

**DESIGN, MANUFACTURING, SUPPLY, INSTALLATION SUPERVISION, COMMISSIONING, STARTUP & PERFORMANCE TESTING OF NEW CENTRIFUGAL COMPRESSORS AND MODIFICATIONS OF EXISTING TURBO COMPRESSORS TRAINS**

**Tender No. PROC-FC/CB/PROJ/QADIRPUR-4261/2019**

**PRE-BID CLARIFICATION No. OGDCL-QP-4261-008**



Sr. No.	Reference	Bidder Query	OGDCL Response (01-04-2019)
AA	Page 22/ Clause - 30.0 (Taxes & Duties), Section-IV (Conditions of Contract), Volume I	<p>We understand that:-</p> <p>The provided Goods/ Supplies shall be quoted in US\$ on C&amp;F Karachi Basis inclusive of all Exporting Country Taxes but Exclusive of all Taxes of Pakistan including Sales Tax and at source Income Withholding Tax.</p> <p>OGDCL shall make Payment(s) against quoted price without any deduction on account of withholding tax whatsoever from due payments. Please confirm.</p>	<p>Payment shall be made after deduction of withholding taxes applicable at the time of payment for composite contract as laid out in clause # 30.1 of the conditions of contract</p>
BB	<p>Sr.No. DD of Pre-Bid Clarification No. OGDCL-QP-4261-004</p> <p>&amp;</p> <p>Sr.No.CC of Pre-Bid Clarification No. OGDCL-QP-4261-005</p>	<p>As informed by OGDCL in the response of Pre-Bid Clarification that Bidders may ask directly from the OEM, i.e.SOLAR for the required information, however there is no feedback for the required information/ technical documents from SOLAR upto date.</p> <p>Considering the tense time, OGDCL may coordinate with SOLAR directly to provide the said information.</p> <p>Besides, it is to note that the following documents of the Gas Turbine are required urgently for the Model Selection and Simulation of Centrifugal Compressor. Please provide at least following information on priority basis:</p> <ul style="list-style-type: none"> <li>- Corresponding power-rotation speed curve of Gas Turbine design point performance.</li> <li>- Shaft head size.</li> <li>- Dynamical model of Gas Turbine Rotor.</li> </ul>	<p>Attached please find the details of mechanical installation drawing for the existing units.</p> <p>For the power-rotation curve, OGDCL has already included the tabular turbine performance data in the tender document, this is the information normally shared with OEM Compressor vendors when designing compressors to match our turbine drivers. If additional information is needed by the bidder, it can be provided during detailed engineering.</p>

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12	11	10	9A	9	8B	8A	8	7	6	5	4	3F	3E	3D	3C	3B	3A	3	2B	2A	2	1	SHEET
B	B		B	B	A	B	C	B	A	C	C	A	A	B	B	C		B	C	B	C	C	REV

THIS PRINT IS PROVIDED ON A RESTRICTED BASIS AND IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO SOLAR TURBINES INCORPORATED.

**GENERAL NOTES**

**1.0 SYMBOLS AND ABBREVIATIONS:**

"	INCHES	KPAD	KILOPASCAL DIFFERENTIAL
'	FEET	KPAG	KILOPASCAL GAGE
[ ]	MILLIMETERS	L	LITER
ACFM	ACTUAL CUBIC FEET PER MINUTE	LPM	LITERS PER MINUTE
AH	AMPERE HOURS	LBS	POUNDS
BARG	BAR GAGE	M	METER
BTU	BRITISH THERMAL UNIT	M <sup>3</sup>	CUBIC METER
°C	DEGREE CELSIUS	MM	MILLIMETER
CFM	CUBIC FEET PER MINUTE	MIN	MINUTE
CS	CENTISTOKES (MM <sup>2</sup> PER SECOND)	MPH	MILES PER HOUR
DIFF	DIFFERENTIAL	M/S	METERS PER SECOND
°F	DEGREE FAHRENHEIT	N	NEWTONS
FT	FEET	NM <sup>3</sup>	NORMAL CUBIC METER
GPM	GALLONS PER MINUTE	PSIG	POUNDS PER SQUARE INCH GAGE
HR	HOOR	PSID	POUNDS PER SQUARE INCH DIFFERENTIAL
KG	KILOGRAM	SCF	STANDARD CUBIC FOOT
KJ	KILOJOULE	SCFM	STANDARD CUBIC FOOT PER MINUTE
KPA	KILOPASCAL	SSU	SAYBOLT SECONDS UNIVERSAL

**1.1 SPECIFICATIONS: THE FOLLOWING SOLAR DOCUMENTS MAY APPLY TO THIS DRAWING.**

ES 9-62	INGESTIVE CLEANING SOLAR GAS TURBINE ENGINES
ES 9-98	FUEL, AIR, AND WATER (OR STEAM) FOR SOLAR GAS TURBINE ENGINE
ES 9-224	LUBRICATING OIL FOR SOLAR GAS TURBINES
ES 2069	EVAPORATIVE COOLER

**INSTALLATION INSTRUCTIONS FOR:**

ES 1754	LUBE OIL TANK VENT
ES 1757	LUBE OIL TANK VENT WITH SEPARATOR AND FLAME ARRESTOR
ES 1733	INTAKE DUCTING FOR SOLAR TURBINE ENGINES

**SYSTEM DRAWINGS:**

52121-149171	LOGIC DIAGRAM
52121-149291	LUBE OIL SYSTEM SCHEMATIC
52121-149373	GAS FUEL SYSTEM SCHEMATIC
52121-149471	ELECTRIC START SYSTEM SCHEMATIC
52121-149480	ELECTRIC SCHEMATIC
52121-149481	WIRING DIAGRAM
52121-149482	INTERFACE/INTERCONNECT DIAGRAM
52121-149770	AIR ASSIST/ENGINE DRAIN SCHEMATIC

**PACKAGE INSTALLATION**

**2.0 ESTIMATED COMPONENT WEIGHTS:**

DRIVER FRAME WITH ACCESSORIES	54,000 LBS ( 24494 KG)
TURBINE AND MOUNTS WITH AIR INLET AND EXHAUST DUCTS	16,916 LBS ( 7673 KG)
PACKAGE ENCLOSURE	12,000 LBS ( 5443 KG)
<b>TOTAL INSTALLED DRY PACKAGE WEIGHT</b>	<b>82,916 LBS ( 3760 KG)</b>
OIL TO FILL SYSTEM (EXCLUDING COOLER FILL)	12,000 LBS ( 5443 KG)
<b>TOTAL INSTALLED WET PACKAGE WEIGHT</b>	<b>94,916 LBS ( 4305 KG)</b>
AIR/OIL COOLER (EACH)	9,050 LBS ( 4105 KG)
MAIN CONTROL CONSOLE	1,580 LBS ( 717 KG)
BATTERY AND CHARGER ASSEMBLY (24VDC)	552 LBS ( 251 KG)
FLAME ARRESTOR, LUBE OIL TANK VENT	185 LBS ( 84 KG)
OIL MIST ELIMINATOR	2,410 LBS ( 1093 KG)
WATER WASH CART	360 LBS ( 163 KG)
ENCLOSURE VENT FAN	800 LBS ( 363 KG)
ENGINE LIFTING EQUIPMENT	2,620 LBS ( 1188 KG)
ANCILLARY EQUIPMENT SUPPORT STRUCTURE - EXH	9,200 LBS ( 4173 KG)
ANCILLARY EQUIPMENT SUPPORT STRUCTURE TAI	7,000 LBS ( 3175 KG)
ENCLOSURE VENT SILENCER (EACH)	700 LBS ( 318 KG)
ENCLOSURE VENT FILTER	200 LBS ( 91 KG)
FIRE CYLINDER CABINET (PRIMARY)	1,440 LBS ( 635 KG)
VARIABLE FREQUENCY DRIVE	212 LBS ( 96 KG)
FIRE CYLINDER CABINET (EXTENDED)	900 LBS ( 408 KG)
FLOWMETER RUN	230 LBS ( 104 KG)

**2.1 LOOSE SHIP FOR FIELD INSTALLATION.**

**2.2** WHEN A CONVENTIONAL REINFORCED CONCRETE SLAB IS TO BE USED, THE THICKNESS WILL BE DETERMINED BY THE CUSTOMER BASED ON LOCAL SOIL CONDITIONS. THE TURBINE ENGINE (OR "DRIVER") BASEPLATE IS DESIGNED SUCH THAT IT WILL UNDERGO THERMAL GROWTH WITH OPERATION OF THE PACKAGE. THEREFORE, STRUCTURAL GROUT MUST NOT BE USED DIRECTLY ADJACENT TO THE 3 MOUNTING PADS ON THE DRIVER BASEPLATE OR UNDER THE PERIMETER OF THE DRIVER BASEPLATE RAILS. DRIVEN EQUIPMENT BASEPLATE MOUNTING LIMITATIONS ARE DEFINED IN A SEPARATE NOTE OR IN THE DRIVEN EQUIPMENT SUPPLIER DRAWINGS/MANUALS.

FLEXIBLE SEALANT MAY BE USED AROUND THE PERIMETER OF THE DRIVER BASEPLATE, BUT SHALL NOT RESTRAIN THE UNIT FROM THERMAL GROWTH. THE BASEPLATE PAINT IS COMPATIBLE WITH MOST SEALANTS. THIS PAINT SHOULD NOT BE REMOVED.

PRIOR TO SETTING THE PACKAGE IN PLACE, THE SUPPORT STRUCTURES ON WHICH THE MOUNTING PADS WILL REST SHALL BE FLAT AND PARALLEL TO ONE ANOTHER WITHIN ±1/8" [3.2] ON ADJACENT PADS, SIDE OR END, AND ±1/4" [6.4] ON DIAGONAL PADS.

THE ACCESS PATH AROUND THE PACKAGE IS RECOMMENDED TO BE A MINIMUM OF 10'-0" [3048] WIDE FOR ENGINE REMOVAL.

**2.3** THE PACKAGE FRAME ASSEMBLY IS PROVIDED WITH FOUR (4) LIFTING BOLLARDS. ALL FOUR POINTS MUST BE USED WITH SPREADER BARS TO PREVENT DAMAGE TO THE PACKAGE.

THE CENTER OF GRAVITY PLANE FOR THE PACKAGE FRAME ASSEMBLY IS STENCILED OR LABELED ON EACH SIDE OF THE PACKAGE FRAME.

LIFTING OF THE CONTROL CONSOLE MAY BE ACCOMPLISHED BY ATTACHING A LIFTING SLING TO LIFTING EYES ON TOP OF CONSOLE.

**2.4** REVERSE ROTATION OF THE DRIVEN EQUIPMENT DURING OPERATION IS NOT PERMITTED. SEVERE DAMAGE TO SHAFT BEARINGS WILL OCCUR. STATION VALVING MUST BE ARRANGED AND SEQUENCED TO PREVENT REVERSE ROTATION.

**2.5** BASE LEVELING PROCEDURE: SEE SHEET 11

**2.6** FLOW, PRESSURE AND TEMPERATURE VALUES SHOWN ON THIS DRAWING ARE INTENDED FOR USE IN THE DESIGN OF EXTERNAL SYSTEMS AND EQUIPMENT ONLY, AND CANNOT BE USED IN ANY TURBINE PERFORMANCE CALCULATIONS.

**2.7** NOTE NOT USED.

**2.8** ENGLISH UNITS ARE PRIMARY AND METRIC CONVERSIONS SHOWN IN BRACKETS ARE DERIVED FROM THE ENGLISH UNITS. OVERALL DIMENSIONS SHOWN ON THIS DRAWING ARE NOMINAL AND SMALL VARIATIONS CAN BE EXPECTED. TOLERANCES ARE ±1/4" [±6] ON THE PIPING INTERFACE CONNECTIONS AND ±1/8" [±3] ON HOLD DOWN FOUNDATION POINTS. IT IS RECOMMENDED THAT SUFFICIENT ALLOWANCE BE LEFT ON MATING PIPES AND FLANGES FOR FINAL FIELD ALIGNMENT. DO NOT SCALE THIS DRAWING. WORK TO DIMENSIONS GIVEN. DIMENSIONS IN PARENTHESIS ARE FOR REFERENCE ONLY.

CUSTOMER CONNECTION PIPE FLANGES CONFORM TO AMERICAN NATIONAL STANDARDS INSTITUTE STANDARD (ANSI) B.16.5. ALL FLANGE HOLES STRADDLE THE VERTICAL CENTERLINE SYMMETRICALLY.

ALL EXTERNAL PIPES, DUCTS OR VENTS CONNECTED TO THE PACKAGE MUST BE FULLY SELF-SUPPORTING. MINIMUM PIPE SIZES ALLOWABLE ARE DETERMINED BY PACKAGE CONNECTION POINT. NO REDUCTIONS ARE ALLOWED.

