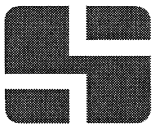


SMITHCO

FINAL I.O.M. DATA BOOK

SMITHCO JOB NUMBER: 2010B339

CUSTOMER: ENGINEERING TECHNOLOGY, INC. (ETI)

REF. PO: D12197

EDI JOB #: DO062109

TAG: AC-8180

DATE: 09/7/2010

Smithco Engineering
6312 S. 39th West Ave., Tulsa, OK 74132
(918) 446-4406
www.smithco-eng.com

SMITHCO

TABLE OF CONTENTS

INTRODUCTION

RECEIVING THE EQUIPMENT

The SMITHCO Air Cooled Heat Exchanger should be inspected thoroughly by receiving personnel. Check the columns, fan drive support, plenum panels, fan ring and guard, and cooling sections for damage. Any damage in transit must be noted on receiving documents presented by the carrier. Prompt claim filing will expedite compensation from the carrier.

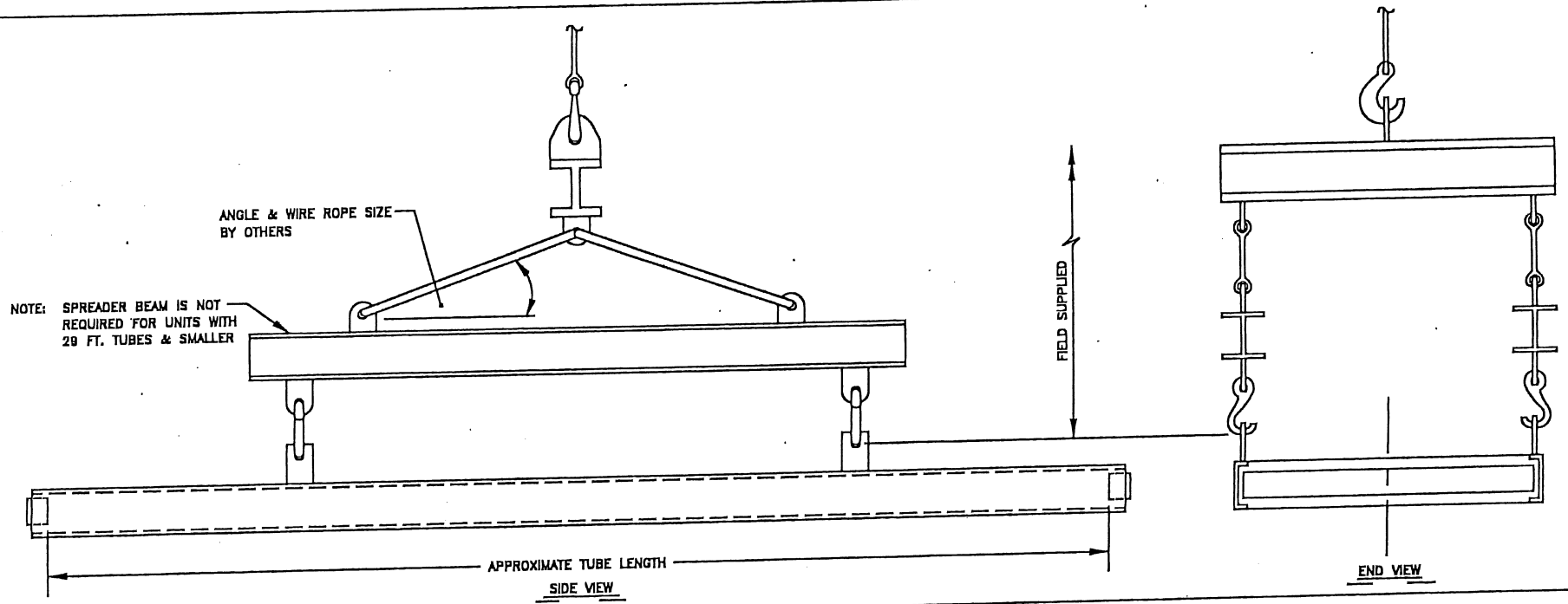
The base unit is a shop assembled cooling unit. The columns, braces, walkway supports, and walkways may be shipped disassembled due to shipping limitations. The ship loose parts will normally be secured on the trailer with the base unit or may require additional trailer(s), depending on the size and extent of these items.

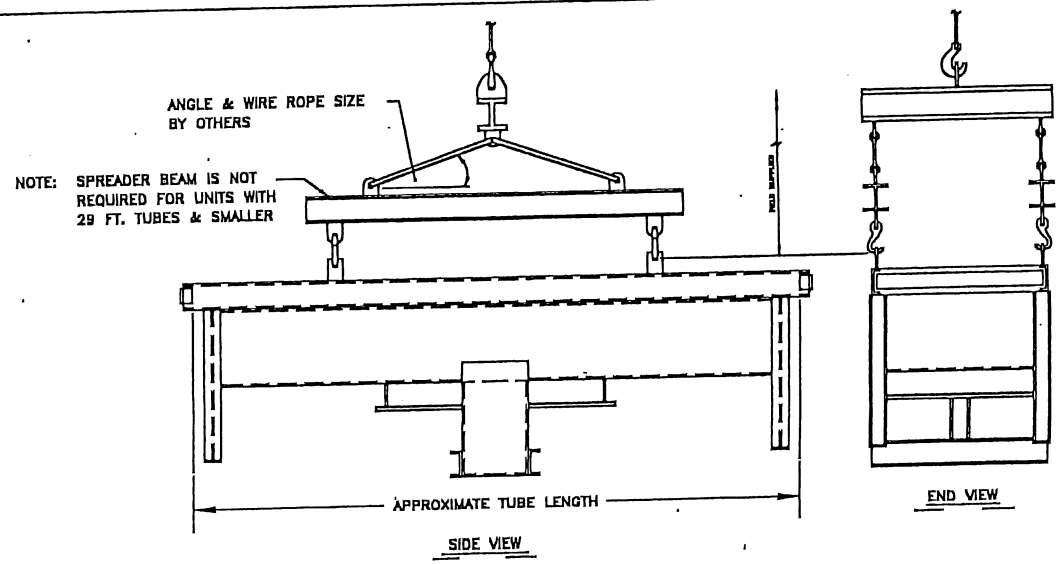
Included with the shipping documents is a Shipping List. This document lists all ship loose items with the part number or piece mark number shown as the Item #. Each ship loose item should be counted and marked as received.

To enable assembly of the components, the appropriate assembly instructions will accompany the shipment.

Attached:

1. Shipping List
2. General Storage Recommendations
3. Lifting Details





FOR INFORMATION ONLY
NOT FOR REVIEW

SMITHCO
ENGINEERING, INC.
Tulsa, Oklahoma

COIL SECTION & STRUCTURE
LIFTING DETAIL

DWN KIM	CKD -------	DATE 10/12/92	
JOB NO. STD.		DWG NO. A-1000	
REVISION	0		F

COIL SECTION & STRUCTURE LIFTING DETAIL

Serving the Industry Since 1952
Member of HTRI & ACHEMA

SMITHCO ENGINEERING, INC.

P.O. Box 571330
Tulsa, OK 74157
Phone: (918) 446-4406
Fax: (918) 445-2857

SHORT TERM AND LONG TERM STANDBY RECOMMENDATIONS

Shut down periods of an air cooled heat exchanger for an extended period of time can cause serious damage to some components under almost any conditions. Shut down in a wet or humid atmosphere can cause condensate to damage the electric motors, bearings, and unprotected machined surfaces. Drive belts can be damaged by extended exposure to either wet or dry conditions. The terms of shut down as shown below are general and based on moderate conditions. If the shut down is on a coastal or tropical area, the conditions will require a higher level of protection for even a short storage period.

Shut Down Period — 1 Month or Less
If the unit will be idle for a period longer than one week, it will be necessary to run the unit for ten minutes every week it is idle. This short operation will keep the gears and bearings coated with oil and prevent rusting due to condensation of moisture resulting from temperature changes.

Shut Down Period — 1 to 6 Months (Moderate Conditions)

1. Nozzles covered and sealed with tape.
2. Drive belts relieved of tension.
3. Motors covered (shrink wrap and add desiccant bags) to protect against weather.
4. Plywood covers on fin tube bundle to avoid damage to the fins.
5. Coat all exposed machined surfaces with rust inhibiting preservative.
6. Rotate the fan and motor shafts by hand every 60 days (maximum) to circulate lubricant and avoid "brinelling" the bearings.
7. Parts such as vibration switches, louver actuators, and all other parts boxed separately should be properly marked and stored indoors in an area designated for the cooler.

Shut Down Period — 6 Months or longer (Moderate Conditions)

1. Nozzles — Install gaskets and seal with metal covers or blind flanges.
2. Nitrogen purge of bundle to retard corrosion. Check the purge pressure every week and recharge as necessary to maintain 5 to 15 psi pressure.
3. Remove motors and drives from unit and store inside a humidity controlled building.
4. If the electric motors have internal space heaters, they can be connected to power continuously to avoid condensate in the motors.
5. Plywood covers on fin tube bundle to avoid damage to the fins.
6. Coat all exposed machined surfaces with rust inhibiting preservative.
7. Rotate the fan and motor shafts by hand every 60 days (maximum) to circulate lubricant and avoid "brinelling" the bearings.
8. Parts such as vibration switches, louver actuators, and all other parts boxed separately should be properly marked and stored indoors in an area designated for the cooler.

The above are recommendations only. All or part of the recommendations may be selected depending on length of shut down and weather conditions at the site. You are advised to document all steps taken to protect the components during storage should a warranty issue arise at a later date. These recommendations are made with the understanding that Smithco assumes no responsibility for deterioration on any part of the equipment due to corrosion or erosion, when such deterioration occurs after leaving Smithco premises.

INSTALLATION

PREPARING FOR START UP

1. FIELD ASSEMBLED COMPONENTS

Structural components requiring field assembly are to be assembled per the drawing furnished. All parts are marked with a piece mark and the drawing shows the location of the part by piece mark number.

After Assembly:
Check all bolts (including shop assembled unit) to confirm they are tightened.
Remove any protective plywood panels from the top of the tube bundles.
Remove any restraint used to keep the fan from rotating during transport.

2. BEARINGS

Rotate the fan by hand to confirm that the shaft, bearings, speed reducer and driver turn freely.

Remote lubrication lines should be disconnected at the bearing, and then purged with grease from the fitting end. Reconnect the lube line at the bearing. This will ensure that the lube lines are full of grease and free of air and debris.

Check bearing flange bolts and set screws and tighten if necessary.

3. ELECTRIC MOTORS

Remove the condensate drain plug from each motor to drain any condensate that may have accumulated during storage. If space heaters are provided in the electric motors, activate them approximately 24 hours before starting the equipment.

4. V-BELT DRIVES

Check V-Belt tension in accordance with V-Belt tensioning in the Maintenance section of this manual.

5. GEAR BOX

Check gearbox for oil. Some gearboxes are shipped with no oil and must be filled and serviced per the Maintenance section of this manual.

6. LOUVERS

Check all louvers for ease of movement prior to operation. If they do not operate freely, loosen the frame mounting bolts and adjust the frame until the louvers move freely. Retighten the bolts.

Check all mounting brackets and bolts for tightness.

Check the operation of manually operated louvers by moving the manual operator from full open to full closed several times to confirm proper linkage adjustment.

To check the operation of air motor operated (automatic) louvers, disconnect the actuator linkage and move the blades by hand. When operating correctly, retighten the bolts and reconnect the actuator. Check air supply line fittings for tightness and operate the air motor with air at the operating pressure to confirm proper linkage adjustment and the louvers operate freely with the specified air supply.

7. FLOATING HEADER BOLTS TO BE REMOVED PRIOR TO BEING PUT IN SERVICE.

If the bundle has an even number of passes, bolts attaching return header(s) to sideframes must be removed. If the bundle has an odd number of passes, the bolts attaching the outlet header to the sideframes must be removed. In either case, the bolts must be removed before the unit is put into service to allow thermal expansion of the tubes.

Failure to remove these bolts may result in serious damage to the bundle.

8. FANS

The fan must be checked for adequate fan blade tip clearance. Move the blades around the inside of the fan ring and observe where blades have the least amount of. clearance. The fan tip clearance should be approximately 1/2" for fans up to 9 ft. Dia., 5/8" for fans 9 ft to 11 ft. Dia., 3/4" for fans 11 ft. Dia. and larger.

Confirm the fan blade pitch setting. Looking into the end of the fan blade, the leading edge of the blade should be down and to the left. See the maintenance section for vendor instructions to set the blade pitch.

9. HYDROSTATIC TEST

SMITHCO tube bundles are hydrostatically tested at 1.3 times the design pressure before being released for shipment. To ensure that no damage has occurred during shipment and/or erection, it is good practice to hydrostatically test the entire system, including piping, heat exchangers, pumps, etc., prior to start-up. **Do not use water to hydrostatically test Oil Coolers. Movement during shipment and temperature fluctuations may cause minor seepage at the plug to plug-sheet joint. If this occurs, it will require tightening the plugs. Please contact the factory at the phone number below for advice on how to proceed.**

After hydrostatic test, remove the test connections. Completely drain the bundle and, if required, dry it. Connect all process piping and auxiliary connections.

Inspect all process connections as well as vent, drain, temperature and pressure connections to confirm they are plugged or connected properly.

START UP

1. Complete wiring of all electrical components including the motor(s), vibration switch(s), controls, etc. **DO NOT START MOTORS.**

2. ***WARNING! Turn off and lock out or tag power source before proceeding.***

3. Remove all hand tools and debris from the cooler plenum, drive supports, and any area containing components that will be moving when the fan is turning. Any loose debris under or around the unit may be pulled into the fan and should be removed from the area of the unit.

4. **If the unit is equipped with a fan anti windmilling device, it must be disengaged prior to applying power to the electric motors or serious damage could occur.**

5. Install all equipment guards to protect personnel from possible injury.

6. Switch on the fan driver momentarily to check for proper direction of rotation and fan blade orientation. A forced draft horizontal cooler fan should rotate counter-clockwise (left hand rotation) when looking at the air intake of the fan. The fan in an induced draft cooler should rotate clockwise looking at the air discharge of the fan.

7. Re-engage the anti windmilling device if the unit is so equipped.

8. If the starting torque trips the vibration switch turn the adjusting screw located on the right hand side of the vibration switch to the right (clockwise) for a less sensitive setting.

