The design, as detailed in your Design Portal application E005063-01 (E001123-01-4211) #113802 for a Pressure Vessel is registered with the following notes and considerations:

Registered To: Enerflex Ltd.
Project Name: E005063-01 (E001123-01-4211) #113802
Site Location: LSD: 10-19-87-23W6M Longitude: 56.72
Serial No.: E001123014211
Drawing No.: E001123-01-4211
Drawing Revision: 1

Design Details Summary:

MAWP (psig)	MAWT (deg F)	MDMT (deg F)
230	300	-20

Conditions of Registration:

This registration is for an used vessel with CRN# W8008.2x , Serial # E001123014211 based on original design, Drawing# 001123-01-4211 Rev.1 : 1) Per statement from the applicant the used pressure vessel had never been used since it was built in 2015 and it was properly stored with N2 preservation . 2) An alteration nameplate with CRN to be added. 3) TSBC BSO to be notified of installation of this used vessel in BC prior to any field work starting

Full details of this submission including the scope of registration, design conditions, fabrication details, and calculations pertaining to this design are located in the above Admin Number on the Design Portal. For all other enquiries, please contact eim@technicalsaftybc.ca.

The Engineering Information Management Team

ATTN: STEVE WU ENERFLEX LTD.
ENERFLEX LTD.
4700 47 ST SE
CALGARY AB T2B 3R1

Date: 14-Jan-2025
TSBC Account #: 757643
TSBC Admin Number: 114763
Canadian Registration Number: W8114.21

Re: Application for Design Registration

The design, as detailed in your Design Portal application E005063-01 (E001123-01-4236) #113870 for a Pressure Vessel is registered with the following notes and considerations:

Registered To:	Enerflex Ltd.
Project Name:	E005063-01 (E001123-01-4236) #113870
Site Location:	none none , wonowon, BC V0C2N0 LSD: 10-19-87-23 w6m
Serial No.:	E001123014236
Drawing No.:	E001123-01-4236
Drawing Revision:	0

Design Details Summary:

MAWP (psig)	MAWT (deg F)	MDMT (deg F)
230	300	-20

Conditions of Registration:

This registration is for an used vessel with CRN# W8014.2x , Serial # E001123014236 based on original design, Drawing# 001123-01-4236 Rev.0 : 1) Per statement from the applicant the pressure vessel has never been used since it was built in 2015 and it was properly stored with N2 preservation . 2) An alteration nameplate with CRN to be added. 3) TSBC BSO to be notified of installation of this used vessel in BC prior to any field work starting

Full details of this submission including the scope of registration, design conditions, fabrication details, and calculations pertaining to this design are located in the above Admin Number on the Design Portal. For all other enquiries, please contact eim@technicalsaftybc.ca.

The Engineering Information Management Team



TSBC Licence # LBP0002069

PRV INSPECTION AND TEST REPORT

BRANCH: Edmonton

UVL ID#: 51762E

Work Order: W14008174

Customer PO#:

Customer: ENERFLEX LTD

Date: 01/07/2025

Facility: LSD:

PSV Location: SUCTION FILTER

A#: Vessel SN:

Cust Id: PSV-1101

Cust. Ref.: Valve PO:

PO LINE#:

Cust. WO#: Cust AFE#:

Cost Centre#:

VALVE DATA

Man.: FARRIS Model: 27CA13-M20/S7 Serial: 827709-1-KE Seat: HARD
Conn. Threaded Inlet: 0.5" MNPT Orifice: C Outlet: 1" FNPT Vacuum: N/A
Set Press. 230 PSI Back Press.: 23 PSI CDT: 207 PSI Temp: N/A F Cap: 292 SCFM
Lift Lever ☐ Cap Assembly: Closed Bellows: ☐ Code Symbol: UV/NB CRN#: 0G11969.5C