EXTERNAL OIL LINES ARE TO BE CLEANED BY CONTRACTOR PRIOR TO CONNECTION TO THE TURBINE SKID OR EXTERNALLY MOUNTED OIL COOLERS. EXTERNAL PIPING IS TO BE CLEANED OF ALL DIRT AND RUST AND IS TO BE TREATED WITH A RUST INHIBITOR. SOLAR RECOMMENDS THAT OIL PIPING BE FLUSHED WITH A MINIMUM REYNOLDS NUMBER OF 4000 UNTIL THE FLUSHING FLUID MEET AN ISO CLEANLINESS CODE (4406) OF 14/12, AND THERE ARE NO PARTICLES COLLECTED ON A 100 MESH SCREEN AT THE LINE OUTLET AFTER FLUSHING FOR AT LEAST ONE HOUR. NR=3162XGPM/CENTISTOKES/PIPE ID (INCHES). CARBON STEEL PIPING MUST BE PICKLED AND PASSIVATED PRIOR TO FLUSHING. UNDER NO CIRCUMSTANCES ARE THE EXTERNAL PIPES TO BE CLEANED WHILE THEY ARE CONNECTED TO THE TURBINE OR EXTERNALLY MOUNTED OIL COOLERS.

ALL CUSTOMER PIPING INTERFACE CONNECTIONS 4" [102] OR LESS IN DIAMETER ARE STAINLESS STEEL UNLESS OTHERWISE SPECIFIED. CUSTOMER PIPING INTERFACE CONNECTIONS GREATER THAN 4" [102] IN DIAMETER ARE CARBON STEEL UNLESS OTHERWISE SPECIFIED.

**2.9** SUPPLIED BY OTHERS.

**2.10** THE FLANGE FACES OF EXTERNAL DUCTING TO THE TURBINE AIR INLET AND EXHAUST EXPANSION JOINTS MUST BE ALIGNED TO MATING FLANGE FACES TO WITHIN 1/4" [6]. THIS DUCTING MUST ALSO BE SUPPORTED TO LIMIT THE MOVEMENT OF THE DUCTING DURING TURBINE OPERATION AS FOLLOWS:

- A. VERTICAL GROWTH TOWARDS THE TURBINE MUST NOT EXCEED 1/2" [13].
- B. MOVEMENT LATERAL TO PLANE -A- AND -B- MUST NOT EXCEED 1/4" [6].
- C. THE ENGINE EXHAUST JOINT IS METAL TO METAL. A GASKET IS NOT REQUIRED.
- D. ALL AIR INLET DUCT FLANGES MUST BE SEALED WITH COMPOUND PROVIDED BY SOLAR. SEALANT MUST BE APPLIED JUDICIOUSLY IN ORDER TO EFFECT AN AIR TIGHT SEAL. EXCESS SEALANT WHICH MIGHT BE INGESTED BY THE ENGINE MUST BE REMOVED BEFORE ENGINE START-UP.

**2.11** TURBINE AIR FLOW VALUES ARE FOR DUCT SIZING CALCULATION PURPOSES ONLY AND DO NOT CORRESPOND TO ANY GIVEN TURBINE CONDITIONS. SYSTEMS SHOULD BE DESIGNED SUCH THAT PRESSURE LOSSES DO NOT EXCEED 4" [102] H<sub>2</sub>O FOR THE INLET AND 6" [152] H<sub>2</sub>O FOR THE EXHAUST. 10" [254] H<sub>2</sub>O FOR EXHAUST SYSTEM WITH HEAT RECOVERY. TURBINE INLET AIR TO BE IN ACCORDANCE WITH ES 9-98.

MARS TURBINE INLET AMBIENT TEMPERATURE RANGE FROM -20F (-29°C) TO 120°F (49°C).  
 MAXIMUM NORMAL OPERATION EXHAUST TEMPERATURE: 989°F (535.9°C)  
 MAXIMUM EXHAUST GAS FLOW: 209,000 ACFM (5914.7 ACTUAL M<sup>3</sup>/MIN)  
 MAXIMUM AIR INLET FLOW VOLUME: 70,500 ACFM (1995.1 ACTUAL M<sup>3</sup>/MIN)  
 TURBINE INLET TO BE IN ACCORDANCE WITH ES 9-98.  
 DUCTING TO MEET ES 1733.

UNDER CONDITIONS OF NON-NORMAL OPERATION, MAXIMUM EXHAUST GAS TEMPERATURE MAY REACH 1,032°F (560°C). IF NON-STANDARD OPERATION IS EXPECTED, IT IS RECOMMENDED THAT THE CUSTOMER TAKE INTO CONSIDERATION INCREASED EXHAUST GAS TEMPERATURE LEVELS WHEN SELECTING EXHAUST SYSTEM COMPONENTS.

**2.12** NOTE NOT USED.

**2.13** NOTE NOT USED.

**2.14** NOTE NOT USED.

**2.15** THE EXHAUST COLLECTOR AND COMBUSTOR DRAIN MAY CONTAIN WATER, FUEL, OR OIL, AND SHOULD BE PIPED TO A SUITABLE CONTAINER OR SEPARATE DRAIN LINE. **NO BACK PRESSURE ALLOWED. SEE WARNING NOTE 10.2 AND TABLE 3.**

**2.16** DIRECTION REFERENCES TO THE PACKAGE - LEFT SIDE, RIGHT SIDE, FORWARD, AND AFT ARE ESTABLISHED BY VIEWING THE PACKAGE FROM THE EXHAUST END (AFT), AND LOOKING FORWARD TO THE TURBINE AIR INLET (FWD).

**2.17** SOLAR'S PACKAGE FRAME DESIGN DOES NOT REQUIRE GROUT UNDER EITHER THE SUPPORT PADS OR UNDER THE FRAME RAILS. GROUT MATERIAL MAY BE USED TO SEAL THE FRAME RAILS TO THE FOUNDATION WHEN A SEAL IS NECESSARY TO PREVENT THE LOSS OF FIRE SUPPRESSANT, OR TO LEVEL THE SUPPORT FOUNDATION. THE PACKAGE FRAME AND SUPPORT PADS ARE PAINTED TO THE SAME PROCESS AS THE OTHER SURFACES OF THE FRAME. THIS PAINT SHOULD NOT BE REMOVED WHEN APPLYING GROUT.

**2.18** THE SOLAR SUPPLIED IN-LINE STRAINER IS TO BE INSTALLED IN THE SUPPLY PIPE EXTERNAL TO THE PACKAGE CONNECTION, AND AS TO THE PACKAGE CONNECTION AS POSSIBLE. REFER TO ZONE E/82 FOR STRAINER REMOVAL CLEARANCE.

**START SYSTEMS**

**3.0** NOTE NOT USED.

**3.1** THESE TABLES ARE BASED UPON THE FOLLOWING:

- A. RATED INPUT AND OUTPUT CURRENT OF VFD.
  - B. REASONABLE MARGINS OF THESE CURRENTS (125% OF CURRENT INTO VFD, 150% OF NAME PLATE CURRENT OF MOTOR)
  - C. A MAXIMUM ALLOWABLE VOLTAGE DROP OF 5% (19 VAC, SINCE ALL VFD'S ARE PROGRAMMED TO OUTPUT 380 VAC MAXIMUM TO MOTOR)
  - D. PHYSICAL CONSTRAINTS OF WIRING CONNECTIONS.
- UL-LISTED MOTOR  
 MARS 90/100:  
 WIRING INTO THE VFD: 2/0 AWG RECOMMENDED, 2/0 AWG MAXIMUM.  
 WIRING VFD TO MOTOR: DEPENDENT UPON LENGTH OF CONDUIT. REFERENCE THE FOLLOWING TABLE. LINE REACTORS TO BE INSTALLED BETWEEN VFD AND MOTOR WHEN SUPPLIED.

LENGTH OF CONDUIT	RECOMMENDED WIRE SIZE (AWG)	LINE REACTORS (YES/NO)
0 - 250 FEET		NO
251 - 380 FEET	1	YES
381 - 480 FEET	1/0	YES
481 - 600 FEET	2/0	YES

THE MAXIMUM WIRE SIZE INTO THE MOTOR IS 2/0 AWG.

CUSTOMER	
<b>PIRKOH GAS COMPRESSION PROJECT PIRKOH GAS COMPANY (PVT) LIMITED HYUNDAI ENGINEERING CORPORATION.LTD. MITSUBISHI HEAVY INDUSTRIES.LTD. PIRKOH PAKISTAN</b>	
<input checked="" type="checkbox"/> SUBMITTED FOR REVIEW	DATE 07-25-97
<input type="checkbox"/> CERTIFIED AS NOTED WITH	DATE
<input checked="" type="checkbox"/> CERTIFIED FOR CONSTRUCTION	DATE 04-29-98
SYMBOLS	
	2 DENOTES EXTERNAL CONNECTION POINT
	2 INDICATES REFERENCE TO NOTE
	A DENOTES REVISION
	2 DENOTES COMPONENT OR INSTRUMENTATION
	A/12 DENOTES DRAWING ZONE LOCATION
FSCM NO. <b>66195</b>	"THIS IS A PROPRIETARY DESIGN OF SOLAR TURBINES INCORPORATED. REPRODUCTION, MANUFACTURE OR USE OF ANY ASSEMBLY, SUBASSEMBLY OR PART INDICATED HEREIN OR THE USE OF THE DESIGN OF ANY SUCH ASSEMBLY, SUBASSEMBLY OR PART, IS PERMISSIBLE ONLY IF EXPRESSLY AUTHORIZED IN WRITING BY SOLAR TURBINES INCORPORATED."
APPROVED	DRAWING TITLE
PROJECT L. YATOLCSI/ B. LEBLANC	DATE 07-25-97
DESIGN R. WILKEY	DATE 07-25-97
CHECK R. WILKEY	DATE 07-25-97
DRAFT J. LOGAN	DATE 07-25-97
SOLAR PROJECT IYER NO. <b>2-52121</b>	<b>MARS 100 MECHANICAL DRIVE MECHANICAL INSTALLATION</b>
CUSTOMER IDENT. NO.	
CUSTOMER <b>SEE ABOVE</b>	<b>Solar Turbines</b> <i>A Caterpillar Company</i>
CUSTOMER <b>52121-149746</b>	DRAWING NO. <b>52121-149746</b>
	REV <b>C</b>
	SHEET 1 OF 12

FUEL SYSTEMS

4.0 GAS FUEL IS TO BE IN ACCORDANCE WITH SOLAR SPECIFICATION ES 9-98. MAXIMUM FLOW DEMAND RATE IS 2,909 SCFM (77.9 NM<sup>3</sup>/MIN). FUEL PRESSURE AT PACKAGE CONNECTION MUST BE REGULATED BETWEEN 360 PSIG (2482.2 KPAG) AND 500 PSIG (3447.5 KPAG). GAS TEMPERATURE TO BE 20°F (-7°C) TO 160°F (71°C). IT IS RECOMMENDED THAT A REMOTE QUICK CLOSING AND EASILY ACCESSIBLE HAND-OPERATED VALVE BE INSTALLED IN THE EXTERNAL FUEL SUPPLY LINE TO PROVIDE EMERGENCY SHUTOFF CAPABILITY. A SOLAR SUPPLIED IN-LINE STRAINER IS TO BE INSTALLED IN THE GAS FUEL SUPPLY PIPES TO THE PACKAGE CONNECTION AND AS CLOSE TO IT AS POSSIBLE. SEE DETAILS ON SUBSEQUENT SHEETS FOR REQUIRED STRAINER REMOVAL CLEARANCE.

4.1 NOTE NOT USED.

4.2 TOTAL PILOT VENT VOLUME PER START OR SHUTDOWN IS APPROXIMATELY 2 SCF (.05NM<sup>3</sup>). MAXIMUM PILOT VENT BACK PRESSURE IS 5 PSIG (35 KPAG). THE VENT MUST BE CONNECTED TO A SAFE LOCATION OR COLLECTOR. THE VENT TERMINATION SHALL AFFORD PROTECTION FROM RAIN AND SNOW BY MEANS OF A SHIELD OR BY PIPE GEOMETRY AND BE SCREENED TO PREVENT ENTRY OF LARGE FOREIGN OBJECTS. INTERMITTENT FLOW RATE IS LESS THAN 70 SCFM (1.9 NM<sup>3</sup>).

FOR PILOT VALVE SYSTEMS WHICH USE SHOP AIR, THE AIR SUPPLY MUST BE CLEAN, DRY AIR REGULATED BETWEEN 80 PSIG (551.5 KPAG) AND 300 PSIG (2068 KPAG) AT THE PACKAGE CONNECTION. AIR USAGE PER START IS 70 SCFM (1.96 NM<sup>3</sup>/MIN) FOR 1/2 SECOND.