9. When the above steps are completed, start the fans and let then run for several minutes to warm the motors, bearings, etc. The fan should run smoothly and evenly in the fan ring. If there is noticeable vibration in the unit, stop and lock out the motor(s) and check the drive bolting for tightness. If necessary, tighten the bolts. If the vibration persists, check the fan blades for proper pitch and possible damage.

   With the unit running smoothly, the next step is to start the process through the tube bundle(s). The following methods of introducing the process fluid into the bundle should be followed.
   The process start-up should minimize thermal shock to the tube bundle(s) and avoid overcooling critical services during conditions of low ambient temperature and low heat load.

10. Low pour point and low viscosity services should have the process fluid introduced at a low rate and gradually increased to the design flow rate with the fans off. Start the fan(s) one at a time as the process fluid starts to exceed the design operating temperature. Start the fans until all fans are on or the process temperature is at the design operating temperature.

11. High viscosity fluids and fluids with a pour point above the ambient air temperature should have the process fluid introduced rapidly to prevent over cooling the first process liquid to contact the tubes. When the design process flow is reached and the process temperature begins to exceed the design temperature, start the fan(s) one at a time until the process temperature is at the design temperature or all the fans are running.

SHIP LIST

SMITHCO ENGINEERING INC.

P.O. Box 571330
Tulsa, OK 74157-1330
Phone (918) 446-4406 Fax (918) 445-2857

Ship To:

ETI
TBA
TBA
ATTN: ENGINEERING
TECNOLOGY IN

Date: 7/30/2010
Job #: 2010B339
Cust. PO: D12197
Shipped Via:

Item #	Qty	Description	Weight(lbs)
	1	SMITHCO Model 1 F26-101-2 Air Cooled Heat Exchanger	23100

UNIT DESCRIPTION: Size(ft)(Length x Width x Height) Weight(lbs)
27.5 x 10.1 x 8.4 19703 each

Timbers : 3 Timber Size : 8 X 8 X 124

LOOSE STRUCTURE:
Note: Stubbed Columns

101	1	BOTTOM LEFT COLUMN	{ W 6.00 x 15 x 45}
106	1	BOTTOM RIGHT COLUMN	{ W 6.00 x 15 x 45}
111	2	BOTTOM CENTER COLUMN	{ W 6.00 x 15 x 45}
131	6	END COLUMN BRACE	{ L 2.50 x 0.25 x 52}
136	8	SIDE COLUMN BRACE	{ L 2.50 x 0.25 x 52}

WALKWAYS:
INLET END:

1311	1	BOTTOM LEFT COLUMN	{ W 6.00 x 15 x 45}
1316	1	BOTTOM RIGHT COLUMN	{ W 6.00 x 15 x 45}
1326	2	WALKWAY SUPPORT	{ W 6.00 x 15 x 52}
1331	2	WALKWAY COLUMN BRACE	{ L 3.00 x 0.25 x 66}
1336	1	WALKWAY FLOOR	{FLR 31 x 5.00 x 127}
1341	2	WALKWAY OUTSIDE RAIL	{ L 42 x 2.50 x 127}
1351	2	WALKWAY END TOP RAIL	{ L 2.50 x 2.50 x 37}
1354	1	WALKWAY END TOE PLATE	{ PL 0.18 x 5.00 x 37}
1361	1	LADDER	{ PL 0.38 x 2.50 x 104}
A71-27	1	FABENCO SAFETY GATE	

LOOSE BOLTS:

292	130	BOLT,NUT,LOCK&(2)FLATS 5/8" X 2" A-325 GALV.
293	30	BOLT,NUT,LOCK&(2)FLATS 5/8" X 2 1/2" A-325 GALV.

OPERATION

OPERATION

This section of the manual contains drawings and documents specific to this air cooled heat exchanger. Please consult the Maintenance section of this manual for schedules of periodic maintenance.

LIST OF DOCUMENTS IN THIS SECTION (IF APPLICABLE)

1. Specification Sheet
2. Drawings
3. Header Calculations
4. Nozzle Loads
5. Weld Map
6. Vendor Specific Data
    a. Fan Rating, Curves, Noise Data
    b. Motor Data Sheet

OTHER REFERENCE SOURCES

VENDOR WEBSITES:

ELECTRIC MOTORS:	www.reliance.com
	www.sea.siemens.com/motors
FANS:	www.cofimco.com
	www.moorefans.com
FAN SHAFT BEARINGS:	www.dodge-pt.com
V-BELTS:	www.gates.com
	www.dayco.com
VIBRATION SWITCHES:	www.fwmurphy.com
	www.metrix1.com
	www.icca.invensys.com (Robert Shaw)
SPIRAL BEVEL GEAR BOXES:	www.amarillogear.com
	www.hubcityinc.com
LOUVER ACTUATORS AND CONTROLLERS:	www.airtechproducts.com
	www.emersonprocess.com (Fisher Actuators and Controls)
LOUVERS:	www.airtechproducts.com

SPEC SHEET

SMITHCO Engineering Inc.

P.O. Box 571330 Tulsa, OK 74157
Ph. (918) 446-4406 FAX (918) 445-2857

AIR COOLED EXCHANGER SPECIFICATION SHEET

Date	Mon* 9:42 am*14-JUN-10
Proposal/Job No.	2010B-339-01
Reference	D12197
Item No.	AC-8180

Customer	ENGINEERING TECNOLOGY IN					
Plant Location	unknown					
Service	Regen Gas Cooler					
Model	1 F26-101-2	Type	FORCED		No. of Bays	1
Surface per Unit-Finned Tube	29,710	Ft²			Bare Tubes	1,403 Ft²
Heat Exchanged	13,410,000	BTU/Hr			MTD (Eff.)	159.2 (Counter Flow)°F
Transfer Rate-Finned Tube	2.83	Bare Tube, Service	60.00			BTU/Hr. Ft2 °F

PERFORMANCE DATA-TUBE SIDE

Fluid Name	2.83 SG			Lethal Service Yes ☐ No ☒	IN	OUT
Total Fluid Entering	Lb/Hr 28,700			Density Lb/Ft³	10.5	38.3
		IN	OUT	Specific Heat (Liq/Vap) BTU/Lb°F	/ .880	.565 / .880
Temperature	°F	550.0	135.0	Cond. avg (Liq/Vap) BTU/HrFt°F	.0560/	.0278
Liquid	Lb/Hr		28,700	Pour/Freeze Point °F		
Vapor	Lb/Hr (MW)	28,700 (82.0)		Bubble Point °F		
Nocond	Lb/Hr (MW)			Latent Heat BTU/Lb		
Steam	Lb/Hr			Pressure Psia	763.00	
Water	Lb/Hr			Pressure Drop Allow/Calc Psi	5.00 / 1.74	
Viscosity (Liq/Vap)	Cp	/.022	.1887 /	Fouling resist, Inside ft² hr °F/BTU	0.00200	

PERFORMANCE DATA-AIR SIDE

Air Quantity SCFM	166,700	Lb/Hr 750,300	Altitude Ft 3,300
Air Quantity/Fan ACFM	100,700		Temperature In °F 110.0
			Temperature Out °F 184.1

DESIGN - MATERIAL - CONSTRUCTION

Design Pressure	1,100 Psig	Test Pressure	1,650 Psig	Design Temperature	650 / MDMT -20 °F		
TUBE BUNDLE		**HEADER,** Type	SPLIT PLUG BOX	**TUBE** Material	SA-179 SMLS		
Size	10.1 x 26.0	Material	SA-516 GR-70				
No. 1	No. Tube Rows 4	No. Passes 8	Slope 0.0000 In/Ft	OD 1.000 In	Min. Thick 0.0830 In		
Bays 1	In Parallel In Series	Plug	A1051822	No./Bundle 206	Length 26.0 Ft		
Bundles 1	In Parallel In Series	Gasket	CS1813	Pitch 2.3125	InΔ		
Pass Arrangement (Top to Bottom)		Corrosion Allowance	0.0625 In	FIN Type	IMBEDDED		
Rows / Pass	4/ 8	Size In Nozzle	(1) 4.00 SCH XS SA-106B In	Material	ALUM		
Turbulators	NO	Size Out Nozzle	(1) 4.00 SCH XS SA-106B In	OD 2.250 In	Stock Thick 0.016 In		
Steam Coil	NO	Rating & Facing	600 -RF SA-105	No/In 10	Support Chan. / Staple		
Hailscreens	YES	Vent	(2) 1-6000 Drain (1) 1-6000	Code-ASME VIII,Div 1 YES	Stamp NATL		
Louvers	ALUM (1) DURASTROKE 1500	TI	PI	Radiograph YES API-661	Heat Treat YES		
Frame Finish	HTC 1 Coat Galvanize	Header Finish	WMSB 1 Coat Metalize	Tube Hole Grooving	YES		

MECHANICAL EQUIPMENT

FAN Mfg & Model	Moore EC 30 10K VE Tips			**DRIVER** Type	ELECTRIC MOTOR	**SPEED REDUCER** Type	V-BELT
No./Bay	2	RPM	389	S.F. 1.00	Insul/TR CLASS F / B	BELTS (4) 3VX -1120.	SHEAVES 25.0/5.6
Dia.	9.0 Ft.	No. Blades	4	No./Bay 2	Frame 256T HP 20.0	No./Bay	2 Test Run Fan
Pitch	ADJUSTABLE	Angle°	6.	RPM (2)1750	Duty CHEM	HP Rating 29.7	Ratio 4.50
Matl, Blade	ALUM	Hub	ALUM	Enclosure TEFC DIV II (H.E.)	V & D None	Support:	SUSPENDED FROM STRUCTURE
HP/Fan, Des.	14.9	DBA	82.	V/P/C 460/3/60	Space Heater NO	Vibration Switch	MURPHY VS-2EX

STRUCTURE

Mounting	GRADE		
Windload - PSF	41.5	Seismic	None
Finish	HTC 1 Coat Galvanize		

WALKWAYS

Inlet Header in.	30 GRATING
Outlet/Return in.	None
Drive Access in.	None

NOTES

```
Coil Volume (ft^3):    23.
Assembled Drive, Structure & Bundles (Within Shipping Restrictions)
```

Plot Area	10.1 x 26.0 ft	Weight Bundle	13,870	Lbs	Total Shipping	25,360	Lbs

DRAWINGS

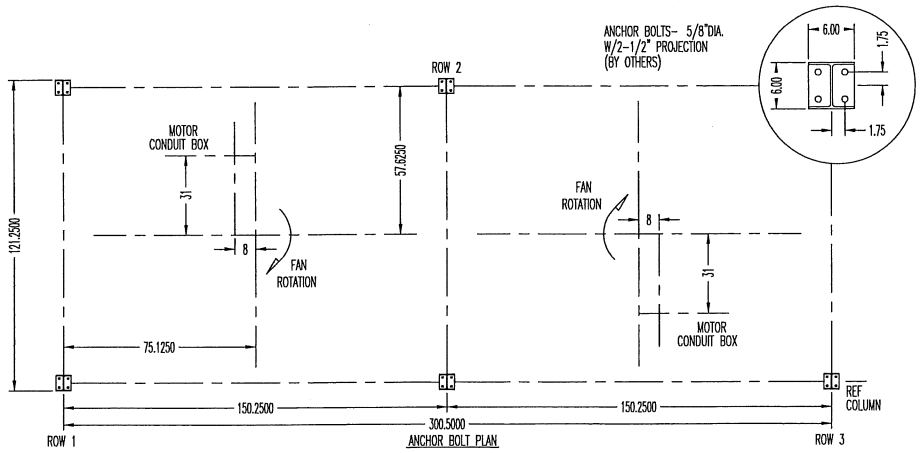
Y WGHT 23100 WIND 41.5 PSF /118 MPH SEISMIC 0 PLATFORM 100 LBS/SQ-FT LIVE

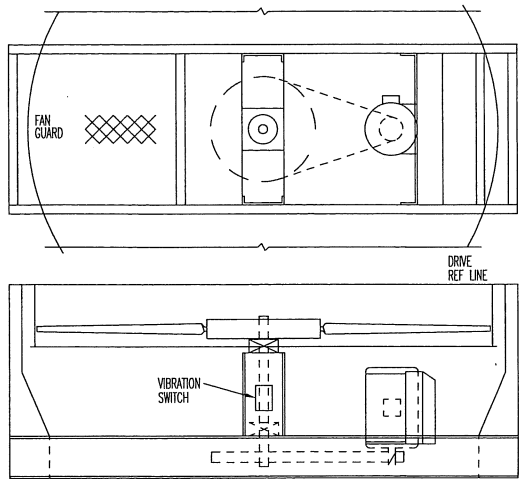
LUMN LOAD (KIPS)	DRY DEAD	WET DEAD	WIND VERT	WIND HORIZ	SEIS VERT	SEIS HORIZ	SNOW	PLAT	NOZZ VERT	NOZZ HORIZ	TOTAL
W 1 /COLUMN	2.8	3.0	1.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	4.1
W 2 /COLUMN	5.5	6.0	2.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	8.1
W 3 /COLUMN	2.8	3.0	1.1	0.6	0.0	0.0	0.0	1.0	0.0	0.0	5.0

FAN 30 10K VE
108 IN. DIAMETER 4 BLADE
101000 ACFM 5.5 DEG.
DRIVE REDUCER
BELTS (4) 3VX -1120
SHEAVES FAN 25.0 MOTOR 5.6
BEARINGS 2.1875 IN.
FAN SHAFT 2.1875" DIA. 42.625" LONG

MOTOR HP 20.0 RPM 1750. /0.
256T TEFC DIV II
INSULATION CLASS F /B TEMP RISE
460 /3/60 SINGLE WINDING VARIABLE TORQUE
AMPS(±10%)FLA 25. LRA 145.
VIBRATION SWITCH MURPHY VS-2EX
VOLTS 480. AMPS 5.0 CONTACTS (2) SPDT