CUSTOMER INSTRUCTIONS

Instructions: Quote Before Service

Pretest Required? ☒Reset Required? ☐

CONDITION AS RECEIVED

Visual Condition: Fair Data Plate Condition: OK Date of last service: 11/2014
Seal Condition: Top: Intact Bottom: N/A Insignia: F Fittings Attached: Inlet: ☐ Outlet: ☐
Inlet: Product Inlet Plugged: ☐ Outlet: Product Outlet Plugged: ☐ Initial Insp. Signoff: Wally Praxedes

PRETEST 1 - TESTED ON Air

Simmer: 207 PSI Set Press: 209 PSI Reseat: 185 PSI Leakage: 20 BPM Test Gauge: CDG03/04
Tested By: Davin Steidel Pretest Comments:

PRETEST 2

Simmer: Set Press: Reseat: Leakage: Test Gauge: CDG03/04
Tested By: Pretest Comments:

COMPONENTS INSPECTION

(0 Like New / 1 Minor / 2 Medium / 3 Major)

ITEM	CLEAN	OILY	RUSTY	CARBON	PITTED	CORRODED	SCALE	VIBRATION	GROOVED	DENTED	GALLING	GOUNDED	OTHER	Machined	Lapped	Polished	Replaced	Replace Next Service	COMMENTS
DISC	0				1									☒	☒	☐	☐	☐	
NOZZLE	0				1									☒	☒	☐	☐	☐	
CAP-LEVER ASSY	0													☐	☐	☐	☐	☐	
COMP SCREW and LOCK	0													☐	☐	☐	☐	☐	
AS FOUND: 12MM																			
AS LEFT: 12MM																			
SPRING and BUTTONS	0													☐	☐	☐	☐	☐	
SPINDLE / STEM	0													☐	☐	☐	☐	☐	
STEM RETAINER														☐	☐	☐	☐	☐	
DISC HOLDER	0													☐	☐	☐	☐	☐	
GUIDE / UPPER RING	0													☐	☐	☐	☐	☐	
LOWER RING														☐	☐	☐	☐	☐	
RING PIN(S)														☐	☐	☐	☐	☐	
BELLOWS														☐	☐	☐	☐	☐	
GASKET / SEALS													3	☐	☐	☐	☒	☐	CRUSHED
CONNECTION ENDS	0													☐	☐	☐	☐	☐	
OTHER														☐	☐	☐	☐	☐	

DISC: Min: 0.344 As Rcv'd- 0.357 ACT - 0.357 NOZZLE: Min 0.985 As Rcv'd- 1.001 ACT - 1.000

SPRING NUMBER: NO# Vacuum Weights: As Rcv'd- As Sent:

Disassembly: Devon Harris Inspection: Devon Harris Reassembly: Devon Harris

FINAL TEST

Test Medium Air Simmer: 206 PSI Cold/Diff Set: 207 PSI
Reseat: 183 PSI Leakage Acceptable: ☒ B.P. Test: 60 PSI Vacuum: N/A
ADJ. RING SETTING (NOTCHES): Upper: N/A Lower: N/A Test Gauge: CDG03/04 Set Press Def POP
Tested by: Davin Steidel Date Final Tested: 01/07/2025

FINAL INSPECTION:

SEAL: Top: ☒ Bottom: ☐ End Protectors Installed: ☒ Painted: ☒ Palletized: ☐ Ship Container: ☒ Flex Gaskets Supplied: ☐

Final Inspection: Wally Praxedes

Customer Inspection:

Comments: - SERVICE RATING: ROUTINE



TSBC Licence # LBP0002069

PRV INSPECTION AND TEST REPORT

BRANCH: Edmonton

UVL ID#: 51761E

Work Order: W14008174

Customer PO#:

Customer ENERFLEX LTD

Date: 01/07/2025

Facility: LSD:

PSV Location: OIL SEPARATOR (DISCHARGE)

A#: Vessel SN:

Cust Id: PSV-1201

Cust. Ref.: Valve PO:

PO LINE#:

Cust. WO#: Cust AFE#:

Cost Centre#:

VALVE DATA

Man.: FARRIS Model: 26GA10A-120/S7 Serial: 824542-2-A10/G Seat: HARD
Conn. Flanged Inlet: 1.5" 150 RF Orifice: G Outlet: 3" 150 RF Vacuum: N/A
Set Press. 230 PSI Back Press.: 23 PSI CDTF: 207 PSI Temp: N/A F Cap: 2,353 SCFM
Lift Lever ☐ Cap Assembly: Closed Bellows: ☐ Code Symbol: UV/NB CRN#: 0G8442.5R2CI

CUSTOMER INSTRUCTIONS

Instructions: Quote Before Service

Pretest Required? ☒Reset Required? ☐

CONDITION AS RECEIVED

Visual Condition: Fair Data Plate Condition: OK Date of last service: 11/2014
Seal Condition: Top: Intact Bottom: N/A Insignia: F Fittings Attached: ☐ Inlet: ☐ Outlet: ☐
Inlet: Product Inlet Plugged: ☐ Outlet: Product Outlet Plugged: ☐ Initial Insp. Signoff: Wally Praxedes

PRETEST 1 - TESTED ON Air

Simmer: 209 PSI Set Press: 210 PSI Reseat: 176 PSI Leakage: 20 BPM Test Gauge: CDG03/04
Tested By: Davin Steidel Pretest Comments:

PRETEST 2

Simmer: Set Press: Reseat: Leakage: Test Gauge: CDG03/04
Tested By: Pretest Comments:

COMPONENTS INSPECTION

(0 Like New / 1 Minor / 2 Medium / 3 Major)

ITEM	CLEAN	OILY	RUSTY	CARBON	PITTED	CORRODED	SCALE	VIBRATION	GROOVED	DENTED	GALLING	GOUGED	OTHER	Machined	Lapped	Polished	Replaced	Replace Next Service	COMMENTS
DISC	0				1									☒	☒	☐	☐	☐	
NOZZLE	0				1									☒	☒	☐	☐	☐	
CAP-LEVER ASSY	0													☐	☐	☐	☐	☐	
COMP SCREW and LOCK	0													☐	☐	☐	☐	☐	
AS FOUND: .35MM AS LEFT: .35MM																			
SPRING and BUTTONS	0													☐	☐	☐	☐	☐	
SPINDLE / STEM	0													☐	☐	☐	☐	☐	
STEM RETAINER	0													☐	☐	☐	☐	☐	
DISC HOLDER	0													☐	☐	☐	☐	☐	
GUIDE / UPPER RING	0													☐	☐	☐	☐	☐	
LOWER RING	0													☐	☐	☐	☐	☐	
RING PIN(S)	0													☐	☐	☐	☐	☐	
BELLOWS														☐	☐	☐	☐	☐	
GASKET / SEALS	0												3	☐	☐	☐	☒	☐	CRUSHED
CONNECTION ENDS	0													☐	☐	☐	☐	☐	
OTHER														☐	☐	☐	☐	☐	

DISC: Min: 0.296 As Rcv'd- 0.313 ACT - 0.313 NOZZLE: Min 4.093 As Rcv'd- 4.187 ACT - 4.187

SPRING NUMBER: NO# Vacuum Weights: As Rcv'd- As Sent:

Disassembly: Devon Harris Inspection: Devon Harris Reassembly: Devon Harris

FINAL TEST

Test Medium Air Simmer: 205 PSI Cold/Diff Set: 207 PSI
Reseat: 193 PSI Leakage Acceptable: ☒ B.P. Test: 60 PSI Vacuum: N/A
ADJ. RING SETTING (NOTCHES): Upper: N/A Lower: -5 Test Gauge: CDG03/04 Set Press Def POP
Tested by: Davin Steidel Date Final Tested: 01/07/2025

FINAL INSPECTION:

SEAL: Top: ☒ Bottom: ☒ End Protectors Installed: ☒ Painted: ☒ Palletized: ☒ Ship Container: ☐ Flex Gaskets Supplied: ☐

Final Inspection: Wally Praxedes

Customer Inspection:

Comments: - SERVICE RATING: ROUTINE