4.3 NOTE NOT USED.

4.4 NOTE NOT USED.

4.5 NOTE NOT USED.

4.6 NOTE NOT USED.

4.7 NOTE NOT USED.

4.8 NOTE NOT USED.

4.9 FUEL SUPPLY TEMPERATURE IS BETWEEN -20°F (-29°C) AND 160°F (72°C). OPERATION ABOVE 160°F (72°C) WILL SHORTEN THE LIFE OF FUEL SYSTEM ELASTOMER COMPONENTS.

5.3 THE EXTERNAL OIL TANK VENT PIPE MUST BE SELF-SUPPORTING AND HAVE AN UPWARD SLOPE OF .25" PER FOOT (21 MM/M) WITH NO TRAPS OR RESTRICTIONS AND MUST BE ROUTED SUCH THAT OIL VAPORS WILL NOT MIX WITH TURBINE INLET OR EXHAUST GAS. THE TANK VENT AIR AND OIL VAPOR FLOW IS APPROXIMATELY 120 SCFM (3.2 NM<sup>3</sup>/MIN.). MAXIMUM ALLOWABLE PIPING BACK PRESSURE LOSS IS 1" (25.4 MM) H<sub>2</sub>O. VENT PIPE TERMINATION SHALL AFFORD PROTECTION FROM RAIN AND SNOW BY MEANS OF A SHIELD OR PIPE GEOMETRY AND BE SCREENED TO PREVENT ENTRY OF LARGE FOREIGN OBJECTS. THE FLAME ARRESTOR, WHEN INSTALLED, WILL PREVENT POSSIBLE FLASH BACK INTO THE LUBE OIL TANK AND MUST BE INSTALLED WITHIN 15' (4576 MM) OF THE VENT TERMINATION POINT. REFERENCE SOLAR SPECIFICATION ES 1746. SEE WARNING NOTE 2.16, 2.17 AND TABLE 3 ON SHEET 2A.

5.4 SERVO OIL SYSTEM ACCUMULATORS SHALL BE PRECHARGED WITH NITROGEN ONLY TO 200 PSIG (1,380 KPAG). PRECHARGED SEAL SHOULD BE MONITORED AS A SCHEDULED MAINTENANCE ACTIVITY, E.G. QUARTERLY.

5.5 THE PNEUMATIC BACKUP POST LUBE OIL PUMP MOTOR FLOW IS 160 SCFM (4.3 NM<sup>3</sup>/MIN) AND MUST BE REGULATED BETWEEN 200 PSIG (1380 KPAG) AND 500 PSIG (3450 KPAG) AT THE PACKAGE INLET. THE PNEUMATIC SUPPLY MUST BE CLEAN AND DRY AIR OR NATURAL GAS. IT IS RECOMMENDED THAT A QUICK CLOSING AND EASILY ACCESSIBLE HAND OPERATED VALVE BE INSTALLED IN THE EXTERNAL SUPPLY LINE TO PROVIDE IMMEDIATE SHUTOFF CAPABILITY. TOTAL CONSUMPTION PER CYCLE IS APPROXIMATELY 16800 SCF (457 NM<sup>3</sup>). MAXIMUM ALLOWABLE EXHAUST VENT BACK PRESSURE IS 5 PSIG (34.5 KPAG).

5.6 THE OIL TANK VENT AIR/OIL SEPARATOR IS NOT INTEGRAL WITH THE PACKAGE AND MUST BE LOCATED AND INSTALLED SEPARATELY. (REFERENCE SOLAR SPECIFICATION ES 1755). THE VENT PIPE TO AND FROM THE SEPARATOR MUST CONFORM TO THE REQUIREMENTS OF NOTE 5.3 AND 2.8 PARAGRAPH 4.

5.7 THE FLAME ARRESTOR IN CONJUNCTION WITH APPROVED AIR/OIL SEPARATOR MUST BE USED WHEN THE OIL TANK VAPORS ARE TO BE DISPERSED BY TURBINE EXHAUST DRAFT. THE FLAME ARRESTOR IS NOT INTEGRAL WITH THE PACKAGE AND MUST BE LOCATED AND INSTALLED SEPARATELY. (REFERENCE SOLAR SPECIFICATION ES 1756) AND NOTE 2.8, PARAGRAPH 4. THE FOLLOWING INSTALLATION REQUIREMENTS APPLY:

- A. THE FLAME ARRESTOR IS REQUIRED TO PREVENT FIRE FLASHBACK INTO THE OIL TANK AND SHALL BE INSTALLED AS CLOSE TO THE EXHAUST DRAFT AS POSSIBLE AND IN NO CASE MORE THAN 15' [4572] FROM THE VENT TERMINATION.
B. THE VENT PIPE TO THE FLAME ARRESTOR MUST CONFORM TO REQUIREMENTS OF NOTE 5.3.
C. FLAME ARRESTORS WITH ALUMINUM HOUSINGS SHOULD BE MATED WITH 125 LB ANSI FLAT FACE FLANGES. FULL FACE FLANGE GASKETS ARE RECOMMENDED. MAXIMUM TORQUE OF FLANGE BOLTS MUST NOT EXCEED 200 FT-LBS.

ELECTRICAL SYSTEMS

6.0 PACKAGE ELECTRICAL INSTALLATION REQUIREMENTS ARE AS SHOWN ON AC-DC SCHEMATIC AND INTERCONNECTION WIRING DIAGRAM. (REFERENCE SYSTEMS DRAWING NOTE 1.2).

6.1 NOTE NOT USED.

6.2 GROUNDING LUGS PROVIDED FOR SEPARATELY GROUNDING PACKAGE FRAME, CONTROL CONSOLE, AND BATTERY CHARGER TO THE CUSTOMER'S GROUNDING CONDUCTOR AS REQUIRED. GROUNDING CONDUCTOR TO BE SIZED IN ACCORDANCE WITH REQUIREMENTS OF APPLICABLE ELECTRICAL CODES. LUG SURFACES TO BE FREE OF DIRT, GRIT, PAINT, AND OIL TO ALLOW FOR CLEAN METAL-TO-METAL CONTACT. LUG ALSO SUITABLE FOR CONNECTION OF MAIN BONDING JUMPER FOR GROUNDING SYSTEMS. MAIN BONDING JUMPER TO BE SIZED IN ACCORDANCE WITH THE APPLICABLE ELECTRIC CODE.

- 6.3 A. THE EXACT LOCATIONS FOR EXTERNAL ELECTRICAL CONNECTIONS INTO THE CONTROL CONSOLE TO BE DETERMINED ON THE SITE AT INSTALLATION. THE AREA AVAILABLE IN THE CONSOLE FOR THESE CONNECTION STUBS IS SHOWN. THE CONSOLE IS SUPPLIED WITH FACTORY CUTOUTS AND REMOVABLE GLAND PLATES ON TOP AND BOTTOM.
B. THE CONTROL CONSOLE MUST BE LOCATED IN A CLEAN, DRY ENVIRONMENT CONSISTENT WITH GOOD OPERATING PRACTICES FOR MICROPROCESSORS. TO ENSURE GOOD PERFORMANCE OF THE VIDEO DISPLAY UNIT; THE FILTER LOCATED AT THE REAR OF THE CONTROL CONSOLE SHOULD BE CHECKED AT REGULAR INTERVALS FOR CLEANLINESS AND CLEANED AS APPROPRIATE.

6.4 BATTERIES AND BATTERY CHARGER ARE DEDICATED TO THE SOLAR ELECTRICAL SYSTEMS AND MUST NOT BE SHARED WITH OTHER SITE/CUSTOMER SYSTEMS, EXCEPT WITH PRIOR ENGINEERING APPROVAL.

6.5 ALL AC AND DC CIRCUITS MUST BE SEPARATED. INTRINSICALLY SAFE CIRCUITS MUST BE SEPARATED FROM NON-INTRINSICALLY SAFE CIRCUITS.

6.6 THIS IS THE RECOMMENDED QUANTITY OF ELECTROLYTE FOR SOLAR SUPPLIED CONTROL BATTERIES. THIS ELECTROLYTE IS SUPPLIED BY SOLAR.

Table with 2 columns: NI-CAD BATTERY SYSTEM, ELECTROLYTE QUANTITY. Row 1: 214 AH, 35 LBS (15.8 KG)

NI-CAD BATTERY SYSTEM UTILIZES POTASSIUM HYDROXIDE (KOH). DRY FLAKE, MERCURY CELL GRADE TYPE E-26 PER NIFE STANDARD J11.85002 OR EQUIVALENT. 0.33 GAL (1.25 LITERS) DISTILLED OR DE-IONIZED WATER IS REQUIRED FOR EACH POUND OF 'KOH' FOR SP. GR. 1.20. LIQUID REQUIREMENT IS 14 GALLONS (53 LITERS).

DRY SEAL SYSTEMS

7.0 NOTE NOT USED.

7.1 NOTE NOT USED.

7.2 NOTE NOT USED.

7.3 NOTE NOT USED.

7.4 PROCESS TAPS FOR COMPRESSOR SUCTION AND DISCHARGE PRESSURE TO BE 5 PIPE DIAMETER ±1 FOOT UP AND DOWN STREAM OF COMPRESSOR AND INSIDE OF STRAINERS, CHECK VALVES, ETC.. TUBING RUNS SHALL HAVE NO LIQUID TRAPS OR LOW SPOTS AND SHALL SLOPE UPWARDS AT LEAST 1 IN/FT FROM THE PROCESS CONNECTION TO THE TRANSMITTER. TUBING WALL THICKNESS TO PROVIDE A MINIMUM 6:1 SAFETY FACTOR OVER MAXIMUM SUCTION AND DISCHARGE PRESSURES.

ENCLOSURE NOTES

8.0 TURBINE COMPARTMENT VENTILATION COOLING AIR FLOW IS APPROXIMATELY 26,000 SCFM (696.8 NM<sup>3</sup>/MIN). IF ADDITIONAL DUCTING IS ADDED AND THE PRESSURE DROP INCREASES BY MORE THAN 1/2" [12.7] H<sub>2</sub>O, THE VENT FAN CAPACITY MUST BE INCREASED. TURBINE COMPARTMENT HEAT REJECTION IS APPROXIMATELY 570,000 BTU/HR (601,350 KJ/HR).

TO ENSURE PROPER VENTILATION AIR FLOW, SEAL ALL UNUSED HOLES, INSULATE ALL EXPOSED EXHAUST DUCTING, AND SEAL THE PACKAGE FRAME TO THE FOUNDATION.

TO PREVENT EXTINGUISHANT LEAKAGE ENSURE THE FOLLOWING:

- THE AREA BETWEEN THE SKID AND THE FOUNDATION MUST BE SEALED IF THE DRIP PAN IS PENETRATED.
- SKID BASE IS SEALED AFTER CONDUIT/PLUMBING INSTALLATION IS COMPLETE. ALL UNUSED AND/OR OVERSIZED HOLES MUST BE SEALED.
- INSPECT THE UNIT FROM WITHIN FOR DAYLIGHT. SEAL ANY OPEN AREAS.

8.1 ENCLOSURE IS EQUIPPED WITH A FIRE DETECTION/SUPPRESSION SYSTEM CONSISTING OF U.V. FLAME DETECTORS AND RATE COMPENSATED HEAT DETECTORS. THE EXTINGUISHANT DISCHARGE PRESSURE ACTIVATES PNEUMATICALLY RELEASED FIRE DAMPERS ON ALL VENT OPENINGS.

FIRE EXTINGUISHANT CYLINDERS SHIP LOOSE FOR FIELD INSTALLATION BY OTHERS. CYLINDERS MUST BE LOCATED WITHIN 25 EQUIVALENT PIPE FEET (7620) OF THE ENCLOSURE CONNECTION.

ALL INTERCONNECT PIPING FOR THE PRIMARY SYSTEM TO BE 3/4" SCHEDULE 40. ALL INTERCONNECT PIPING FOR EXTENDED SYSTEM TO BE 1/2" SCHEDULE 40. ASTM-A-53 OR ASTM-A-106. PIPE RUNS SHOULD BE ROUTED TO MINIMIZE PIPE LOSS. REMOVE DISCHARGE NOZZLES AND BLOW OUT ALL PIPING AFTER INTERCONNECT PIPING IS COMPLETE.

TO PREVENT EXTINGUISHANT LEAKAGE ENSURE THE FOLLOWING:

- THE AREA BETWEEN THE SKID AND THE FOUNDATION MUST BE SEALED IF THE DRIP PAN IS PENETRATED.
- SKID BASE IS SEALED AFTER CONDUIT/PLUMBING INSTALLATION IS COMPLETE. ALL UNUSED AND/OR OVERSIZED HOLES MUST BE SEALED.
- INSPECT THE UNIT FROM WITHIN FOR DAYLIGHT. SEAL ANY OPEN AREAS.