SHOP RUN IN TEST

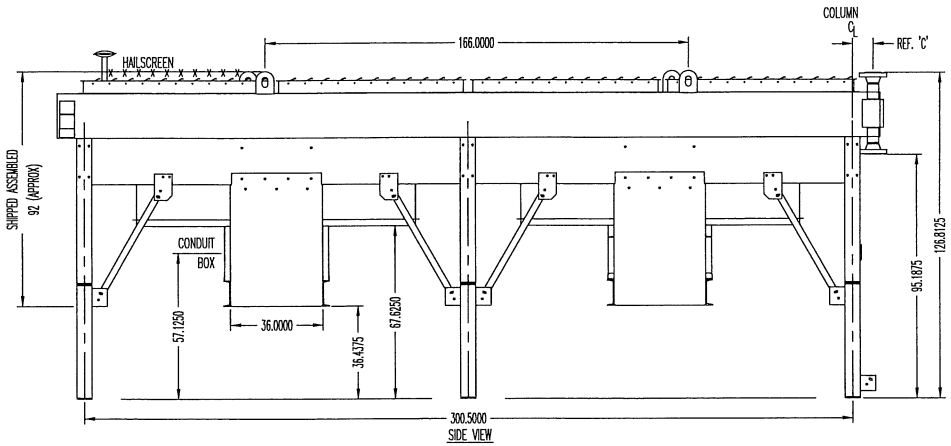


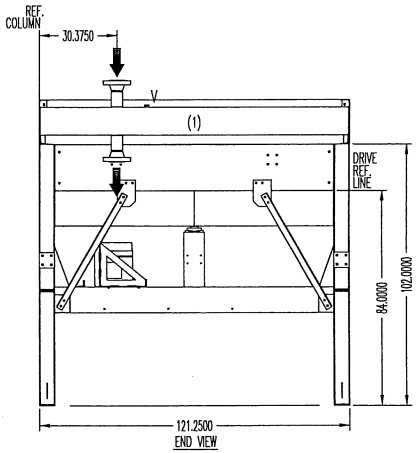


FAN & DRIVE DETAILS
ONE AS SHOWN
ONE OPP. HAND

= THIS END

= FAR END





ITEM	SERVICE	NOZZLES INLET	NOZZLES OUTLET	REFERENCE DIMENSIONS A	B	C	D	BUNDLE WEIGHT	COUPLINGS V&D	TEMP	PRESS	SHUTTER- OPERATOR	HAIL SCRN	CODE	DESIGN PRESS.
AC-8180	REGEN GAS COOLER	(1) 4.00 - 600 # RF SCH XS	(1) 4.00 - 600 # RF SCH XS	126.875	95.250	8.125		13900	1-6000			DURASTROKE 1500	YES	NATL	1100

REV 0: CERTIFIEDF FINAL JJ 6/17/10

TOLERANCES: (ALL DIMENSIONS IN INCHES)
MECHANICAL EQUIPMENT ±1/8" PER 10 ' -0"
NOZZLE ±1/8"
STRUCTURAL- HAND TOOL CLEAN
WITH 1 COAT GALVANIZE
FRAME- HAND TOOL CLEAN
WITH 1 COAT GALVANIZE
HEADER- WHITE METAL BLAST CLEAN
WITH 1 COAT METALIZE

CUSTOMER ENGINEERING TECNOLOGY IN
LOCATION SEMINOLE, TX
REFERENCE D12197

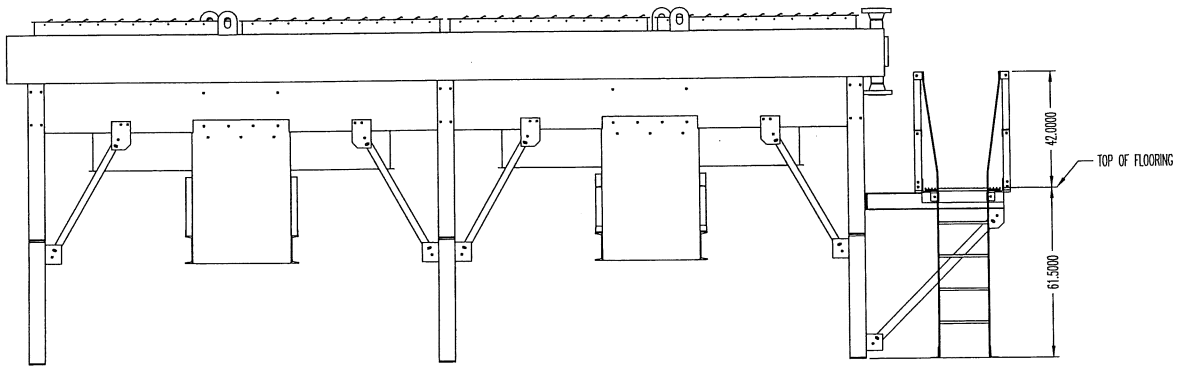
CERTIFIED BY J. HARRISON, JR. DATE 6/17/10

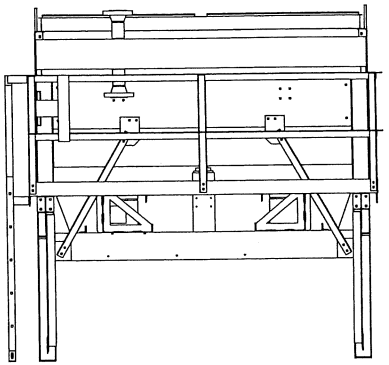
SMITHCO
AIR COOLED DIVISION
TULSA, OKLAHOMA

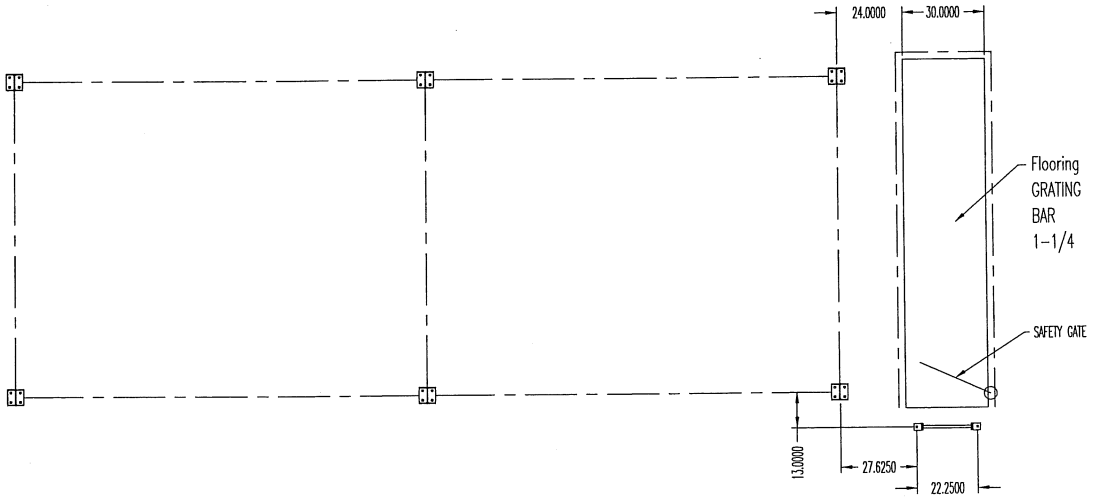
PIPING, EQUIPMENT OUTLINE & ANCHOR BOLT PLAN
MODEL 1 F 26 - 101 -2 QUANTITY 1

DWN HP CKD DATE 6 -16 -2010

REV 0 JOB 2010B 339 -A







Ladder Anchor Bolts
5/8" Dia W/ 2" Proj.

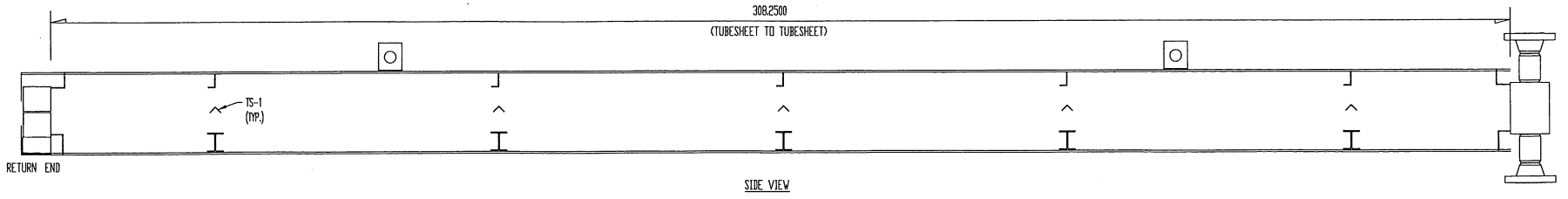
REV 0: CERTIFED FINAL JJ 6/17/10

TOLERANCES:	(ALL DIMENSIONS IN INCHES)
MECHANICAL EQUIPMENT	±1/8" PER 10 ' -0"
NOZZLE	±1/8"
STRUCTURAL-	HAND TOOL CLEAN
WITH	1 COAT GALVANIZE
FRAME-	HAND TOOL CLEAN
WITH	1 COAT GALVANIZE
HEADER-	WHITE METAL BLAST CLEAN
WITH	1 COAT METALIZE
CUSTOMER	ENGINEERING TECNOLOGY IN
LOCATION	UNKNOWN
REFERENCE	D12197
CERTIFIED BY	J. HARRISON, JR.
DATE	6/17/10

SMITHCO
AIR COOLED DIVISION
TULSA, OKLAHOMA

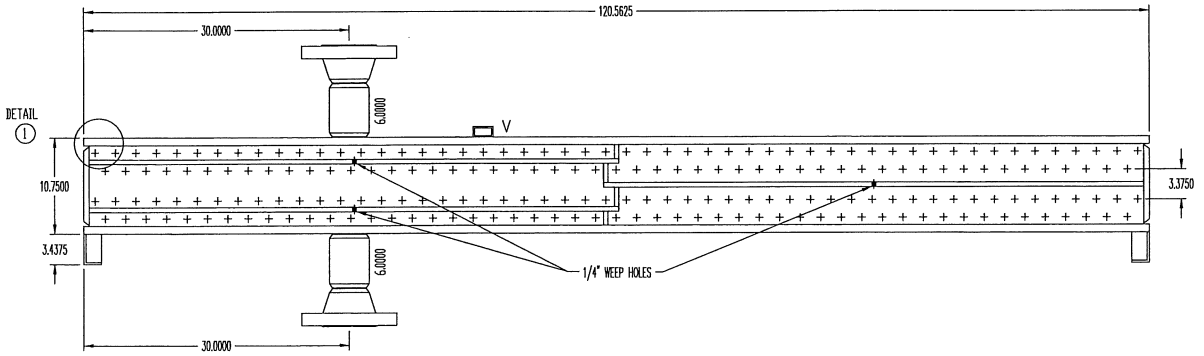
WALKWAY, OUTLINE & ANCHOR BOLT PLAN
MODEL 1 F 26 -101 -2 QUANTITY 1

DWN	HP	CKD	DATE 6 -16 -2010
REV	0		JOB 2010B 339 -W

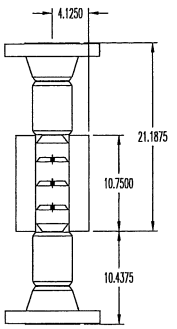


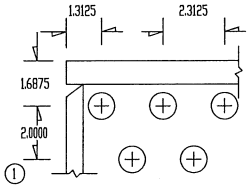
SIDE VIEW

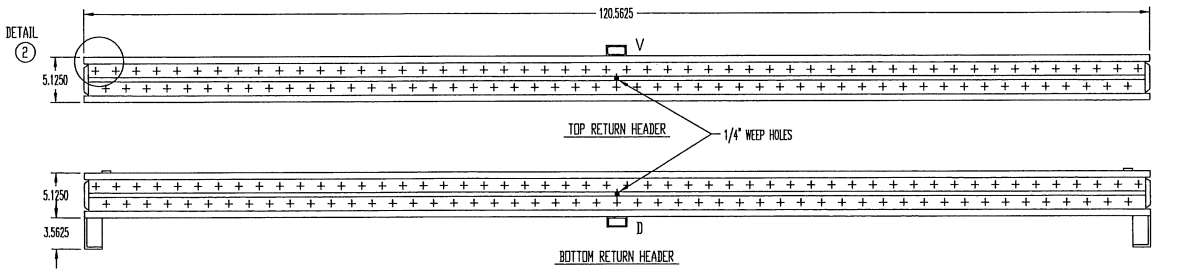
OUT TO OUT OF SIDEFRAMES - 121.4375'



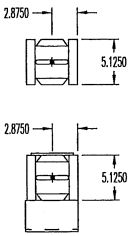
INLET HEADER



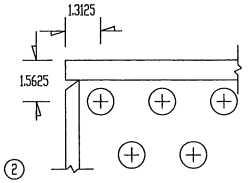




BOTTOM RETURN HEADER



TUBE SHEET SIDE



REV 1: CHANGE PLUG QTY FITZ 7/7/10 VR
REV 0: CERTIFIED FINAL JJ 6/17/10

MACHINING	DRILL	REAM	SPECIAL
TUBE HOLE	0.9375	1.010 ± 0.002	DG
PLUG HOLE	1.0312	#_ SF 1.375	TAP 1.1875
NOZZLE	IN (1) 4.00	#_ 600	# RF SCH XS
	OUT (1) 4.00	600	# RF SCH XS
VENT	(2) 1-6000	DRAIN (1) 1-6000	
HEAT TREAT	1150	DEG. F 75	MIN.
RADIOGRAPH -		API-661 10	INCH SHOT
WEIGHT	3600		

		THICK	LENGTH	WIDTH	BEVELS
INLET	TUBE PLUG	2.2500	120.5625	10.7500	NONE
INLET	COVER	0.8750	120.5625	3.5000	LONG SIDES
INLET	END	0.6250	3.5000	8.6875	ALL SIDES
INLET	PASS	0.5000	119.0000	3.5000	ALL SIDES
TOP RETURN	TUBE PLUG	1.0000	120.5625	5.1250	NONE
TOP RETURN	COVER	0.7500	120.5625	3.5000	LONG SIDES
TOP RETURN	END	0.5000	3.5000	3.3125	ALL SIDES
TOP RETURN	PASS	0.5000	119.5625	3.8125	DB LONG SIDES
BOTTOM RETURN	TUBE PLUG	1.0000	120.5625	5.1250	NONE
BOTTOM RETURN	COVER	0.7500	120.5625	3.5000	LONG SIDES
BOTTOM RETURN	END	0.5000	3.5000	3.3125	ALL SIDES
BOTTOM RETURN	PASS	0.5000	119.5625	3.8125	DB LONG SIDES

MATERIAL	SPECIFICATIONS	
PLATE	SA-516 GR-70	NORM
FLG	SA-105	
PIPE	SA-106B	STOCK
CPLG	SA-105	STOCK

WELD PROCEDURES	
PIPE-FLG	GWP01HT/FWP01HT
FLG-HEAD	GWP01HT/SWP01HT
HAND WLD	GWP01HT/FWP01HT
AUTO WLD	GWP01HT/AWP01HT

PLATE TOLERANCES ± 1/16"

TUBES 206 TF 52 ROWS 4 PASS 8 LGTH 312 IN.
TUBE OD 1.000 X 0.083 MATL SA-179 SMLS
FIN TYPE IMBEDDED 10.0 - 0.625 - alum
INLET PLUG QTY 206 TYPE A105 -1838
RETURN PLUG QTY 206 TYPE A105 -1822
GASKET CS -1813
EXPANDER 0.8340 LENGTH 14.0000
FRAME -THICK 0.1875
LENGTH 322 IN. DEPTH 17.2500 X 3
SUPPORT- 5 ,BINDER- 5 ,CLOSER- 4 120.188
SUPPORT TYPE - SCALLOPED CHANNEL
STAPLED ENDS
F.FOOT: 6" X 3.4375 " B.FOOT: 6" X 3.5625 "

J27107
STOCK0
STOCK0
STOCK0
STOCK0

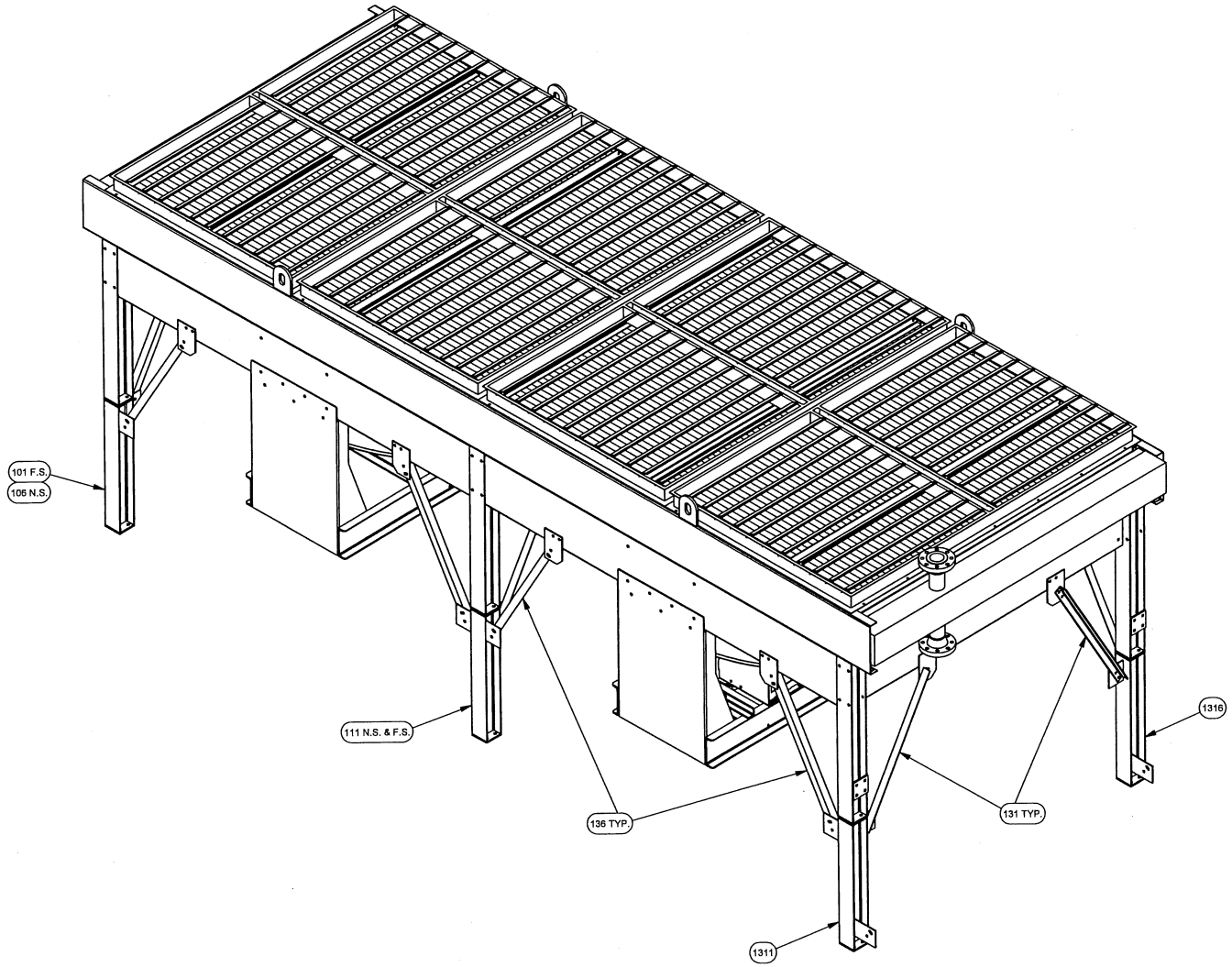
TEST PRESSURE: 1650 TIME: 60 MIN. W/ CHART
HEADS: WHITE METAL BLAST CLEAN
w/ 1 metallize
FRAME: HAND TOOL CLEAN
w/ 1 galvanize
COIL VOLUME: 23 CUBIC FEET
DESIGN TEMP: 650 F
DESIGN PRESSURE: 1100 Psig
MDMT: -20 F
CORROSION ALLOWANCE: 0.0625
CERTIFIED BY: J. HARRISON, JR. DATE: 6/17/10
TOLERANCES LENGTH & WIDTH ± 0.125" PER 10 " -0 "
TUBE PROJECTION API 661

AIR COOLED DIVISION
BUNDLE DETAILS
APPRV JJ | REV 1 | 6 - 16 - 2010

SERVICE : Regen Gas Cooler
ITEM : AC-8180

MFG	WELD	FIN	ASMBL	STRUC	INSP	CUST
1	2		2	1	1	0

QTY 1 | WEIGHT 13800 | 2010 B 339 1



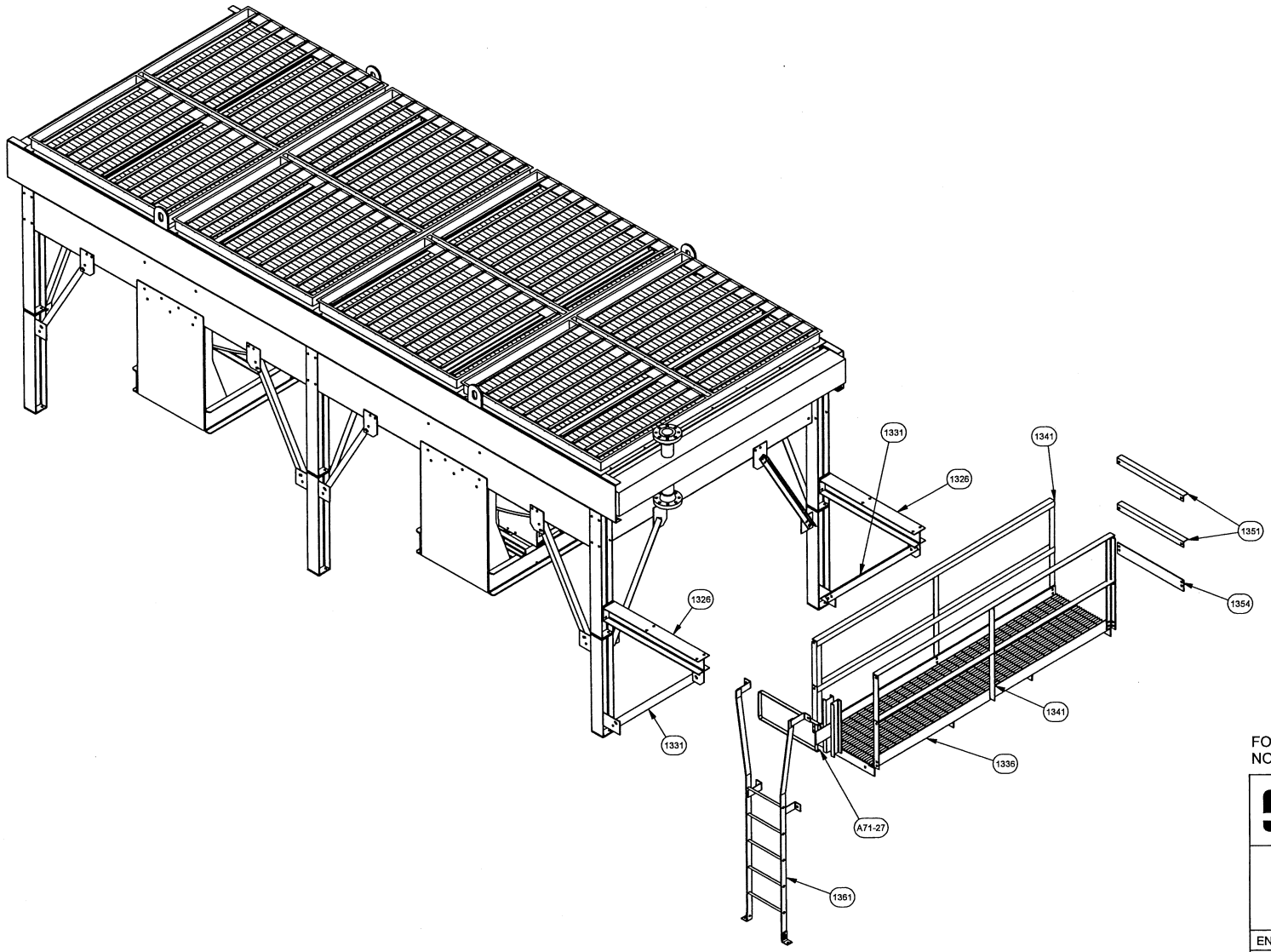
NOTE:
1. USE 5/8" X 2 1/2" (A-325) BOLT, NUT, LOCKWASHER & (2) FLATWASHERS AT ALL COLUMN SPLICE CONNECTIONS.
2. USE 5/8" X 2" (A325) BOLT, NUT, LOCKWASHER & (2) FLATWASHERS AT ALL COLUMN BRACE CONNECTIONS.
3. REMOVE REAR HEADER BOLTS BEFORE START UP.

FOR INFORMATION ONLY
NOT FOR REVIEW

SMITHCO
ENGINEERING, INC.
Tulsa, Oklahoma

FIELD
ERECTION

ENGR: JJ	CK'D BY:	DATE: 6/17/2010
JOB NO: 10B339		DWG NO: FE-1
REV: 0	SCALE:	QTY: 1



NOTE:
1. USE 5/8" X 2" (A325) BOLT, NUT, LOCKWASHER & (2) FLATWASHERS AT ALL WALKWAY CONNECTIONS.

FOR INFORMATION ONLY
NOT FOR REVIEW

SMITHCO
ENGINEERING, INC.
Tulsa, Oklahoma

FIELD
ERECTION

ENGR: JJ	CK'D BY:	DATE: 6/17/2010
JOB NO: 10B339		DWG NO: FE-2
REV: 0	SCALE:	QTY: 1

HEADER CALCS

Smithco Engineering Incorporated
P.O. Box 571330
Tulsa, Oklahoma 74157-1330
(918) 446-4406

Customer: ENGINEERING TECNOLOGY IN
Customer P.O. No.: D12197
Item no.: AC-8180
Service :Regen Gas Cooler

Date: 06-14-2010

Approved: [signature]

Header Design Calculations
Per ASME Code Section VIII Division 1 2007 /08Add Appendix 13
Fig. 13-2(A) Vessels of Rectangular Cross Section
Sketch (1)

Job No.:2010B3391 (Inlet/Outlet Header)
Short side = Cover Plate
Design Press.(P): 1100. PSI Test Press.: 1650. PSI
Design Temp.: 650. Deg. F / -20. Deg. F MDMT
Material: SA-516 GR-70 Normalized
Allow. Membrane Stress: 18800. PSI
Allow. Bending and Total Stress: 28200. PSI (1.5 x Membrane Stress)
Corrosion Allowance: 0.0625 Inch
Long side Sheet Thickness: 2.2500 Inch
Long side Sheet Thickness Less Corr. Allow.= t2 = 2.1875 Inch
Short Side Thickness: 0.8750 Inch
Short Side Thickness Less Corr. Allow. = t1 = 0.8125 Inch
H (corroded) = 3.9375 In
h (corroded) = 9.1250 In
Horz. Tube Pitch (Pitch): 2.3125 In
D (Hole diameter): 1.0709
E= 1.0(see 13-4-g-1)
Bending & Membrane eff, eb = em = (Pitch - D)/Pitch = 0.5369
Short side eb = em = 1.0000
Long side eb = em = 0.5369
c = (c1 or c2)
c1 = t1/2 = 0.406250 In
c2 = t2/2 = 1.093750 In
a = H/h = 0.431507
$I1 = t1^3/12 = 0.044698$ In**4
$I2 = t2^3/12 = 0.872294$ In**4
K = (I2/I1) a = 8.420963
Lv = Vessel length = 120.5625 Inches

Job No.:2010B3391 (Inlet/Outlet Header)

(1) Membrane Stress

Short-Side Plates

$Sm = Ph/(2t1em) = 6177.$ PSI (1)

Long-Side Plates

$Sm = PH/(2t2em) = 1844.$ PSI (2)

(2) Bending Stress

Short-Side Plates

$$(Sb)N = \pm \frac{Pc1}{12I1eb}\left[1.5H^2 - h^2\left(\frac{1+a^2K}{1+K}\right)\right] = -466. \text{ PSI} \quad (3)$$

$$(Sb)Q = + \frac{Ph^2c1}{12I1E}\left(\frac{1+a^2K}{1+K}\right) = 18909. \text{ PSI} \quad (4)$$

Long-Side Plates

$$(Sb)M = + \frac{Ph^2c2}{12I2eb}\left[1.5 - \left(\frac{1+a^2K}{1+K}\right)\right] = -21879. \text{ PSI} \quad (5)$$

$$(Sb)Q = + \frac{Ph^2c2}{12I2E}\left(\frac{1+a^2k}{1+K}\right) = 2609. \text{ PSI} \quad (6)$$

(3) Total Stress

Short-Side Plates

$(ST)N = EQ(1) + EQ(3) = 6643.$ PSI (7)

$(ST)Q = EQ(1) + EQ(4) = 25086.$ PSI (8)

Long-Side Plates

$(ST)M = EQ(2) + EQ(5) = 23723.$ PSI (9)