EXTINGUISHANT SHOULD BE LOCATED IN AN ENVIRONMENT PROTECTED FROM THE WEATHER AND WHERE THE AMBIENT TEMPERATURE DOES NOT EXCEED +130°F (54°C) NOR FALL BELOW 0°F (-18°C).

NOTE: CYLINDERS MUST BE PROTECTED FROM DIRECT SUNLIGHT.

8.2 ANCILLARY EQUIPMENT AND ENCLOSED PACKAGE SHIP SEPARATELY. THESE INTERCONNECTIONS ARE TO BE MADE DURING FIELD ERECTION. THIS INTERCONNECTING PIPING AND HARDWARE IS SUPPLIED BY SOLAR.

8.3 THE ENCLOSURE IS EQUIPPED WITH (4) 4-TON (3,632 KG) HOISTS AND TWO MOVABLE TROLLEY BEAMS WITH EXTENSIONS FOR ENGINE REMOVAL, PLUS ONE AUXILIARY 2-TON (1,816 KG) HOIST AND MOVABLE TROLLEY BEAM WITH EXTENSION FOR COMPONENT REMOVAL.

8.4 NOTE NOT USED.

8.5 ENCLOSURE IS EQUIPPED WITH E.P. AC INCANDESCENT LIGHTS AND LIGHT SWITCHES.

8.6 ENCLOSURE IS EQUIPPED WITH STANDBY DC EXPLOSION PROOF INCANDESCENT LIGHT FIXTURES.

8.7 ENCLOSURE IS EQUIPPED WITH A GAS DETECTION SYSTEM WHICH PROVIDES HIGH GAS LEVEL ALARM AND HIGH GAS LEVEL SHUTDOWN.

8.8 ENCLOSURE IS EQUIPPED WITH A HIGH TEMPERATURE ALARM.

8.9 ENCLOSURE IS CONSTRUCTED OF 14 GAGE STEEL SIDE PANELS AND 12 GAGE STEEL ROOF PANELS WITH 2" [51] FIBERGLASS INSULATION AND PERFORATED STEEL LINER. ALL SIDE AND ROOF PANELS ARE REMOVABLE FOR EQUIPMENT ACCESS. THE ROOF STRUCTURE OVER THE TURBINE IS REMOVABLE.

LUBE SYSTEMS

5.0 OIL IN THIS PACKAGE MUST BE IN ACCORDANCE WITH SOLAR SPECIFICATION 9-224 C32 (S150).

THE PACKAGE OIL TANK IS DEFINED AS FOLLOWS: MAXIMUM OPERATING LEVEL (HIGH LEVEL ALARM) CAPACITY = 1,809 GALLONS (6,847 LITERS). MINIMUM OPERATING LEVEL (LOW LEVEL ALARM) CAPACITY = 1,575 GALLONS (5,961 LITERS). CAPACITY AT LOW LEVEL SHUTDOWN = 1239 GALLONS (4,689 LITERS). THE HIGHEST LEVEL THAT OIL IN THE RESERVOIR MAY REACH WHEN THE ENTIRE SYSTEM IS SHUT DOWN (RUNDOWN LEVEL) = 2,200 GALLONS (8,327 LITERS). THE VOLUME OF RUNBACK FROM ON-SKID EQUIPMENT (PIPING AND FILTERS) = 120 GALLONS (454 LITERS). THE RESULTING MAXIMUM ALLOWABLE RUNBACK FROM OFF-SKID EQUIPMENT AFTER SYSTEM SHUTDOWN IS 2,200-1,809-120 = 271 GALLONS (1,025 LITERS).

5.1 THE LUBE OIL SHALL HAVE A POUR POINT WHICH IS AT LEAST 11°F (6°C) BELOW THE MINIMUM AMBIENT TEMPERATURE TO INSURE FLOW IN EXPOSED LINES AND VESSELS. THE MAXIMUM OIL VISCOSITY IN THE LUBE OIL TANK FOR STARTUP IS 375 SSU (80 CENTISTOKES). CONTROL SYSTEM INHIBITS PACKAGE FROM STARTING UNLESS LUBE OIL TEMPERATURE REACHES AT LEAST 68°F (20°C) (32C/S150). REFERENCE SOLAR SPECIFICATION ES 9-224.

A 5.2 C THE PACKAGE AIR/OIL COOLER IS NOT INTEGRAL WITH THE PACKAGE AND MUST BE LOCATED AND INSTALLED SEPARATELY. THE FOLLOWING INSTALLATION REQUIREMENTS APPLY:

- 1. THE TOP OF THE COOLER SHALL NOT BE MORE THAN 50' [15240] ABOVE THE BOTTOM OF THE PACKAGE FRAME. REFERENCE PLANE [C-C].
2. THE TOTAL OIL VOLUME OF THE OFFSKID COOLER AND PIPING SHALL BE LIMITED TO 271 GALLONS (1025 LITERS). THIS IS TO PREVENT OIL TANK OVERFLOW DURING DRAIN BACK.
3. MAXIMUM DESIGN OIL SIDE PRESSURE DROP FOR THE ENTIRE OFFSKID PIPING LOOP IS 40 PSID (276 KPAD) AT 20 CENTISTOKES (98 SSU). MAXIMUM OPERATING PRESSURE IS 150 PSIG (1034 KPAG). MAXIMUM OIL COOLER PRESSURE DROP AT OPERATING FLOW IS 17.7 PSID (122 KPAD).
B. THE OIL COOLER IS DESIGNED FOR USE IN AMBIENT TEMPERATURES UP TO 107°F (41.67°C) AND THE COOLING AIR FLOW IS 72,570 SCFM (1945 NM<sup>3</sup>/MIN). NO BACK PRESSURE IS ALLOWED AT THE COOLER FACE. NORMAL COOLING AIR TEMPERATURE RISE ACROSS COOLER IS 23.5 °F (13.05 °C) MAXIMUM. HEAT REJECTION IS 1,500,000 BTU/HR (1582500 KJ/HR) FOR THE TOTAL SYSTEM.
C. PREVAILING WINDS MUST BE CONSIDERED TO PREVENT THE LUBE OIL COOLER FROM EXHAUSTING INTO THE ENGINE AIR INLET SYSTEM OR FROM TAKING AIR IN FROM THE ENGINE EXHAUST SYSTEM. NO AIR FLOW BACK PRESSURE IS ALLOWED AT THE LUBE OIL COOLER FACE.
D. CHECK VALVES ARE NOT RECOMMENDED IN THE OIL COOLER LOOP.

Solar Turbines A Caterpillar Company

DRAWING NO. 52121-149746 REV C SHEET 2

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**ENGINE CLEANING**

9.0 TURBINE CLEANING SUPPLY CONNECTIONS (21) AND (22) MUST BE CAPPED, OR PLUGGED WHEN NOT IN USE TO AVOID THE ENTRANCE OF DIRT, AND DEBRIS. USE CONNECTION (2) FOR ON-CRANK CLEANING ONLY, AND (21) FOR ON-LINE CLEANING ONLY. FOR ON-CRANK AND ON-LINE CLEANING THE WATER/SOLVENT SOLUTIONS SUPPLY IS TO BE REGULATED BETWEEN 80 PSIG AND 100 PSIG (551.6 KPAG AND 689.5 KPAG) AT THE PACKAGE CONNECTION. WASH FLOW RATES AND TREATMENT QUANTITIES PER WASH CYCLE ARE SHOWN IN THE TABLE BELOW.

ON-CRANK FLOW	ON-LINE FLOW	TREATMENT QUANTITY
4 GPM / (15.1 LPM)	2.3 GPM / (8.7 LPM)	16 GALLONS / (60.5 LITERS)

REFER TO SOLAR ES 9-62 AND THE OPERATION AND MAINTENANCE MANUAL FOR ADDITIONAL ENGINE CLEANING REQUIREMENTS AND PROCEDURES.

9.1 WHEN AMBIENT TEMPERATURES FALL BELOW 50°F (10°C), CONSULT SOLAR ES 9-62 AND THE OPERATION AND MAINTENANCE MANUAL FOR PROPER COLD WEATHER OPERATING PROCEDURES.

9.2 NOTE NOT USED.

9.3 THE SOLAR SUPPLIED WASH CART REQUIRES A CLEAN DRY SUPPLY OF SHOP AIR AT 80 PSIG TO 100 PSIG (551.6 KPAG TO 689.5 KPAG) WITH A FLOW RATE OF:

ON-CRANK AIR FLOW	ON-LINE AIR FLOW
4.2 SCFM / (.11 NM <sup>3</sup> /MIN)	2.4 SCFM / (.06 NM <sup>3</sup> /MIN)

A COMPANION FLANGE INCORPORATING AN INTEGRAL QUICK DISCONNECT COUPLING IS PROVIDED WITH THE WASH CART FOR INSTALLATION AT SITE.

9.4 THE ENGINE AIR INLET DUCT MUST BE FREE OF ACCUMULATED WATER AND SOLVENTS PRIOR TO STARTING THE ENGINE. INSURE THAT THE ENGINE AIR INLET DUCT AND DRAIN ARE COMPLETELY DRAINED AFTER CLEANING AND NOT TERMINATED IN A COMBUSTIBLE ENVIRONMENT. SEE NOTE 2.15, 10.2 AND TABLE 3.

**MISCELLANEOUS AND SAFETY NOTES**

10.0 CAUTION: ENGINE BLEED AIR TEMPERATURE RANGES FROM 660°F (349°C) TO 860°F (460°C). APPLICATION OF THERMAL LAGGING TO EXTERNAL PIPES, TUBES AND FITTINGS IS RECOMMENDED FOR PERSONNEL PROTECTION.

10.1 LOOSE SHIPPED WITH ATTACHING HARDWARE FOR FIELD INSTALLATION.

10.2 WARNING: FAILURE TO LIMIT BACK PRESSURE TO SPECIFIED VALUE CAN RESULT IN SYSTEM OR COMPONENT MALFUNCTION, AND CAN CAUSE PERSONAL INJURY AND/OR PROPERTY DAMAGE. THE USE OF BLOCK VALVES IN THE EXHAUST VENT IS NOT RECOMMENDED. IF A VALVE IS ABSOLUTELY NECESSARY, ELECTRICAL INTERLOCKING MUST BE EMPLOYED TO INHIBIT STARTER OPERATION WITH A CLOSED VALVE. CARE MUST BE TAKEN TO PROPERLY VENT THE EXHAUST TO A SAFE LOCATION. REFER TO TABLE 3 FOR EMISSION QUANTITY AND DURATION.

TABLE 3 - PACKAGE VENT AND DRAIN EMISSION INFORMATION

EXTERNAL CONNECTIONS					
ITEM	DESCRIPTION	PORT SIZE	EMISSION SUBSTANCE	EMISSION QUANTITY	EMISSION DURATION
3	LUBE OIL TANK VENT	8" 150 LB	AIR/OIL	(SEE NOTE 5.3) (SEE NOTE BELOW)	CONTINUOUS
7	LUBE OIL COOLER VENT	1" 150 LB	N/A	SEALED SYSTEM	N/A
19	ENGINE EXHAUST COLLECTOR AND COMBUSTOR DRAIN	1" 150 LB	AIR/WATER/OIL	VARIABLE (SEE NOTE 2.15) (SEE NOTE 9.0)	RANDOM
22	ENGINE AIR INLET DUCT DRAIN	1" 150 LB	WATER	VARIABLE (SEE NOTE 3.0) (SEE NOTE 9.2)	RANDOM
26	LUBE OIL TANK DRAIN	2" NPT	OIL	(SEE NOTE 5.0)	MAINTENANCE
30	PILOT VALVES AIR/GAS VENT	1" 150 LB	GAS	2 SCF INCIDENT (SEE NOTE 4.2)	1/START/STOP
54	LUBE OIL FILTER DRAIN	1" 150 LB	OIL	—————	MAINTENANCE
61	PNEUMATIC POST/LUBE BACKUP VENT	2" 150 LB	GAS	160 SCFM	4 HOURS MAXIMUM
64	LOW POINT DRAIN FROM LUBE OIL HEADER	1" 150 LB	OIL	—————	MAINTENANCE
126	OIL DRAIN FROM DRIP PAN	2" NPT	OIL/WATER	—————	MAINTENANCE
203	FLAME ARRESTOR/LUBE OIL TANK VENT	8" 125 LB	AIR/OIL	(SEE NOTE 5.3) (SEE NOTE BELOW)	CONTINUOUS
289	LUBE OIL MIST SEPARATOR OUTLET	8" 150 LB	AIR/OIL	(SEE NOTE 5.7)	CONTINUOUS

NOTE: 0.2 MG/ACF (100% OF ALL PARTICALS GREATER THAN 3 MICRONS AND 99% OF ALL PARTICLES 3 MICRONS AND SMALLER).

**TURBINE EXHAUST SYSTEM**

11.0 NOTE NOT USED.

11.1 WHEN ASSEMBLING OR DISASSEMBLING THE SYSTEM, USE THE LIFTING LUGS PROVIDED TO HANDLE EACH COMPONENT INDIVIDUALLY. EMPLOY INDUSTRY ACCEPTED LIFTING TECHNIQUES WHEN LIFTING LUGS ARE NOT PROVIDED. (REFER TO COMPONENT WEIGHTS AND ASSUME A GEOMETRIC CENTER OF GRAVITY FOR THE SMALLER, LIGHTER COMPONENTS.)

11.2 NOTE NOT USED.

11.3 NOTE NOT USED.

11.4 ATTACHING HARDWARE KITS - INCLUDING NUTS, BOLTS, WASHERS, GASKETS, AND ANTI-SEIZE COMPOUND ARE INCLUDED FOR ALL MATING FLANGED CONNECTIONS, AND SUPPORT STRUCTURE FOOTPADS.

11.5 THE STATIC PRESSURE DROP ACROSS THE ENTIRE EXHAUST SYSTEM IS 2.5" H<sub>2</sub>O GAUGE.

**TURBINE AIR INLET SYSTEM**

12.0 WHEN SHOWN, A MINIMUM CLEARANCE OR CLEAR AREA IS REQUIRED TO SERVICE THE FILTER ELEMENTS AND TO ENSURE UNRESTRICTED AIR FLOW. DO NOT BLOCK DOOR SWINGS OR ACCESS AREAS.

12.1 ASSUMING THE OPERATING CONDITIONS OF NOTE 2.12 (TURBINE FLOW RATE), THE PRESSURE DROP ACROSS THE ENTIRE INLET SYSTEM (WITH CLEAN FILTER ELEMENTS) IS 3.0" H<sub>2</sub>O GAUGE.

12.2 FOR DETAILED INFORMATION ON THE AIR CLEANER, REFER TO THE VENDOR SUPPLIED INSTALLATION, OPERATION, AND MAINTENANCE MANUAL INCLUDED IN THE "SOLAR PROJECT DOCUMENTATION".

12.3 ALL COMPONENTS ARE SHIPPED WITH ATTACHING AND ASSEMBLY HARDWARE. PRIOR TO ASSEMBLY, USE 1/4" (6MM) THICK BEAD OF CAULKING ON FLANGE FACES TO ENSURE SEAL. USE CAULKING ALSO WHEN ASSEMBLING DUCT SECTIONS. INSPECT ALL JOINTS AND CONNECTIONS. RECAULK AS REQUIRED TO ENSURE AN AIR AND WATER TIGHT SEAL.

12.4 WHEN ASSEMBLING OR DISASSEMBLING THE SYSTEM, USE THE LIFTING LUGS PROVIDED TO HANDLE EACH COMPONENT INDIVIDUALLY. EMPLOY INDUSTRY ACCEPTED LIFTING TECHNIQUES WHEN LIFTING LUGS ARE NOT PROVIDED. (REFER TO COMPONENT WEIGHTS AND ASSUME A GEOMETRIC CENTER OF GRAVITY FOR THE SMALLER, SITE-ASSEMBLED COMPONENTS.)

12.5 NOTE NOT USED.

12.6 AIR CLEANER TECHNICAL DATA  
 A. HIGH ΔP ALARM SWITCH SET AT 3" (76) W.G.  
 B. HIGH ΔP SHUTDOWN SWITCH SET AT 6" (152) W.G.  
 C. AIR SUPPLY (PNEUMATIC) REQUIREMENTS:  
 MAXIMUM AIR FLOW PLUSED AT 30 SEC INTERVALS  
 (INTERMITTENT) 8 FT<sup>3</sup>/MIN (.25/M<sup>3</sup>/MIN) AT 80-100 LB/IN<sup>2</sup>  
 (554-692 kPa). AIR MUST BE DRY TO PREVENT CONDENSATION OR FREEZING LINES OR COMPONENTS.  
 D. INITIAL CLEAN ΔP: 0.45" (11) W.G.  
 START CLEANING: 2.25" (57) W.G.  
 STOP CLEANING: 1.75" (44) W.G.

12.7 THE SOLAR SUPPLIED AIR TREATMENT KIT ITEM 106, IS LOOSE SHIPPED FOR INSTALLATION BY OTHERS. PLUMBING FROM THE TURBINE SKID EDGE CONNECTION (50) TO THE HEAT EXCHANGER INLET (282), FROM THE HEAT EXCHANGER OUTLET (283) TO THE AIR TREATMENT INLET (652), AND FROM THE AIR TREATMENT OUTLET (653) TO THE AIR CLEANER CONNECTION (230), IS SUPPLIED AND INSTALLED BY OTHERS. THE AIR TREATMENT KIT SHOULD BE LOCATED IN AN AREA ACCESSIBLE TO AUTHORIZED MAINTENANCE PERSONNEL. SUGGESTED LOCATIONS ARE ON AIR FILTER SUPPORT LEG, OR ON THE FILTER HOUSE ADJACENT TO CONNECTION 230.

TABLE 1 - EXTERNAL CONNECTIONS

ITEM	DESCRIPTION	REFERENCE NOTE	ZONE
(1)	TURBINE AIR INLET FLANGE SEE DETAIL P	2.10, 2.11	F/34
(2)	TURBINE EXHAUST FLANGE SEE DETAIL J	2.10, 2.11, 2.14	F/35
(3)	LUBE OIL TANK VENT 8" 150 LB ANSI RF FLANGE	5.3, 10.2	F/33
(7)	LUBE OIL COOLER VENT 1" 150 LB ANSI RF FLANGE	10.2	E/45
(8)	LUBE OIL SUPPLY TO DRIVEN EQUIPMENT 2" 150 LB ANSI RF FLANGE		E/46
(9)	LUBE OIL RETURN FROM DRIVEN EQUIPMENT 6" SCHED 40 PIPE TO LUBE OIL DRAIN		D/46
(19)	ENGINE EXHAUST COLLECTOR AND COMBUSTOR DRAIN 1" 150 LB ANSI RF FLANGE	2.15, 10.2	F/54
(20)	NATURAL GAS FUEL INLET 3" 300 LB ANSI RF FLANGE	4.0, 4.2, 4.3	F/55
(22)	ENGINE AIR INLET DUCT DRAIN 1" 150 LB ANSI RF FLANGE	3.0, 10.2	F/56
(26)	LUBE OIL TANK DRAIN 2" NPT FEMALE	10.2	F/54
(30)	PILOT VALVES, AIR/GAS VENT 1" 150 LB ANSI RF FLANGE	4.2, 10.2	F/55
(33)	LUBE OIL TO COOLER 4" 150 LB ANSI RF FLANGE	5.2	E/43
(34)	LUBE OIL FROM COOLER 4" 150 LB ANSI RF FLANGE	5.2	E/44
(50)	COMPRESSOR AIR FOR SELF CLEANING FILTERS 1" 300 LB ANSI RF FLANGE	10.0	E/55
(54)	LUBE OIL FILTER DRAIN 1" 150 LB ANSI RF FLANGE	10.2	E/42
(60)	PNEUMATIC POST LUBE BACKUP SUPPLY 1" 300 LB ANSI RF FLANGE	10.2	E/57
(61)	PNEUMATIC POST LUBE BACKUP VENT 2" 150 LB ANSI RF FLANGE	10.2	E/57
(64)	LOW POINT DRAIN FROM LUBE OIL HEADER 1" 150 LB ANSI RF FLANGE	10.2	E/43
(75)	INLET FROM LUBE OIL CONDITIONING 1" 150 LB ANSI RF FLANGE		F/53
(76)	OUTLET FROM LUBE OIL CONDITIONING TO TANK 1" 150 LB ANSI RF FLANGE		F/53
(97)	ENCLOSURE FIRE EXT. MEDIUM INLET (MAIN) 1" 600 LB ANSI RF FLANGE	8.1	E/44
(98)	ENCLOSURE FIRE EXT. MEDIUM INLET (EXTENDED) 1" 600 LB ANSI RF FLANGE	8.1	E/44
(121)	ON LINE CLEANING FLUID INLET 1" 150 LB ANSI RF FLANGE	9.0	F/55
(122)	ON CRANK CLEANING FLUID INLET 1" 150 LB ANSI RF FLANGE	9.0, 9.1, 9.2	F/56
(126)	OIL DRAIN FROM DRIP PAN 2" NPT FEMALE	10.2	E/44
(164)	LUBE OIL HEADER LOW POINT DRAIN 1" 150 LB ANSI RF FLANGE		E/42
(203)	FLAME ARRESTOR, LUBE OIL TANK VENT 8" 125 LB ANSI RF FLANGE	5.7, 10.2	F/83
(289)	LUBE OIL MIST SEPARATOR OUTLET 8" 150 LB ANSI RF FLANGE	5.3, 5.6, 10.2	B/88
(313)	AC VOLTS, LUBE OIL TANK HEATER MCT / 1" NPT CONDUIT FEMALE		E/42
(321)	DC VOLTS, DRIVER J-BOX I.S. MCT / 2" NPT FEMALE CONDUIT		F/57
(325)	AC VOLTS, SERVO PUMP MOTOR 1" NPT FEMALE CONDUIT	5.4	E/42
(329)	DC VOLTS, DRIVER J-BOX NON I.S. MCT / 3" NPT FEMALE CONDUIT		F/57
(331)	GROUND, PACKAGE FRAME 1/2-13 UNC-2B	6.2	D/42
(334)	GROUND, FRAME TO FRAME 1/2-13 UNC-2B		E/46
(357)	AC VOLTS, ENCLOSURE VENT FAN 1 1/4" NPT FEMALE CONDUIT	8.4	C/33
(358)	AC VOLTS, ENCLOSURE LIGHTING 1" NPT FEMALE CONDUIT	8.5	E/42
(379)	DC VOLTS, ENCLOSURE VENT FILTER PRESSURE SWITCH 1/2" NPT FEMALE CONDUIT		D/94B
(404)	AC VOLTS, STARTER MOTOR DIRECT DRIVE 3" NPT FEMALE CONDUIT		E/43
(405)	AC VOLTS, MAIN NO. 1 LUBE OIL PUMP MOTOR MCT / 1 1/2" NPT FEMALE CONDUIT		E/43
(406)	AC VOLTS, MAIN NO. 2 LUBE OIL PUMP MOTOR MCT / 1 1/2" NPT FEMALE CONDUIT		E/43
(507)	EXHAUST EMISSIONS TEST PORT 4" 150 LB ANSI R.F. FLANGE		D/36B
(644)	DRIVEN EQUIPMENT LUBE SYSTEM VENT TO TANK 2" 150 LB ANSI R.F. FLANGE		C/46
(652)	AIR TREATMENT INLET 1" NPTF		E/38B
(653)	AIR TREATMENT OUTLET 1" NPTF		E/38B