$(ST)Q = EQ(2) + EQ(6) = 4453.$ PSI (10)

(4) End Plate Stress UG 34, EQ. (3) & (4)

d (Corroded) = 3.9375

D (Corroded) = 4.9973

c = 0.2 (see 13-4(F))

End Plate Thickness: 0.6250 Inch

End Plate Thickness Less Corr. Allow. = T4 = 0.5625 Inch

$$Z = 3.4 - 2.4\left(\frac{d}{D}\right) = 1.5090 \quad \text{Max } 2.5$$

$$S = \frac{cd^2ZP}{T4^2} = 16267. \text{ PSI}$$

Header Design Calculations
Per ASME Code Section VIII Division 1 2007 /08Add Appendix 13
Fig. 13-2(A) Vessels of Rectangular Cross Section
Sketch (1)

Job No.:2010B3391 (Return header)
Short side = Tubesheet
Design Press.(P): 1100. PSI Test Press.: 1650. PSI
Design Temp.: 650. Deg. F / -20. Deg. F MDMT
Material: SA-516 GR-70 Normalized
Allow. Membrane Stress: 18800. PSI
Allow. Bending and Total Stress: 28200. PSI (1.5 x Membrane Stress)
Corrosion Allowance: 0.0625 Inch
Long side Sheet Thickness: 0.7500 Inch
Long side Sheet Thickness Less Corr. Allow.= t2 = 0.6875 Inch
Short Side Thickness: 1.0000 Inch
Short Side Thickness Less Corr. Allow. = t1 = 0.9375 Inch
H (corroded) = 3.7500 In
h (corroded) = 3.9375 In
Horz. Tube Pitch (Pitch): 2.3125 In
D (Hole diameter): 1.0709
E= 1.0(see 13-4-g-1)
Bending & Membrane eff, eb = em = (Pitch - D)/Pitch = 0.5369
Short side eb = em = 0.5369
Long side eb = em = 1.0000
c = (c1 or c2)
c1 = t1/2 = 0.468750 In
c2 = t2/2 = 0.343750 In
a = H/h = 0.952381
$I1 = t1^3/12 = 0.068665$ In**4
$I2 = t2^3/12 = 0.027079$ In**4
K = (I2/I1) a = 0.375591
Lv = Vessel length = 120.5625 Inches

Job No.:2010B3391 (Back Header)

(1) Membrane Stress

Short-Side Plates

$Sm = Ph/(2t1em) = 4302.$ PSI (1)

Long-Side Plates

$Sm = PH/(2t2em) = 3000.$ PSI (2)

(2) Bending Stress

Short-Side Plates

$$(Sb)N = \pm \frac{Pc1}{12I1eb}\left[1.5H^2 - h^2\left(\frac{1+a^2K}{1+K}\right)\right] = -6974.\ \text{PSI} \quad (3)$$

$$(Sb)Q = + \frac{Ph^2c1}{12I1E}\left(\frac{1+a^2K}{1+K}\right) = 9456.\ \text{PSI} \quad (4)$$

Long-Side Plates

$$(Sb)M = + \frac{Ph^2c2}{12I2eb}\left[1.5 - \left(\frac{1+a^2K}{1+K}\right)\right] = -9478.\ \text{PSI} \quad (5)$$

$$(Sb)Q = + \frac{Ph^2c2}{12I2E}\left(\frac{1+a^2k}{1+K}\right) = 17583.\ \text{PSI} \quad (6)$$

(3) Total Stress

Short-Side Plates

$(ST)N = EQ(1) + EQ(3) = 11276.$ PSI (7)

$(ST)Q = EQ(1) + EQ(4) = 13758.$ PSI (8)

Long-Side Plates

$(ST)M = EQ(2) + EQ(5) = 12478.$ PSI (9)

$(ST)Q = EQ(2) + EQ(6) = 20583.$ PSI (10)

(4) End Plate Stress UG 34, EQ. (3) & (4)

d (Corroded) = 3.7500

D (Corroded) = 3.9375

c = 0.2 (see 13-4(F))

End Plate Thickness: 0.5000 Inch

End Plate Thickness Less Corr. Allow. = T4 = 0.4375 Inch

$$Z = 3.4 - 2.4\left(\frac{d}{D}\right) = 1.1143 \quad \text{Max } 2.5$$

$$S = \frac{cd^2ZP}{T4^2} = 18010.\ \text{PSI}$$

Job No.:2010B3391 Tube wall and Nozzle Neck Calculations

Tube Wall:

Design Pressure (P): 1100. PSI
Tube OD (D): 1.00 In.
Tube stress (S): 12800. PSI

Minimum wall = P * D/2 / (.4*P + S) = 0.0415 In.
Actual wall: 0.0830 In.

Nozzle neck/Pipe wall:

Inlet nozzle/Pipe:

Pipe Matl : sa-106b
Design Pressure (P): 1100. PSI
Nozzle OD (D): 4.500 In.
Nozzle stress (S): 17800. PSI
Corrosion (C): 0.0625 In.

Calculated wall = P * D/2 / (.4*P + S) + C = 0.1982 In.
Minimum wall: 0.2949 In.

Outlet nozzle/Pipe:

Pipe Matl : sa-106b
Design Pressure (P): 1100. PSI
Nozzle OD (D): 4.500 In.
Nozzle stress (S): 17800. PSI
Corrosion (C): 0.0625 In.

Calculated wall = P * D/2 / (.4*P + S) + C = 0.1982 In.
Minimum wall: 0.2949 In.

JOB SPECIFIC

VENDOR

DATA

800 S. MISSOURI AVENUE
MARCELINE, MO 64658 USA
TELEPHONE: (660) 376-3575
FACSIMILE: (660) 376-2909

MOORE FANS LLC

INSTALLATION MANUAL

304

SOLD TO **SMITHCO ENGINEERING INC.**
PO BOX 571330
TULSA OK 74157-1330

SHIP TO **METAL SERVICES**
644 W. 41ST ST
TULSA OK 74107

JOB NO.: **114582**
INVOICE DATE:
MODEL NO.: **CLASS 10000 HD**
PURCHASE ORDER NO: **J27457**
CUSTOMER JOB NO: **10B339**
SHIP REQUIRED: **07/14/2010**
PAYMENT TERMS: **NET 30 DAYS**
ROUTING: **MOORE TULSA**
F.O.B. POINT: **MARCELINE, MO.**
FREIGHT: **PREPAID**
CRATING: **STANDARD DOMESTIC**

QTY	DESCRIPTION
2	1030/073-U0-A/30R-VE-4-9-4
2	U BUSHING 2.188" BORE .500X.250 K/ H-2.419

Serial Nos.: F211355-211356

ASSEMBLY DATA — MATERIAL: ALUMINUM

SERIES:	30	DIA.:	9.00
BLADES:	4	TYPE:	**MANUAL HD**
ARRANGEMENT:	07	MOUNTS:	**Standard**
CLEVIS ANGLE:	4.6°	WEIGHT:	
	Right Hand		
HUB LENGTH C/L TO BASE:	1.50		
DYNAMIC BALANCE HUB: YES			
4 INCH HOLE IN AIR SEAL:	NO		

BUSHING:	U	H DIM.:	2.409"
KEYWAY:	0.500" X 0.250"	BORE:	2.188"
STD. BORE TOL.:	+.001" -.000"		
			°
STOP DROOP:	3.20	CUT DROOP	
CH TO TIP:	40.45		
BALANCE WT.:		COLOR CODE:	

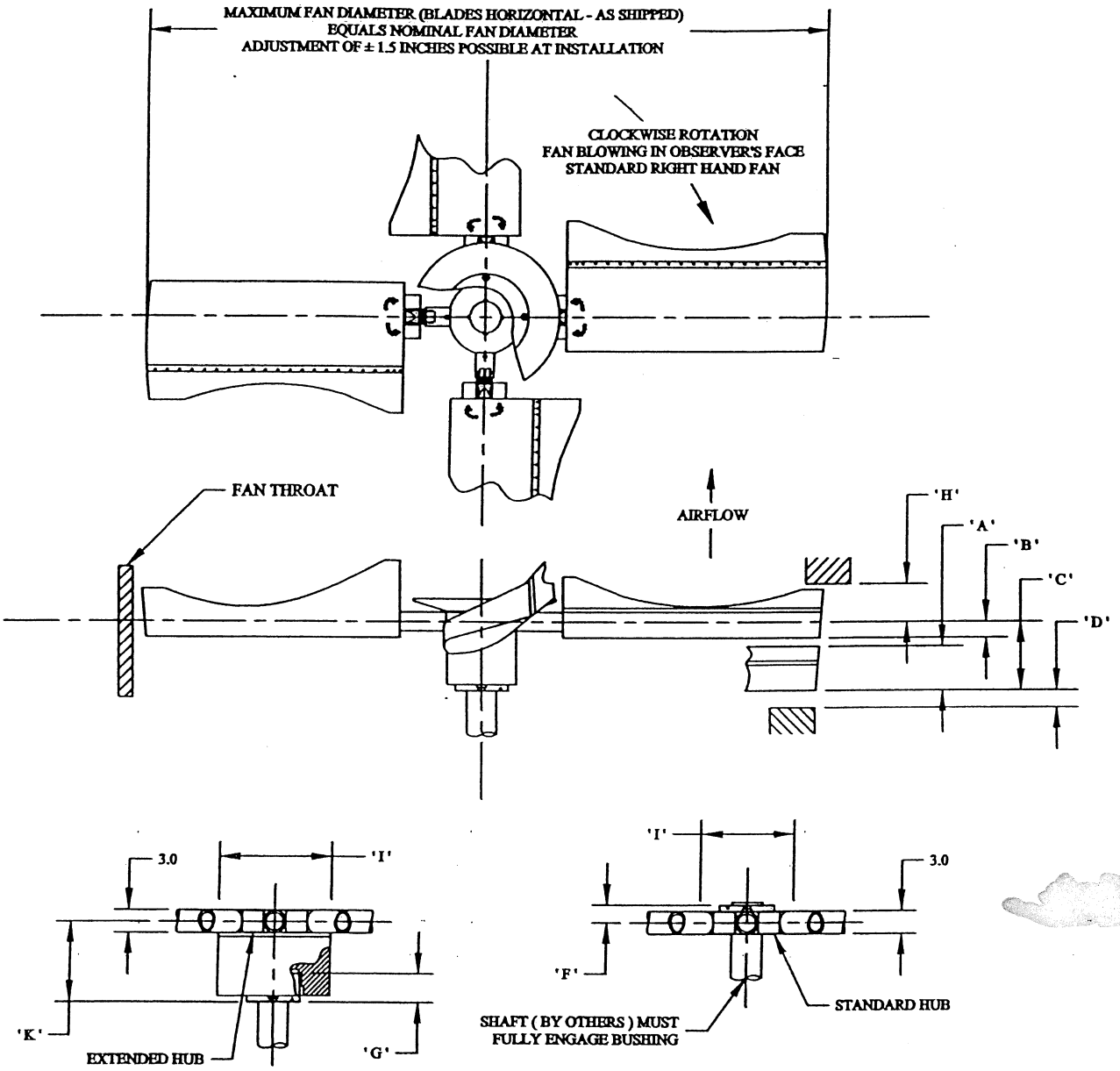
AIR PERFORMANCE DATA

ELEVATION:	3300 Ft.	AIR TEMPERATURE:	110 °	DENSITY RATIO:	0.823
ACFM/FAN:	100662	RPM:	389	PHUD: 1.71	INLET CORRECTION: 1.0
STATIC PRESSURE:	0.500"WG	VELOCITY PRESSURE:	0.142"WG	TOTAL PRESSURE:	0.642"WG
VELOCITY THROUGH FAN:	1666 FPM	TIP CLEARANCE:	0.27"	EFFICIENCY:	0.81
BHP REQUIRED:	12.5	*MOTOR HP:	20.0	*MAXIMUM APPLIED TORQUE:	540 FT.LBS.
THEORETICAL NO. OF BLADES:	2.5	BLADE LOAD FACTOR:	0.63		

CAUTION: * MAXIMUM APPLIED TORQUE USING FACTOR OF NOMINAL TIMES 2.00 (FACTORY SHOULD BE NOTIFIED IF MAX. APPLIED TORQUE OR MOTOR HP IS GREATER THAN THE VALUE SHOWN.)