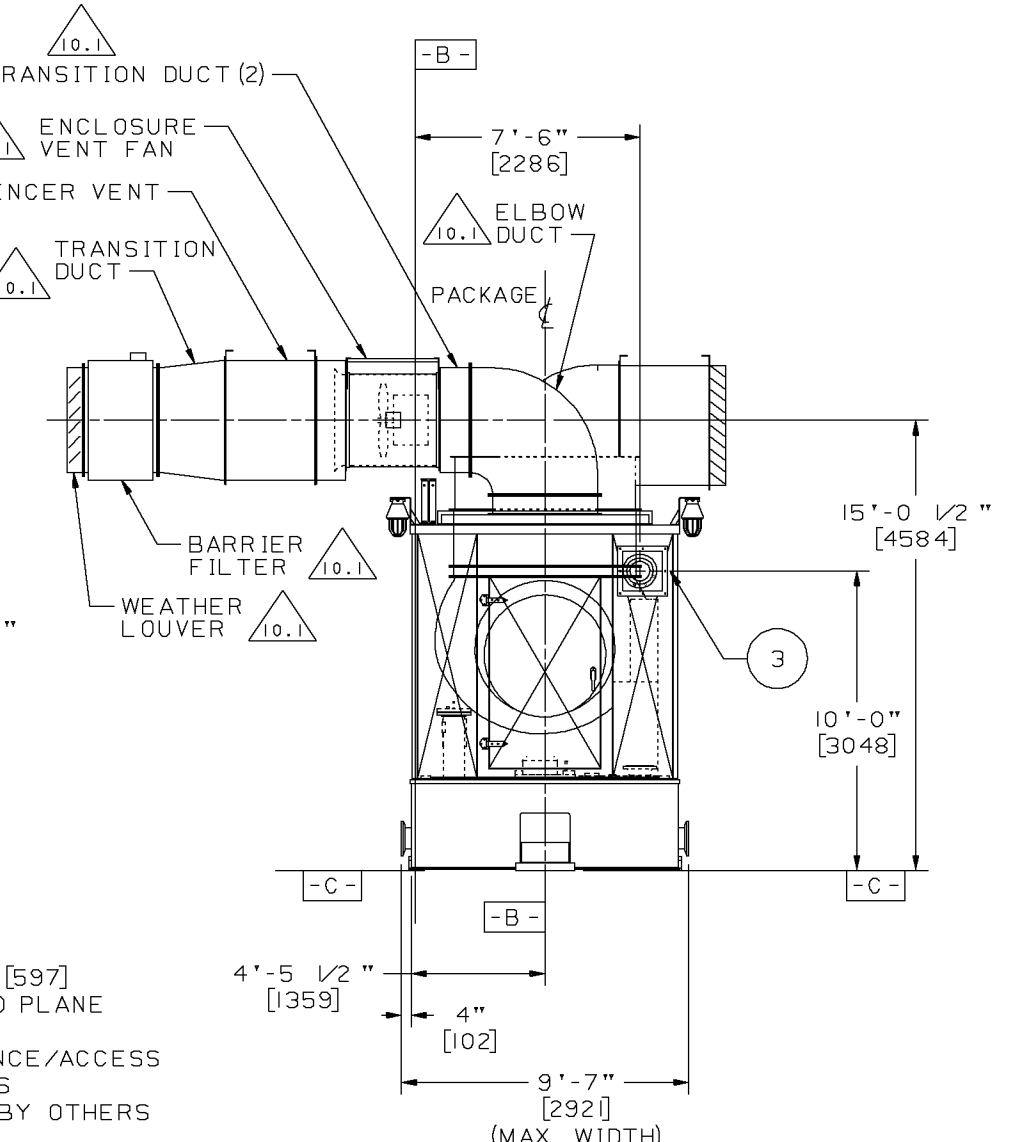
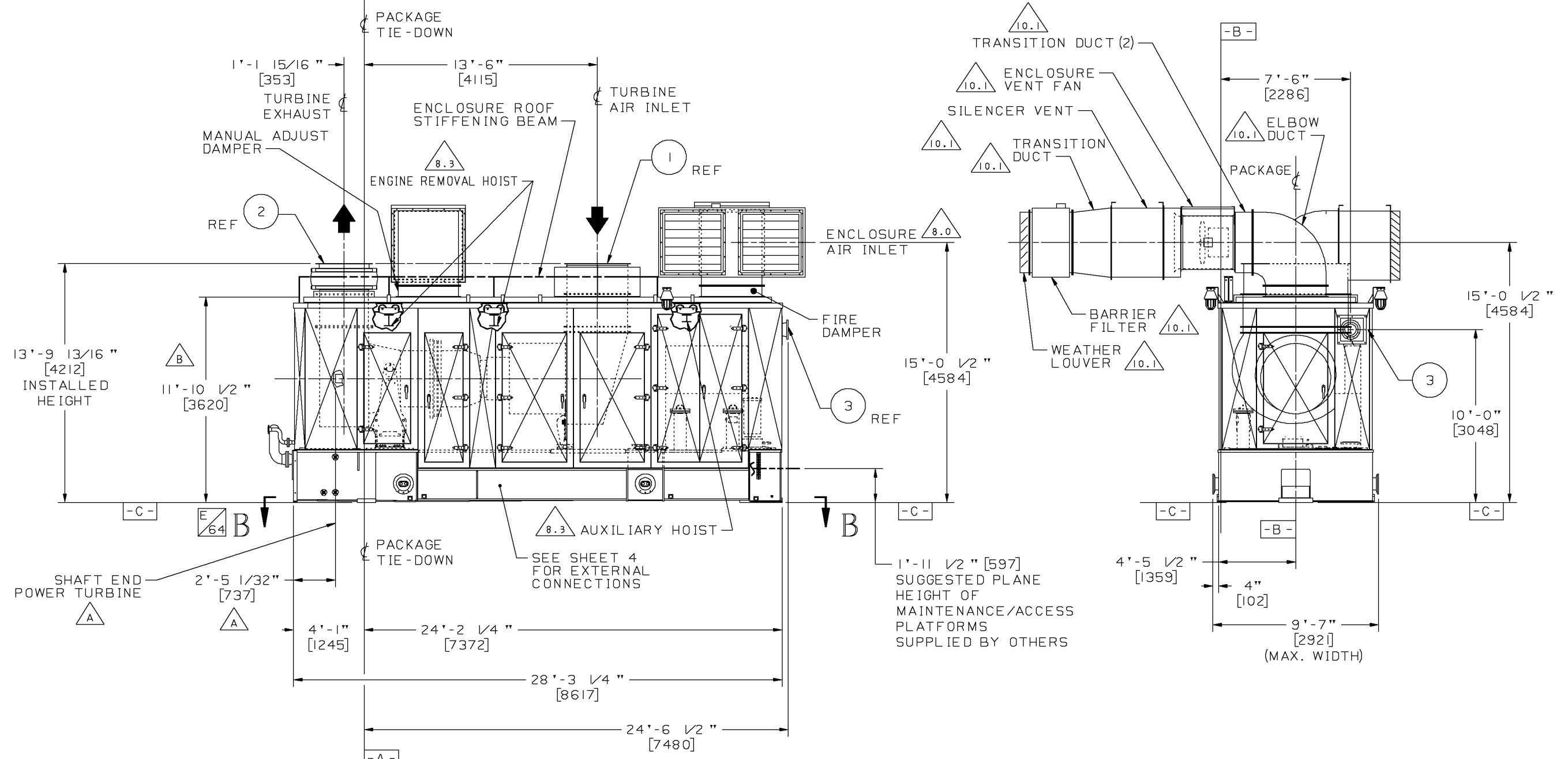
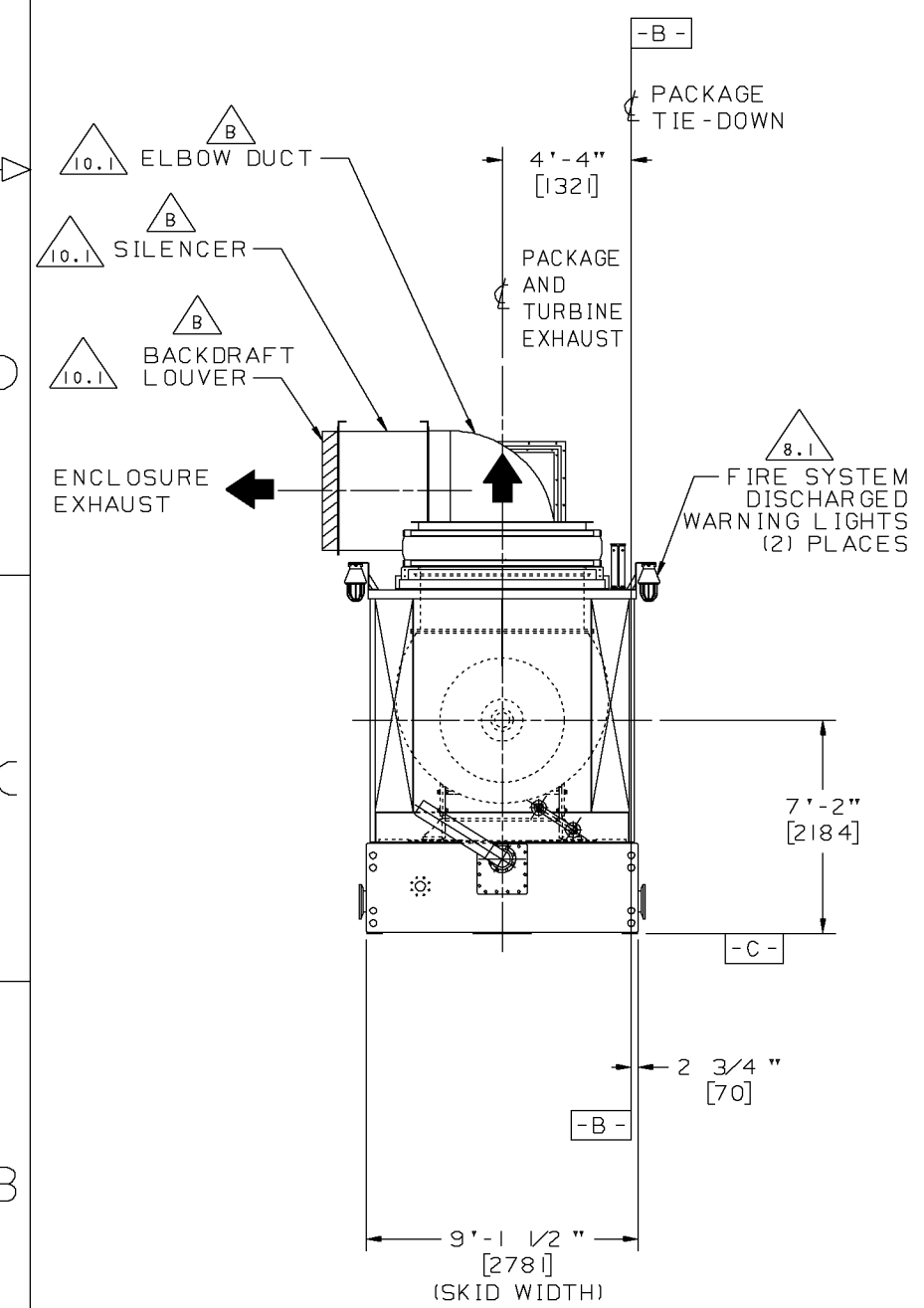
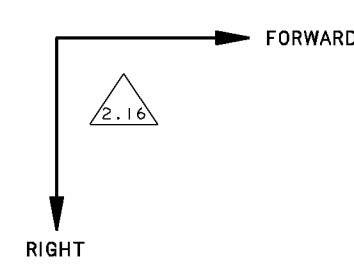
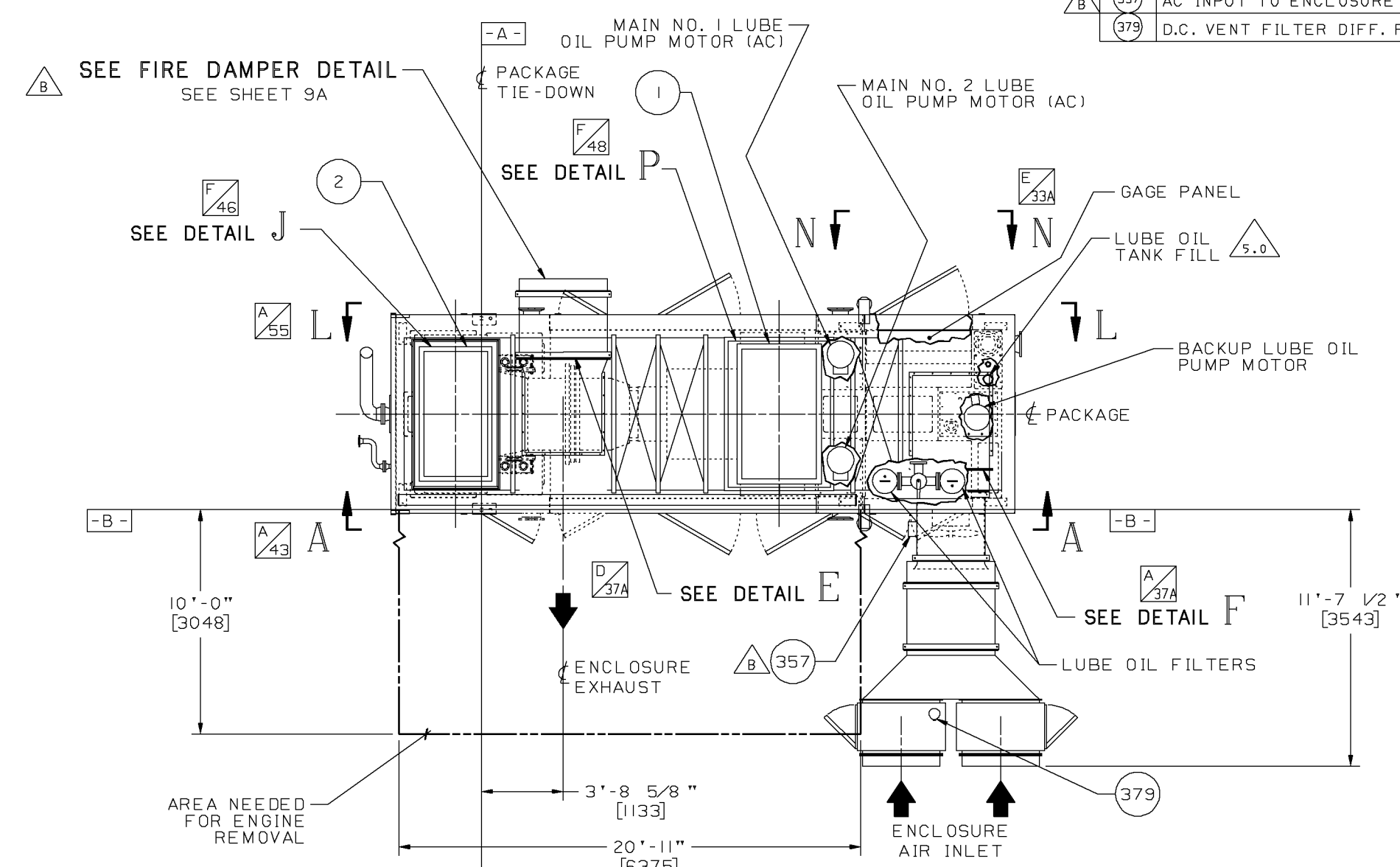
LOOSE SHIPPED ITEMS