ADDITIONAL NOTES:
TAG HUBS & AIR SEALS WITH JOB NO. 10B339

MARKS:
P.O. NO. J27457
JOB NO. 10B339

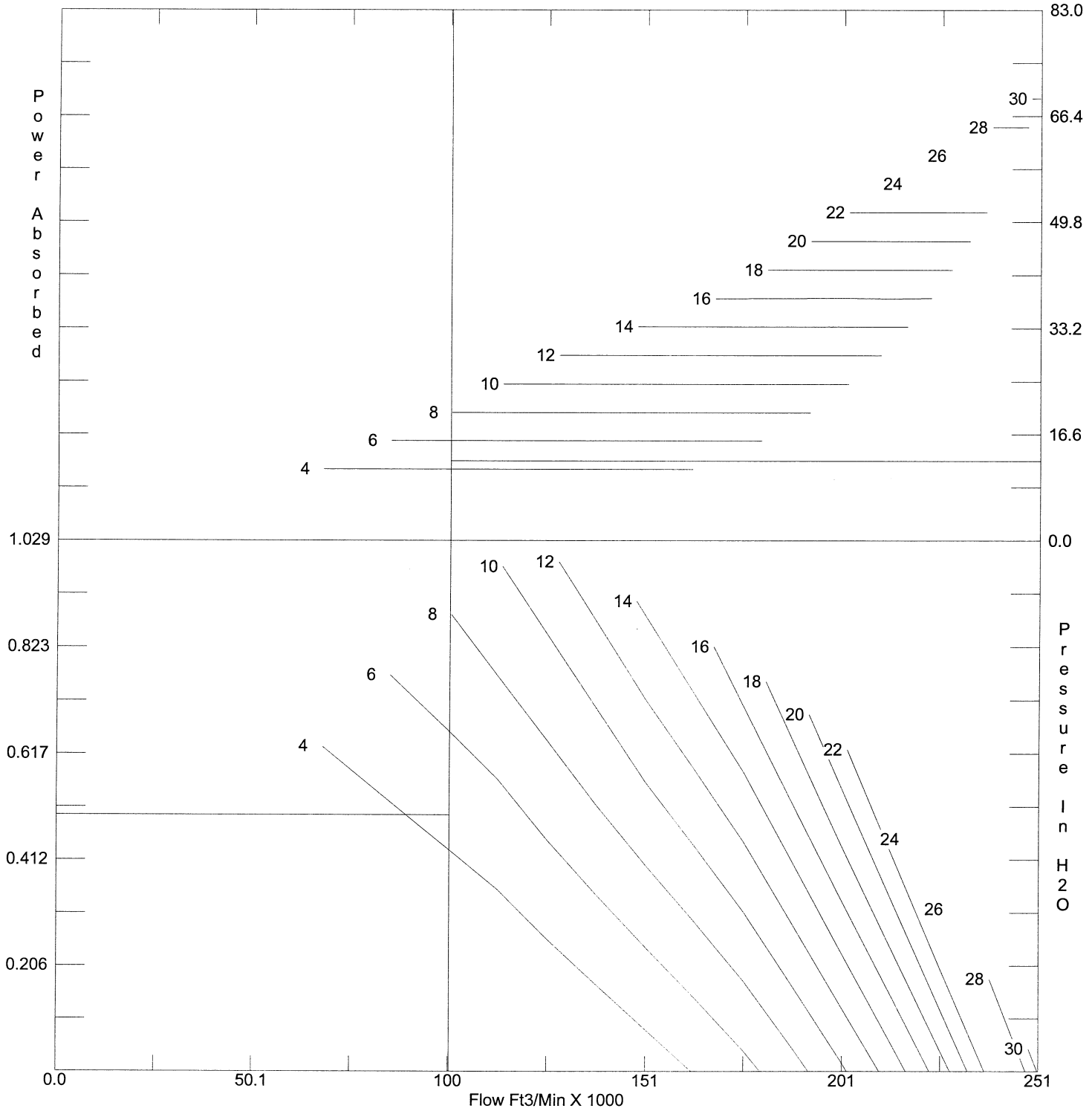


A = BLADE TIP THICKNESS @ 19° BLADE ANGLE
B = RUNNING POSITION OF BLADES
C = MAXIMUM DROOP POSITION OF BLADES
D = MINIMUM OBSTACLE CLEARANCE AT INLET
F = CENTERLINE OF FAN TO BASE OF BUSHING (STANDARD HUB)
G = BUSHING OVERALL HEIGHT (STANDARD & EXTENDED HUBS)
H = MINIMUM OBSTACLE CLEARANCE AT OUTLET
I = NOMINAL MECHANICAL HUB DIAMETER
K = CENTERLINE OF FAN TO BASE OF BUSHING (EXTENDED HUB)
L = MAX . BUSHING TORQUE FT. LBS.
# = WITH S.A.E. STANDARD SQUARE KEYWAY
* = WITH SHALLOW KEYWAY IN BUSHING
° = MAX METRIC BORE WITH STANDARD KEYWAY

DIA	A	B (WITH FAN OPERATING AT 12000 FT : MINUTE BLADE TIP SPEED / PERCENT BLADE LOADING)		C	D	H	MAX BLADES	BUSHING TYPE	MAX # BORE	MAX * BORE	MAX ° BORE	I	F	G	K	L
		100%	75%													
5'	7.5"	4.3"	4.3"	4.6"	2.0"	14.0"										
6'	7.5"	4.7"	4.5"	5.2"	2.0"	14.0"										
7'	7.5"	5.2"	4.9"	6.0"	2.0"	14.0"	6	U	2.750"	2.938"	75	7"	2.0"	~~2.7"~~	~~8" OR 12"~~	4000
8'	7.5"	5.9"	5.4"	7.0"	2.0"	14.0"	7	U	2.750"	2.938"	75	9"	2.0"	2.7"	8" OR 12"	4000
9'	7.5"	6.7"	6.0"	8.3"	2.0"	14.0"	7	W	3.750"	4.000"	100	9"	2.2"	2.8"	8" OR 12"	7300
10'	7.5"	7.6"	6.8"	9.8"	2.0"	14.0"	7	X	3.750"	4.000"	100	9"	2.2"	4.0"	8" OR 12"	9800

SERIES 30 HD FAN EXTENDED CHORD
RIGHT HAND ROTATION

CLASS10000 SERIES 30 HD EC



Moore Fans LLC
800 S. Missouri Ave
Marceline, MO 64658
Telephone: (660) 376-3575
Facsimile: (660) 376-2909

Customer:
Reference:
Item:
Curve No: MOORE JOB 114582

CLASS	10000	
SERIES	30	
Diameter feet	9	
No. Blades	4	
R.P.M.	389	
Temperature	110	Fahren
Elevation	3300	feet
Density	0.823	Ratio
Duty Volume	100662	Ft3/Mir
Duty Pressure	0.5	In H2O
Power Absorbed	12.51	bhp
Clevis Angle	4.6	

Curve generated by Moore Fans Version 1.53

SMITHCO 10B339 J27460

BALDOR®

BALDOR • RELIANCE

Part Information Packet

UNLAUB COMPANY INC, THE

EXR2018256T

20HP,1765RPM,3PH,60HZ,256T,0952M,TEFC,F1

SMITHCO 10B339 J27460

BALDOR • RELIANCE Part Information Packet: - 20HP,1765RPM,3PH,60HZ,256T,0952M,TEFC,F1

Part Detail							
Revision:	C	**Status:**	PRD/A	**Change #:**		**Proprietary:**	Yes
Type:	AC	**Prod. Type:**	0952M	**Elec. Spec:**	09WGY583	**CD Diagram:**	
Enclosure:	TEFC	**Mfg Plant:**		**Mech. Spec:**	09H948	**Layout:**	
Frame:	256T	**Mounting:**	F1	**Poles:**	04	**Created Date:**	10-02-2009
Base:	RG	**Rotation:**	R	**Insulation:**	F	**Eff. Date:**	04-29-2010
Leads:	9#12	**Literature:**		**Elec. Diagram:**		**Replaced By:**	

Nameplate NP2141L							
CAT NO	EXR2018256T-P						
SPEC.							
FRAME	256T	**HP**	20				
VOLTS	230/460						
MAG CUR	18.8/9.4	**FLA**	48/24				
RPM	1765	**RPM MAX**	3600				
HZ	60	**PH**	3	**CLASS**	F		
SER.F.	1.15	**DES**	B	**SL HZ**	1.17		
NEMA-NOM-EFF	93	**WK2**	2.27				
RATING	40C AMB-CONT						
DE BRG	6309	**ODE BRG**	6208				
INV.TYPE	PWM	**C HP FR**	60	**C HP TO**	90	**T. CODE**	T3
CT HZ FROM	30	**CT HZ TO**	60	**VT HZ FROM**	6	**VT HZ TO**	60
ENCL	TEFC	**SER.NO**					
	-						
	-						

SMITHCO 10B339 J27460

BALDOR • RELIANCE Part Information Packet: - 20HP,1765RPM,3PH,60HZ,256T,0952M,TEFC,F1

Parts List		
Part Number	**Description**	**Quantity**
SA186473	SA 09H948Y583G1	1.000 EA
RA174259	RA 09H948Y583G1	1.000 EA
09FN3001D01	EXTERNAL FAN, PLASTIC	1.000 EA
HW1002A63	WASHER, 5/8 HI-COLLAR SPRLCKWASHER	1.000 EA
12CB1000A22	CONDUIT BOX, MACH	1.000 EA
10GS1001	GASKET CONDUIT BOX NEOP	1.000 EA
10XN2520K12	1/4-20 X.75 GRD 5	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	2.000 EA
10XN3816K28	3/8-16 X 1.75 HEX HD CAP SCREW, GRADE 5	4.000 EA
WD1000B16	LUGSDIRECT WIRE LUG, CAT # S4	1.000 EA
10XN2520K08	1/4-20 X .50 GRADE #5, STL, ZINC PLATE	1.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	1.000 EA
09EP1100A36	SPL FR EP LOCKED BRG	1.000 EA
HA3400A33	STUD- 3/8-16 X 4.82 HEX WELKER	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
12CB1500A01	CONDUIT BOX LID, MACH	1.000 EA
12GS1002	GASKET, CONDUIT BOX LID, NEOP	1.000 EA
10XN3118K24	5/16-18 X 1.50" HEX HD, GRADE 5	4.000 EA
HW1001A31	LOCKWASHER 5/16, ZINC PLT.591 OD, .319 I	4.000 EA
09FH1000	FAN COVER, CAST DISA	1.000 EA
XY3816A12	3/8-16 FINISHED NUT	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
HA4017A03	.125 X 1.75 GREASE EXT (F/S)	1.000 EA
HW4600B44SP	V-RING SLINGER 1.500 X 2.290 X 0.280	1.000 EA

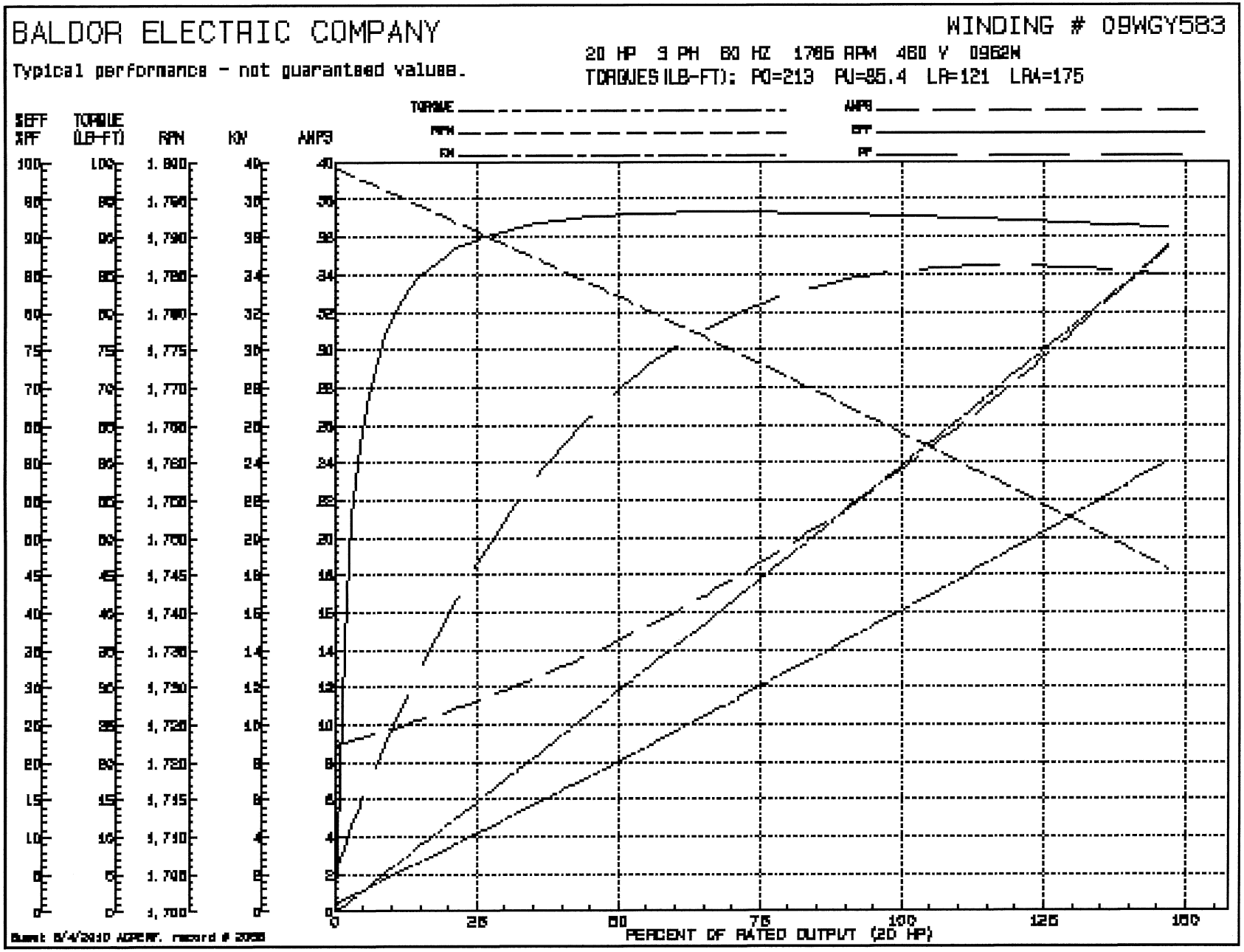
BALDOR • RELIANCE Part Information Packet: - 20HP,1765RPM,3PH,60HZ,256T,0952M,TEFC,F1

Parts List (continued)		
Part Number	**Description**	**Quantity**
10XN2520K28	1/4-20 X 1.75" HX HD SCRWGRADE 5, ZINC P	2.000 EA
09EP1101A109	PU ENDPLATE, MACH	1.000 EA
HW4600B44SP	V-RING SLINGER 1.500 X 2.290 X 0.280	1.000 EA
HW5100A11	W3917-042 WVY WSHR (WB)	1.000 EA
10XN2520K36	1/4-20 X 2.25" HX HD SCRWGRADE 5, ZINC P	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
HW2501G25	KEY, 3/8 SQ X 2.875	1.000 EA
LB1115	LABEL,LIFTING DEVICE	1.000 EA
LB5040	INSTRUCTION TAG, AC & DC	1.000 EA
HW4500A21	1618BALEMITE FITTING 825 UNIVERSAL	1.000 EA
HW4500A17	317400 ALEMITE GREASE RELIEF	1.000 EA
HA4051A00	PLASTIC CAP FOR GREASE FITTING	1.000 EA
HA4001A01SP	DRAIN PLUG, PLASTIC (MICRO PLAS)	1.000 EA
MJ1000A02	GREASE, POLYREX EM EXXON	0.080 LB
HW4500A03	GREASE FITTING, .125 NPT 1610(ALEMITE) 8	1.000 EA
HW4500A17	317400 ALEMITE GREASE RELIEF	1.000 EA
HA4051A00	PLASTIC CAP FOR GREASE FITTING	1.000 EA
HA4001A01SP	DRAIN PLUG, PLASTIC (MICRO PLAS)	1.000 EA
HW2500A25	WOODRUFF KEY USA #1008 #BLOW CARBON STEE	1.000 EA
51XB1214A20	12-14X1.25 HXWSSLD SERTYB	1.000 EA
MG1000G27	PAINT- S9282E CHARCOAL GREY	0.050 GA
85XU0407A04	#4-7 X 1/4 DRIVE PIN	2.000 EA

BALDOR • RELIANCE Part Information Packet: - 20HP,1765RPM,3PH,60HZ,256T,0952M,TEFC,F1

Parts List (continued)		
Part Number	**Description**	**Quantity**
LB1172A01	CUSTOM MTR CARTON LABEL LASER PRINTER	4.000 EA
LC0005E02	SPL CONN.DIA./WARN.LABEL(LC0005/LB1119)	1.000 EA
NP2141L	DIV 2, INV DUTY, ALUM, UL CSA-C US, LASE	1.000 EA
09PA1000	PACKAGING GROUP COMBINED PRINT	1.000 EA
LB1449	DIV-2/NEC WARNING LABEL	1.000 EA

SMITHCO 10B339 J27460



SMITHCO 10B339 J27460

BALDOR

AC Induction Motor Performance Data

Record # 2056

Typical performance - not guaranteed values

Winding: 09WGY583	**Type:** 0952M	**Enclosure:** TEFC

Nameplate Data				General Characteristics at 460 V, 60 Hz: High Volt Connection	
Rated Output (HP)	20			Full Load Torque	59 LB-FT
Volts	230/460			Start Configuration	DOL
Full Load Amps	48/24			Break Down Torque	213 LB-FT
R.P.M.	1765			Pull-Up Torque	85.4 LB-FT
Hz	60	Phase	3	Locked-rotor Torque	121 LB-FT
NEMA Design Code	B	KVA Code	H	Starting Current	175 Amps
Service Factor	1.15			No-load Current	9.41 Amps
NEMA Nom. Eff.	93	P.F.	84	Line-line Res. @ 25°C.	0.426 Ohms
Rating - Duty	40C AMB-CONT			Temp. Rise @ Rated Load	60°C
S.F. Amps				Temp. Rise @ S.F. Load	74°C

Load Characteristics at 460 Volts, 60 Hz

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	46	69	80	84	86	87	85
Efficiency	89	92.8	93.1	93	92.2	91.1	92.5
Speed	1791	1783	1770	1766	1756	1745	1760
Line Amperes	10.7	14	19.1	23.7	29.1	35.4	26.94

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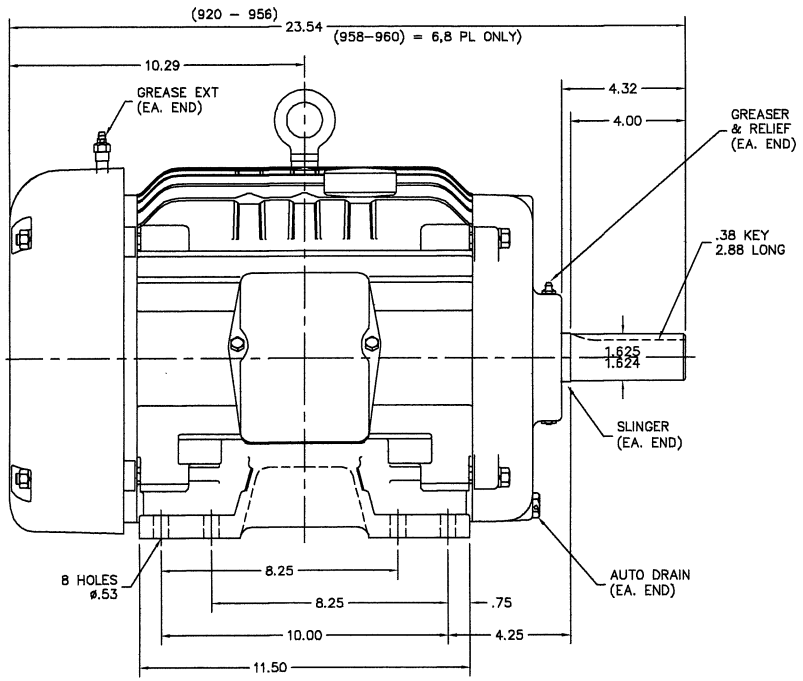

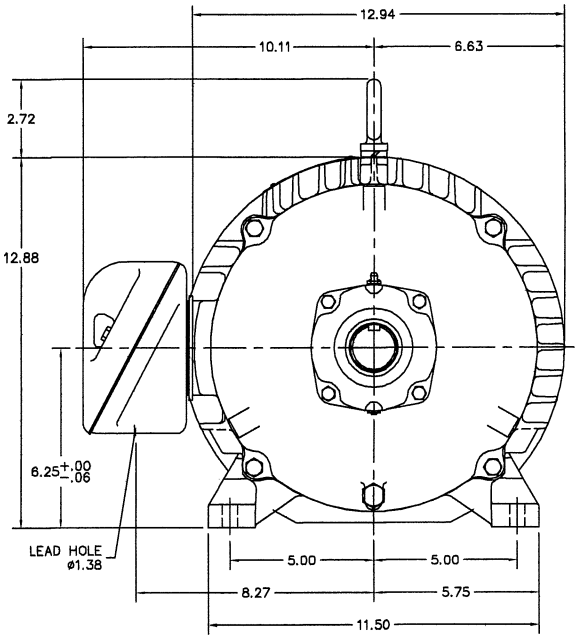

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CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.

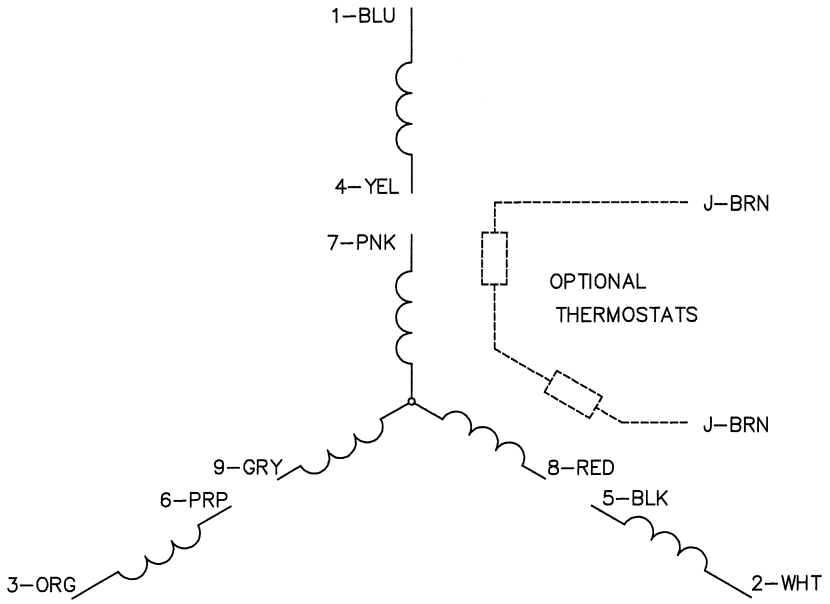
REV. DESC: OMIT GREASE EXT GRAPHICS ON DE		
REV. LTR: B	VERSION: 02	TDR: 00000051B641
FILE: \AAA\00186\518	REVISED: 10:59:32 11/12/2009	BY: ENROBRO
MTL: –		

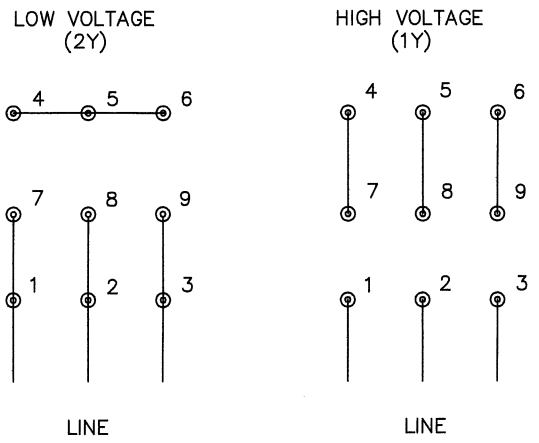
BALDOR • DODGE • RELIANCE

HOR TEFC 254–6T SPL GRSR EXT'S,LOCKED ODE BRG,ALL CAST IRON

SH 1 of 1

CD0005





NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	

BALDOR ELECTRIC Co.

3PH, DV, 9 LEADS

MAINTENANCE

SPARE PARTS

Serving the Industry Since 1952
Member of HTRI & ACHEMA

SMITHCO ENGINEERING, INC.
P.O. Box 571330
Tulsa, Oklahoma 74157
Phone: (918) 446-4406
Fax: (918) 446-7439

Co: Engineering Technology Inc. Date: 8/10/2010
Ref: D12197
Tag: AC-8180

RECOMMENDED SPARE PARTS FOR 2 YEAR OPERATION
SMITHCO JOB NO. 2010B339

Item #	QTY	Description	Net Each	Total Net
001	21	A1051822 Plugs	$5.00	$105.00
002	42	CS1813 gasket	$.50	$21.00
003	1	Fan, 108 inch 4 Blade RH Adjustable Pitch Model 3010K-EC 2.1875 bore with 0.5000 X 0.2500 keyway	$1,522.00	$1,522.00
004	1	2.1875 X 42.625 Shaft with 0.5000 X 0.2500 Keyway 3.19 one end 4.0 other end with keys (2) Snap Rings	$291.18	$291.18
005	1	20 HP Electric Motor Frame 256T Chem Duty 1750 RPMT EFC Enclosure 460/3/60 Premium Eff. Div 2 Class 1 Groups B/C/D T3 Insulation Class F Service Factor 1.0	$1,516.00	$1,516.00
006	2	2.1875 SCM Flange Bearings	$170.30	$340.60
007	1	Matched set of (4) 3VX1120 V-Belt	$123.52	$123.52
008	1	4 groove 3V - 25.00 sheave with 2.1875 bore 0.5000 ks	$420.92	$420.92
009	1	4 groove 3V - 5.60 sheave with 1.6250 bore 0.3750 ks	$77.40	$77.40
010	1	VS-2EX Vibration Switch	$287.36	$287.36
			TOTAL	**$4,704.98**

The recommended quantities are for remote locations.

Serving the Industry Since 1952
Member HTRI

SMITHCO ENGINEERING, INC.
P. O. BOX 571330
TULSA, OK 74157
PHONE: (918) 446-4406
FAX: (918) 445-2857

F-260 SUPPLEMENT

FREIGHT

Freight charges represent present estimate based on existing rates. All shipments, unless dated otherwise in writing, are F.O.B. point of manufacture. Unless otherwise specified, shipments of major components will be by contract truck. Small shipments such as motors, fans, etc., may be by LTL carriers.

Actual freight charges will be for the purchaser's account, prepaid and invoiced in exact amounts to be determined at the time of shipment. Permits and other invoiced items such as dunnage required as an integral part of the carrier's tariff authority and shown on the freight bill, are part of the freight charges.

MATERIAL PURCHASES

All non-stock material will be ordered at the time of receipt of the written purchase order. Any changes in material requirements caused by revision to the certified outline drawings shall be for the purchaser's account.

SHIPMENT

The shipping date is specified in weeks from the date of receipt of the certified outline drawings marked "Approved for Construction," from the purchaser. This is an estimate based on present shop load and material deliveries.

TERMS OF PAYMENT

Unless otherwise specified, terms of payment are net thirty (30) days from date of shipment or notification that the equipment is ready for shipment.

A service charge of 1.5% per month (18% yearly interest rate) will be charged on all past due accounts. Where cash discounts are offered, they apply to equipment only and not freight or taxes.

CONDITIONS OF SALE

This proposal contains the entire contract between the parties, and it is agreed that there are no agreements, warranties, or representation expressed or implied, related to the contract except such as are specifically set forth herein, and when duly accepted and approved, it shall constitute the entire contract between the parties hereto. No modification thereof shall be binding on either party unless in writing and duly signed by the purchasers and the company.

Orders entered on our books may not be canceled except upon our consent and upon terms indemnifying us against loss. We make every effort to ship on dates promised and to maintain production schedules consistent therewith, but we are not liable for claims of damage or any other expense due to failure to meet scheduled shipping date. We are not responsible for damage to equipment in transit. Purchasers are warned against signing for equipment before making careful inspection.

PERFORMANCE GUARANTEE

All Smithco exchangers are guaranteed to have the capacity to perform according to our rating when properly installed and maintained for a period of one year from start-up, not to exceed 18 months from shipping date or notification that the exchangers are ready for shipment. The specified design conditions are those shown on the exchanger specification sheet. The purchaser shall specify the conditions under which the equipment shall be expected to function, and Smithco's guarantee shall extend to meeting said specified conditions. In the event of disagreement concerning performance, arrangement will be made for an inspection of the system of which the equipment in question is a component part and for a test of the same, in whole or in part, to the extent necessary to test our equipment. The test shall be made by Smithco Engineering, Inc., with a mutually agreeable testing procedure for determining heat load and cooling capacity. In case our equipment does not perform as rated, Smithco will bear whatever expense is incurred in making the inspection and test, and will at its option make changes necessary to obtain performance, replace F.O.B. factory the questioned equipment, or promptly refund the purchase price on return of the goods, F.O.B. factory. If the failure is due to failure of components not manufactured by Smithco, or misapplication of components, or incorrect heat load calculation, the purchaser shall bear all expense required to make necessary corrections and will reimburse Smithco for all its expense in connection with the inspection and test.

MATERIAL AND WORKMANSHIP WARRANTY

Smithco warrants each exchanger against defects in material and workmanship for a period of one year from shipping date and shall repair or replace, F.O.B. our plant, any parts proven defective within said period. Finished materials and accessories purchased from other manufacturers, including metal tubing, are warranted only to the extent of the original manufacturer's warranty to the heat exchanger fabricator. Any defective equipment or parts will be promptly replaced or repaired without charge, F.O.B. our factory, and any changes in the field by the customer will be at his expense unless authorized by Smithco.

Smithco assumes no responsibility for deterioration of any part of the equipment due to corrosion, erosion, or any other causes regardless of when such deterioration occurs after leaving our premises.

DISCLAIMER OF WARRANTIES, CONSEQUENTIAL DAMAGES

The warranty provided in this article and the obligations and liabilities of the seller thereunder are exclusive and in lieu of and buyer hereby waives all other remedies, warranties, guaranties, or liabilities, express or implied, arising by law or otherwise (including without limitation any obligations of the seller with respect to fitness, merchantability, indirect and consequential damages) or whether or not occasioned by seller's negligence. This warranty shall not be extended, altered, or varied except by a written instrument signed by seller and buyer.