DESCRIPTION	REFERENCE NOTE	MAXIMUM WEIGHT	MAXIMUM SHIPPING ENVELOPE	QTY REQD
AIR/OIL OIL COOLER	5.2	9,500 LBS (3863 KG)	120" X 120" X 192"	1
BATTERY RACK AND CHARGER ASSEMBLY - 24 VDC	6.4, 6.6	650 LBS (295 KG)	39" X 31" X 48"	1
FLAME ARRESTOR, LUBE OIL TANK VENT	5.7	185 LBS (84 KG)	26" X 17" X 17"	1
FLANGED STRAINER		40 LBS (18 KG)	9" X 7" X 10"	2
LUBE OIL TANK VENT OIL MIST ELIMINATOR	5.3, 5.6	2,680 LBS (1215 KG)	96" X 48" X 48"	1
FIRE CYLINDER CABINET (PRIMARY)	8.1	1,440 LBS (655 KG)	24" X 72" X 96"	1
FIRE CYLINDER CABINET (EXTENDED)	8.1	900 LBS (409 KG)	24" X 48" X 96"	1
WATER WASH CART	9.0, 9.1	360 LBS (163 KG)	48" X 38" X 36"	1
BATTERIES AND CHARGER (24 VDC)	6.4, 6.6	552 LBS (251 KG)	36" X 48" X 54"	1
ENCLOSURE VENT FAN		800 LBS (363 KG)	48" X 48" X 48"	1
ENCLOSURE VENT SILENCER		700 LBS (318 KG)	50" X 50" X 40"	1
ENCLOSURE VENT FILTER		200 LBS (91 KG)	48" X 56" X 36"	1
CONTROL CONSOLE (2 BAY)	6.2, 6.3	1,580 LBS (717 KG)	40" X 60" X 100"	1
VARIABLE FREQUENCY DRIVE	3.1	212 LBS (96 KG)	64" X 24" X 24"	1
AIR TREATMENT KIT		25 LBS (11 KG)	24" X 12" X 12"	1
FLOW METER FOR GAS FUEL		230 LBS (104 KG)	121" X 12" X 12"	1
INLET SILENCER		700 LBS (318 KG)	36" X 60" X 60"	1
SUPPORT STRUCTURE, AIR INLET		7,000 LBS (3175 KG)	24" X 24" X 192"	1
SUPPORT STRUCTURE, EXHAUST SYSTEM		9,200 LBS (4173 KG)	24" X 24" X 192"	1
LIFTING KIT		2,620 LBS (1188 KG)	18" X 42" X 144"	1
FIRE DAMPER		180 LBS (82 KG)	18" X 48" X 48"	1
FLEX BELLOWS, AIR INLET		160 LBS (73 KG)	18" X 78" X 42"	1
FLEX BELLOWS, EXHAUST		225 LBS (102 KG)	42" X 80" X 38"	1

38 37 36 35 34 33 32 31

TABLE 1 - EXTERNAL CONNECTIONS

ITEM	DESCRIPTION	REFERENCE NOTE	ZONE
1	TURBINE AIR INLET FLANGE	SEE DETAIL P ZONE D/48	2.10, 2.11
2	TURBINE EXHAUST FLANGE	SEE DETAIL J ZONE F/48	2.10, 2.11, 2.14
3	LUBE OIL TANK VENT	8" 150 LB ANSI RF FLANGE	5.3, 10.2
357	AC INPUT TO ENCLOSURE VENT FAN	1 1/4" NPT FEMALE	F/34
379	D.C. VENT FILTER DIFF. PRESSURE SWITCH	1/2" NPT FEMALE	G/33

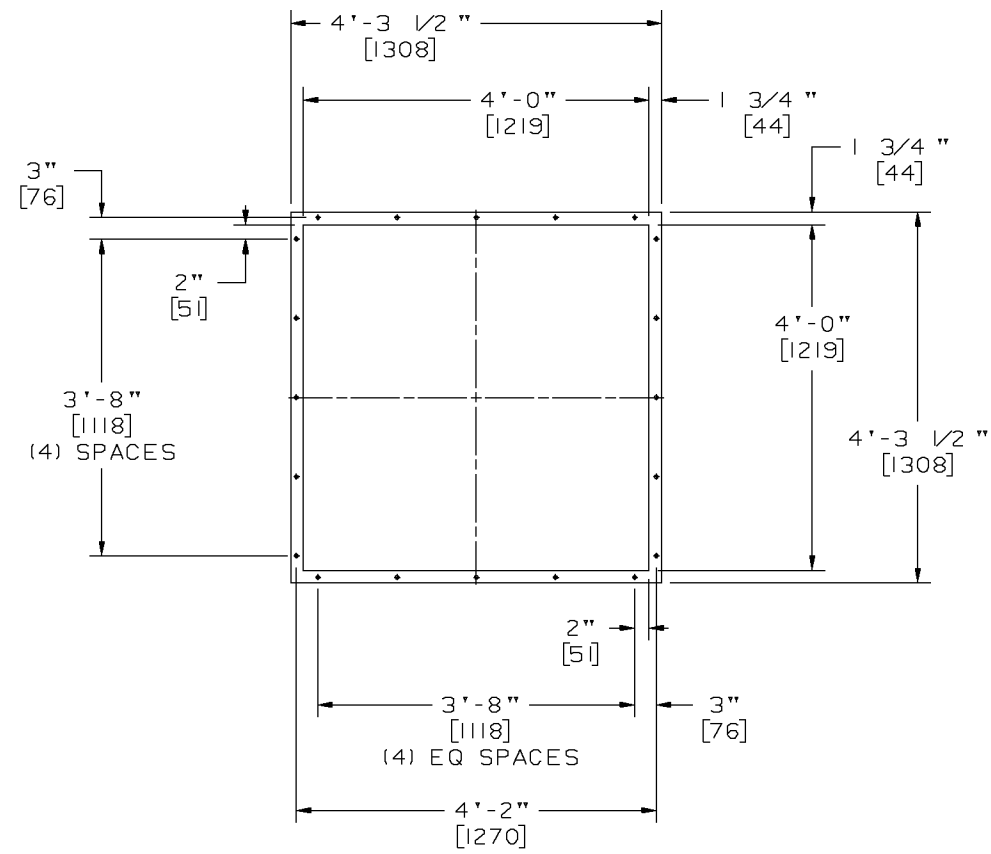


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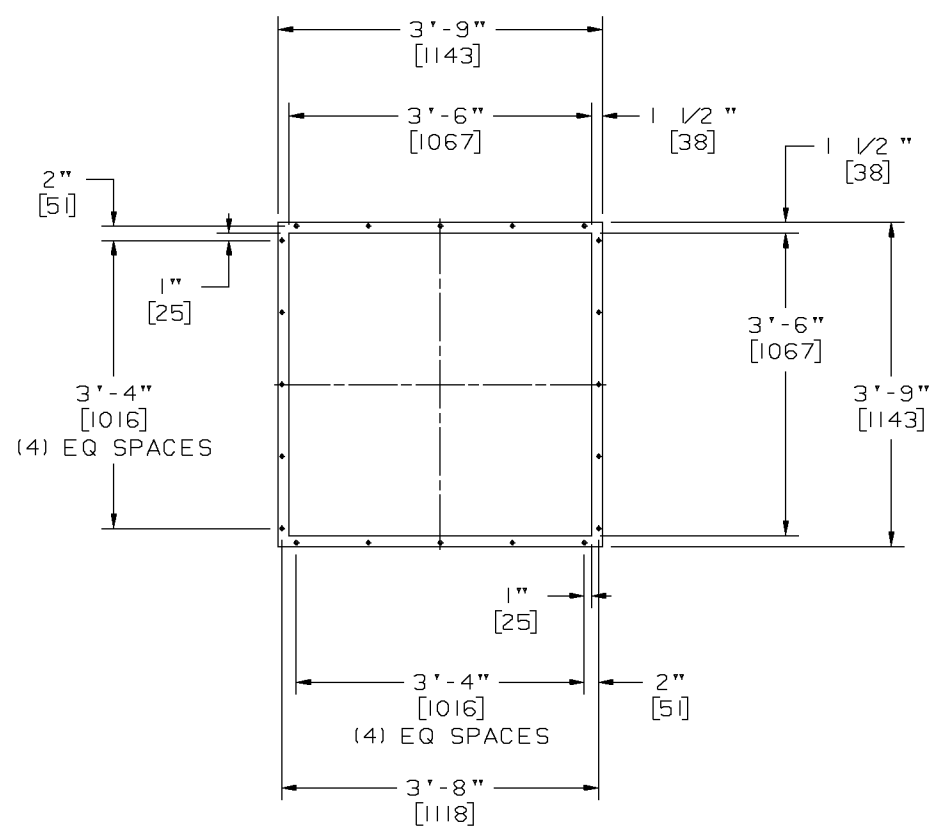
DRAWING NO. 52121-149746 REV B SHEET 3

TABLE 2 - INSTRUMENTATION

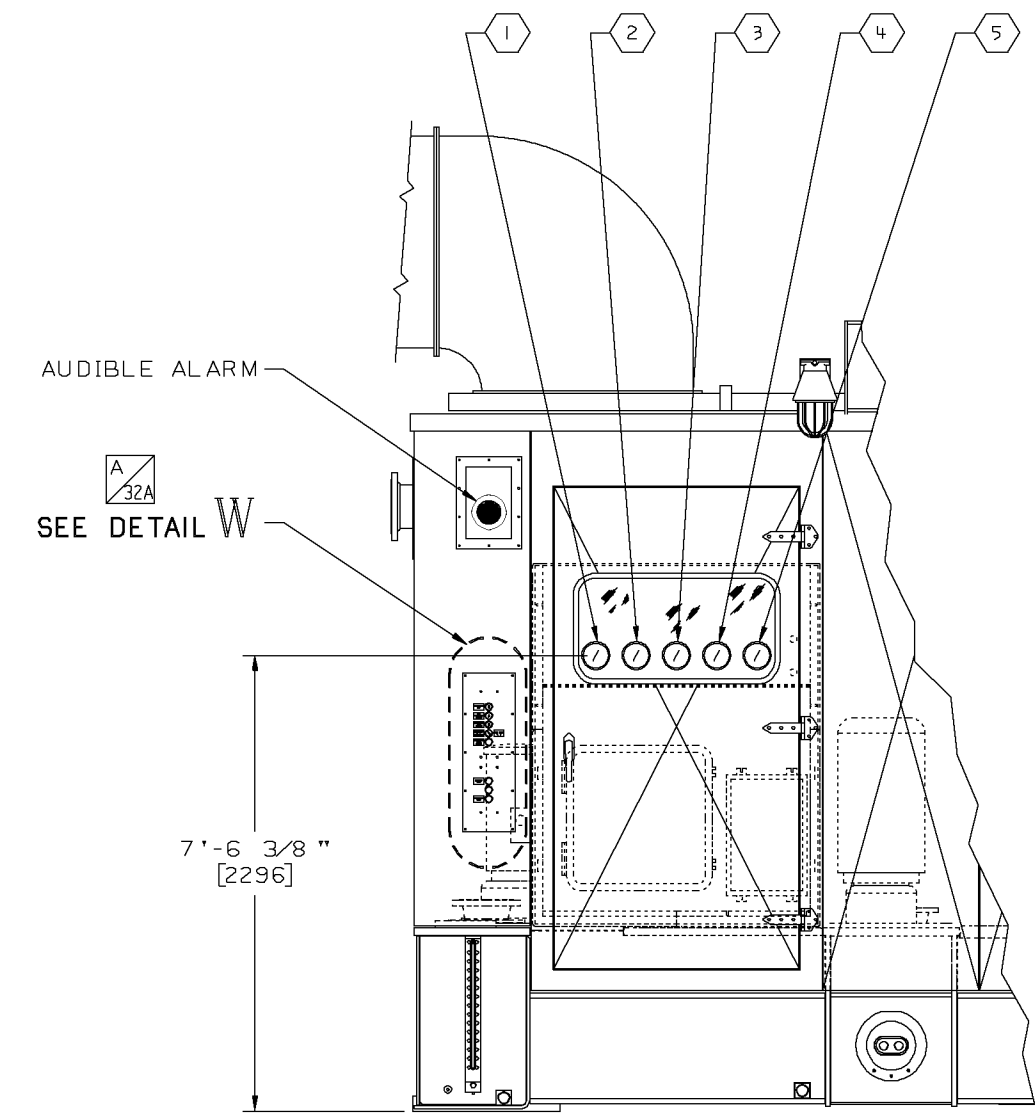
ITEM	DESCRIPTION	REFERENCE DESIGNATOR	ZONE
1	GAGE, GAS FUEL INLET PRESSURE	P1931	H/32B
2	GAGE, LUBE OIL PRESSURE	P1901-1	H/32B
3	GAGE, LUBE OIL FILTER ΔP	PD1902	H/32B
4	GAGE, ENGINE COMPRESSOR PCD	P1930	H/32B
5	GAGE, LUBE OIL TEMPERATURE	T1902	H/31B
8	SWITCH, EMERGENCY STOP	S312	C/31B
9	SWITCH, TEST CRANK	S393	C/31B
11	LIGHT, FIRE SYSTEM AUTO (GREEN)	DS331-1	D/31B
12	LIGHT, FIRE SYSTEM AUTO/INHIBIT (AMBER)	DS331-2	D/31B
13	LIGHT, EXTINGUISHANT RELEASE (RED)	DS331-3	D/31B
14	SWITCH, FIRE SYSTEM AUTO/INHIBIT	S331	D/31B
15	SWITCH, FIRE SYSTEM MANUAL RELEASE	S332	C/31B