SMITHCO

Warranty Contacts

Tom Montgomery

Parts and Service Manager

Smithco Engineering

6312 S. 39th West Ave.

Tulsa, OK 74132

Phone: (918) 388-0325

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Parts Sales Associate

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Smithco Engineering

6312 S. 39th West Ave., Tulsa, OK 74132

(918) 446-4406

www.smithco-eng.com

Maintenance

This section of the manual contains information concerning service and maintenance of your air-cooled heat exchanger.

WARNING: Turn off and lock out or tag power source before proceeding with inspection of the cooler internal surfaces or mechanical equipment.

General Maintenance:

The interior and exterior of the air-cooled heat exchanger should be inspected periodically for safety, damage and cleanliness. All guards provided with the unit must be in place and properly attached. No buildup of grease or dirt should be allowed on any of the components. The finned tubes exterior should be checked for dirty fins and clogging of the fins with dirt or lint. The interior of the tubes should be checked for rust and scale. The thermal design is based on clean exterior and interior heat exchanger surfaces.

Mechanical Equipment References:

VENDOR WEBSITES:

ELECTRIC MOTORS:	www.reliance.com
	www.sea.siemens.com/motors
FANS:	www.cofimco.com
	www.moorefans.com
FAN SHAFT BEARINGS:	www.dodge-pt.com
V-BELTS:	www.gates.com
	www.dayco.com
VIBRATION SWITCHES:	www.fwmurphy.com
	www.metrix1.com
	www.icca.invensys.com (Robert Shaw)
SPIRAL BEVEL GEAR BOXES:	www.amarillogear.com
	www.hubcityinc.com
LOUVER ACTUATORS AND CONTROLLERS:	www.airtechproducts.com
	www.emersonprocess.com (Fisher Actuators and Controls)
LOUVERS:	www.airtechproducts.com

ELECTRIC MOTOR MAINTENANCE

WARNING! ***Turn off and lock out or tag power source before proceeding.***

Inspection:

Each motor should be inspected at regular intervals. The frequency and thoroughness will depend on the amount of operation, nature of service and the environment.

Cleanliness:

The motor exterior should be kept free of oil, dust, dirt, water and chemicals. For fan-cooled motors, it is important to keep the air intake opening clear of debris.

Moisture:

On non-explosion proof TEFC motors, a removable plug in the bottom center of the motor frame permits removal of any accumulated moisture. Drain regularly.

Lubrication Schedule:

Check and re-lubricate bearings each six months (more often if conditions require) as follows:
For best results, grease should be compounded from a lithium soap base and petroleum oil. It should be of No. 2 consistency and stabilized against oxidation. Operating temperature range should be from -15°F to +250°F for Class B insulation and to +300°F for Class F and H. Most major oil companies have special bearing greases that are satisfactory.

CAUTION! Adding grease to bearing when motor is operating may cause grease to go through clearance around inside end cap and be slung onto motor windings.

1. Thoroughly clean the grease connections at the ends of the extended lube lines.
2. Remove plugs from drains.
3 Remove hardened grease from drains with stiff wire or rod.
4. Add grease to inlet with hand type gun until small amount of new grease is forced out of the drain.
5. Clean excess grease from the drains and grease connections and run the motor 30 minutes before replacing the drain plug.

V-BELT TENSIONING INSTRUCTIONS

WARNING! ***Turn off and lock out or tag power source before proceeding.***

SIMPLIFIED BELT TENSIONING METHOD

This tensioning method assumes average static tensions for drives, thereby eliminating the need for calculating static tension. Use this method if the small sheave diameter, small sheave rpm and speed ratio fall within the limits as given in table number 1; the number of belts used corresponds to the number recommended in this manual; and the drive has at least 2 belts.

Step 1: From TABLE NUMBER 1, determine the force required to deflect one belt 1/64" per inch of span length (length from C to C of sheaves along the belt)

- Measure the span length (t) of the drive.
- At the center of the span measure the force required to deflect one belt on the drive 1/64 per inch of span length from its normal position. The adjacent belt can be used as a reference for measuring the deflection. (see the figure below TABLE NUMBER 1, Page 10) Be sure to apply the force perpendicular to the belt.
- Measure the force required to deflect a band of belts 1/64 per inch of span length as discussed above. Divide the value by the number of belt strands in the band to find the deflection force per belt.

Note: Lay a steel bar or a narrow block of wood across the belt and apply the deflection force to the bar so that all of the individual strands in the band are deflected the same amount. If more than one belt is used in the drive, the neighboring band can be used as a reference for measuring the deflection, just as is done with individual belts. If only one band is used, lay a straightedge or stretch a string from sheave-to-sheave to use as a reference for measuring the deflection. Lay the straightedge or string across the back of the belt on the sheaves.

Step 2: Compare this deflection with the range of forces given in TABLE NUMBER 1.

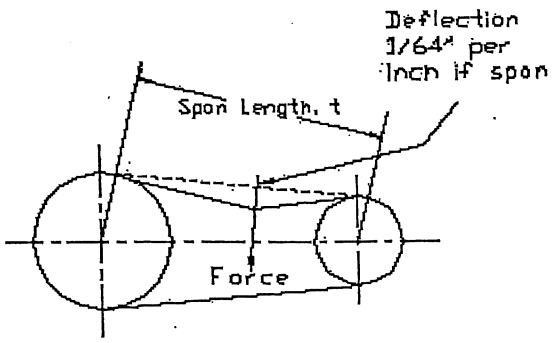
- If it is less than the minimum recommended force, the belts tensioned must be increased.
- If it is more than the maximum recommended force, the drive tension must be reduced.

TABLE NUMBER 1

RECOMMENDED DEFLECTION FORCE PER BELT

Cross Section	Smallest Sheave Diameter Range	RPM Range	Belt Deflection Force			
			3-L Classic & Polyband		Classic Cog	
			Normal	New Belt	Normal	New Belt
A, AX	3.0-3.6	1000-2500 2501-4000	3.7 2.8	5.5 4.2	4.1 3.4	6.1 5.0
	3.8-4.8	1000-2500 2501-4000	4.5 3.8	6.8 5.7	5.0 4.3	7.4 6.4
	5.0-7.0	1000-2500 2501-4000	5.4 4.7	8.0 7.0	5.7 5.1	9.4 7.6
B, BX	3.4-4.2	860-2500 2501-4000			4.9 4.2	7.2 6.2
	4.4-5.6	860-2500 2501-4000	5.3 4.5	7.9 6.7	7.1 7.1	10.5 9.1
	5.8-8.8	860-2500 2501-4000	6.3 6.0	9.4 8.9	8.5 7.3	12.8 10.9
C, CX	7.0-9.0	500-1740 1741-3000	11.5 9.4	17.0 13.8	14.7 11.9	21.8 17.5
	9.5-16.0	500-1740 1741-3000	14.1 12.5	21.0 18.5	15.9 14.6	23.5 21.6
D	12.0-18.0	200-850 851-1500	24.9 21.2	37.0 31.3		
	18.0-20.0	200-850 851-1500	30.4 25.6	45.2 38.0		

Cross Section	Smallest Sheave Diameter Range	RPM Range	Belt Deflection Force			
			D-V Wrapped		D-V Cog	
			Normal New	New Belt	Normal	New Belt
3VX	2.2-2.4	1000-2500 2501-4000			3.3 2.9	4.9 4.3
	2.65-3.65	1000-2500 2501-4000	3.6 3.0	5.1 4.4	4.2 3.8	6.2 5.6
	4.12-6.90	1000-2500 2501-4000	4.9 4.4	7.3 6.6	5.3 4.9	7.9 7.3
5V, 5VX	4.4-8.7	500-1749 1750-3000 3001-4000			10.2 8.8 5.6	15.2 13.2 8.5
	7.1-10.9	500-1740 1741-3000	12.7 11.2	18.9 16.7	14.8 13.7	22.1 20.1
	11.8-16.0	500-1740 1741-3000	15.5 14.6	23.4 21.8	17.1 16.8	25.5 25.0
8V	12.5-17.0	200-850 851-1500	33.0 28.8	49.3 39.9		
	18.0-22.4	200-850 851-1500	39.8 35.3	59.2 52.7		



Belt Deflection Figure

HTD BELT TENSIONING INSTRUCTIONS

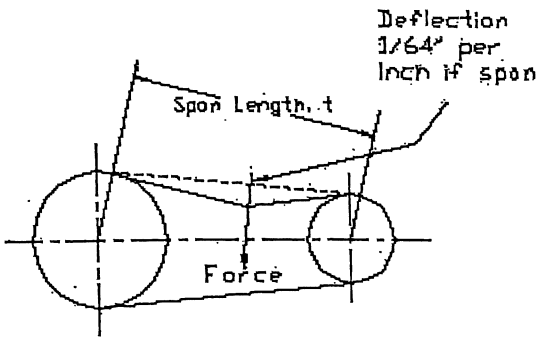
WARNING! ***Turn off and lock out or tag power source before proceeding***

BELT TENSION

HTD drives do not require as much tension as V- belt drives that depend on friction to transmit the load. HTD belts should be installed with a snug fit, neither too taut nor too loose. After the belt has been so tensioned, a force to deflect the belt by an amount to assure proper tension can be measured. Measure the belt span (see sketch). Using a spring scale, apply force perpendicular to the center of the belt width and the center of the belt span. Measure the force necessary to deflect the belt 1/64" for each inch of belt span. For example, the deflection for a 32" belt span is 32 x 1/64 = 1/2" deflection. The force required to deflect the belt the amount required at the proper tension is listed in table below.

DEFLECTION FORCE FOR Power Grip & Poly Chain GT2 BELTS

PITCH	WIDTH	FORCE
8mm	20mm	24 lbs.
	30mm	39 lbs.
	50mm	67 lbs.
	85mm	122 lbs.
14mm	40mm	99 lbs.
	55mm	156 lbs.
	85mm	266 lbs.
	115mm	378 lbs.
	170mm	581 lbs.



NOTE: For belts wider than 2" (50mm), it is suggested that a strip of key stock, or something similar, be placed across the belt under the point of force to prevent distortion.

For drives with shock loading or other unusual conditions, the force may have to be increased for proper operation of the drive.

Smithco Engineering, Inc.□P.O. Box 571330□Tulsa, OK 74157□Phone: (918)446-4406□Fax: (918)445-2857

LUBRICATION OF FAN BEARINGS

The bearings have been greased at the factory and are ready to run. The following table is a general guide for re-lubrication. Operating conditions may require different lubrication periods.
Bearings have been lubricated at the factory with number two consistency lithium base grease which is suitable for normal operating conditions.

Re-lubricate with lithium base grease or grease compatible with original lubricant and suitable for ball bearing service. In certain cases, such as low temperature or high temperature applications, it may be necessary to consult a lubrication supplier for recommendations.

LUBRICATION GUIDE

Read Preceding Paragraphs Before Establishing Lubrication Schedule.

Hours Run Per Day	Fan Shaft RPM and Suggested Lubrication Period In Weeks							
	1 to 250 RPM	251 to 500 RPM	501 to 750 RPM	751 to 1000 RPM	1001 to 1500 RPM	1501 to 2000 RPM	2001 to 2500 RPM	2501 to 3000 RPM
8	12	12	10	7	5	4	3	2
16	12	7	5	4	2	2	1	1
24	10	5	3	2	1	1	1	1

GEAR MAINTENANCE

LUBRICATION INSTRUCTIONS

Recommended lubricants are as follows:

AMBIENT-DEGREES F	15-50	50-125
AGMA NUMBER	4EP	5EP
VISCOSITY RANGE	626-755 SSU @ 100°F	918-1122 SSU @ 100°f

Consult the gear manufacturer's data for a recommended oil and manufacturer.

SYNTHETIC GEAR LUBRICANTS

Synthetic oils have been used in enclosed gear drives for special operating conditions. Synthetic lubricants can be advantageous over standard oils in that they are generally more stable, have a longer life, and operate over a wider temperature range.

INSTRUCTIONS FOR INSTALLATION AND STARTING NEW UNIT

WARNING! Turn off and lock out or tag power source before proceeding.

1. When units are shipped, internal parts are protected by rust preventive film. Flushing is not required since it is soluble in the lubricant. Fill the case with recommended lubricant to the proper oil level.
   NOTE: units may be shipped without oil and must be filled before starting.
2. Gear units may be shipped with the breather port plugged. Prior to operation, a breather type plug (supplied with the unit) must be installed in the upper housing.
3. Coupling connections must be aligned for proper parallel and angular misalignment.
4. If it is required to shim the gearbox for alignment, care must be taken to prevent distortion of the housing. **Note: coupling and unit alignment should be rechecked after two weeks operation.**
5. When units furnished with force feed lubrication are started, it should be confirmed that oil is being pumped.
6. For low temperature operation, with oil viscosity at starting greater than 5,000 SUV, heaters must be used. For units with pressure lubrication systems, confirm the pump is pumping the cold oil.

7. The minimum viscosity required under normal operating conditions ranges from 150 to 400 SUV. Oils having this viscosity under normal operating conditions may not be satisfactory for low temperature starting and heaters must be used.

8. Where unit will not warm up under intermittent operating conditions, low-viscosity oil may be required for low temperature operation.

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OIL CHANGES

After installation, the first oil change should occur after two weeks of operation. After the original oil has been drained, fill the case to the required level with SAE-10 straight run mineral flushing oil containing no additives. Start the fan and let it get up to speed, then stop it. This works as a flushing procedure. Drain the flushing oils and fill with the recommended lubricant to the proper level.

Change the oil every six months unless conditions warrant closer intervals. If the oil temperature is continuously above 200°F, or if the unit is subjected to an unusually moist atmosphere, oil changes may be necessary at one, two or three month intervals, as determined by field inspection of the oil.

Prevent any foreign matter from entering the gear case. Dust, dirt, moisture, and chemical fumes form sludge.

INSTRUCTIONS FOR MAINTENANCE

1. Stop the unit and check the oil level once a week. The lubricant level should be no more than 1/4" below specified level.
2. Units should be given daily visual inspections and observation for oil leaks or unusual noises. If either occurs, the cause must be found and corrected.
3. The operating temperature of the unit is the temperature of the oil inside the housing. The maximum operating temperature should not exceed 200°F.

INSTRUCTIONS FOR SHUTDOWN PERIODS

If unit will be idle for a period longer than one week, it will be necessary to run the unit for ten minutes every week it is idle. This short operation will keep the gears and bearings coated with oil and prevent rusting due to condensations of moisture resulting from temperature changes.