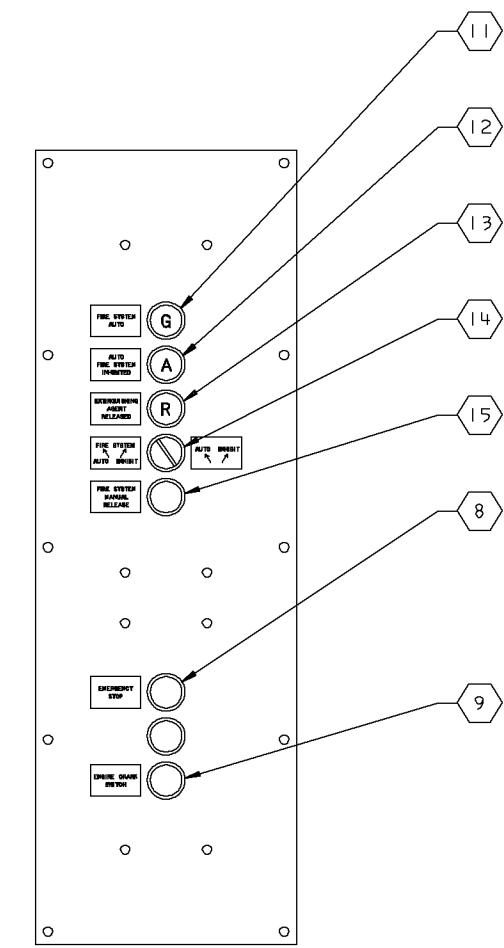
DETAIL E  
ENCLOSURE EXHAUST  
VENT FLANGE DETAIL  
(48" X 48")



DETAIL F  
ENCLOSURE AIR INLET  
VENT FLANGE DETAIL  
(42" X 42")



VIEW N



DETAIL W  
ENCLOSURE  
CONTROL PANEL

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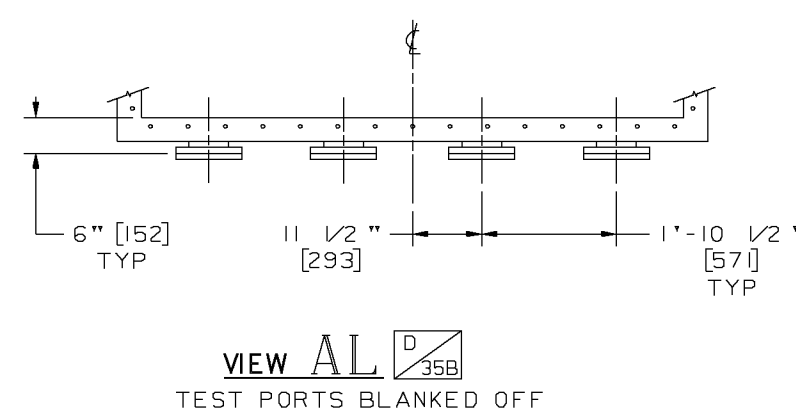
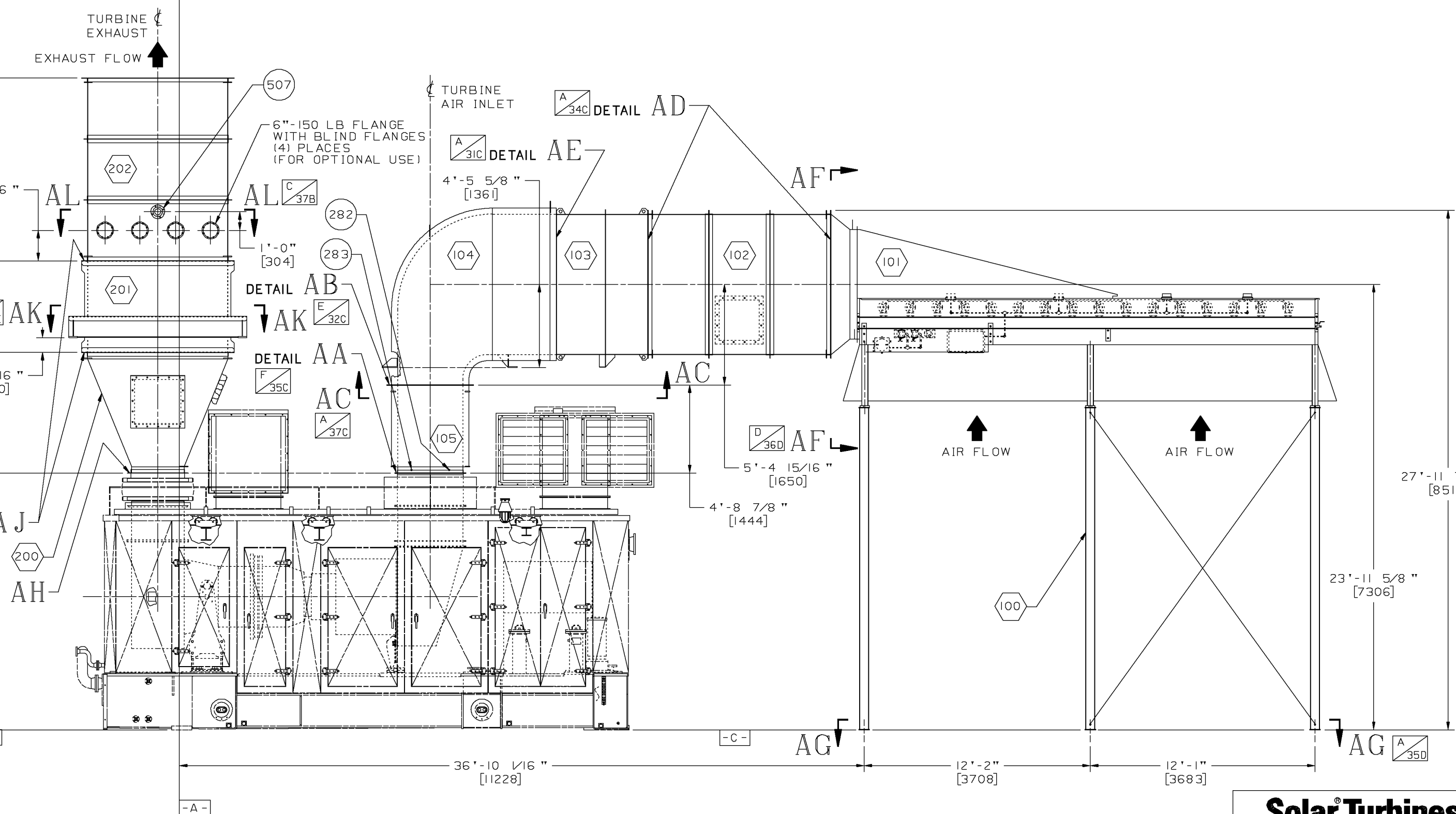
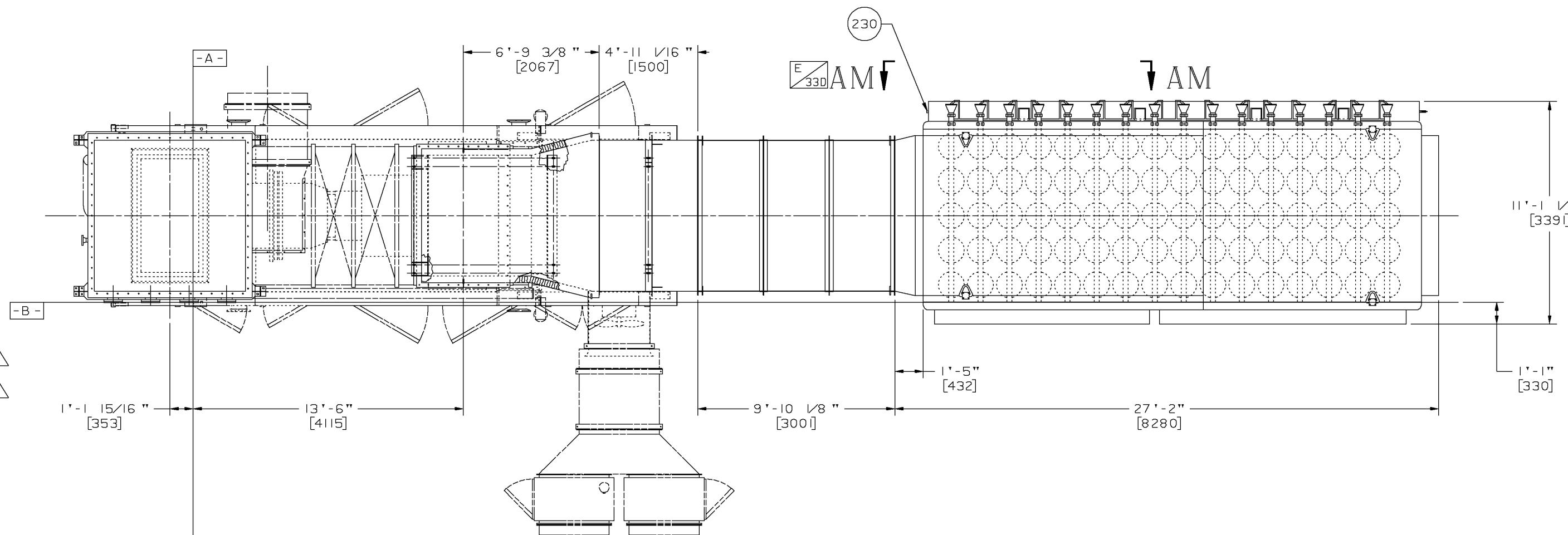
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38B 37B 36B 35B 34B 33B 32B 31B

INLET SYSTEM			EST. UNIT WEIGHT	
DESCRIPTION	NOTES	LBS	KGS	
100 LEG KIT, AIR CLEANER		2500	1136	
101 AIR CLEANER		10600	4818	
102 DUCT		2800	1273	
103 SILENCER		5000	2273	
104 TRANSITION ELBOW		5670	2577	
105 DUCT		1800	818	
106 AIR TREATMENT KIT		25	11	

EXHAUST SYSTEM			EST. UNIT WEIGHT	
DESCRIPTION	NOTES	LBS	KGS	
200 TRANSITION DUCT WITH THERMAL INSULATION		1750	795	
201 SILENCER, EXHAUST		7080	3211	
202 DUCT, EXHAUST		2275	1034	

EXTERNAL CONNECTIONS - TABLE I			
ITEM	DESCRIPTION	NOTES	ZONE
230	AIR SUPPLY, PNEUMATIC (ANCILLARY) (1" NPT)		G/33B
231	DRAIN, PLUGGED (ANCILLARY) (1" NPT)		G/31B
282	AIR COOLER INLET (ANCILLARY) (1" NPT)		H/35C
283	AIR COOLER OUTLET (ANCILLARY) (1" NPT)		H/34C
375	DC VOLTS, TURBINE AIR INLET FILTER DISCRETE 1-0 (3/4" NPT) (Δ SWITCHES, 24VDC)		E/33D
387	AC VOLTS, SELF CLEANING SOLENOID CONTROL (MARS) (3/4" NPT) (220/240 VAC, 50 HZ, 1Ø, 300W)		E/32D
507	EXH EMISSIONS TEST PORTS, (ANCILL.) (4" 150 LB ANSI RF FLANGE)		D/35B
652	AIR TREATMENT INLET (1" NPTF)		H/38C
653	AIR TREATMENT OUTLET (1" NPTF)		G/36C

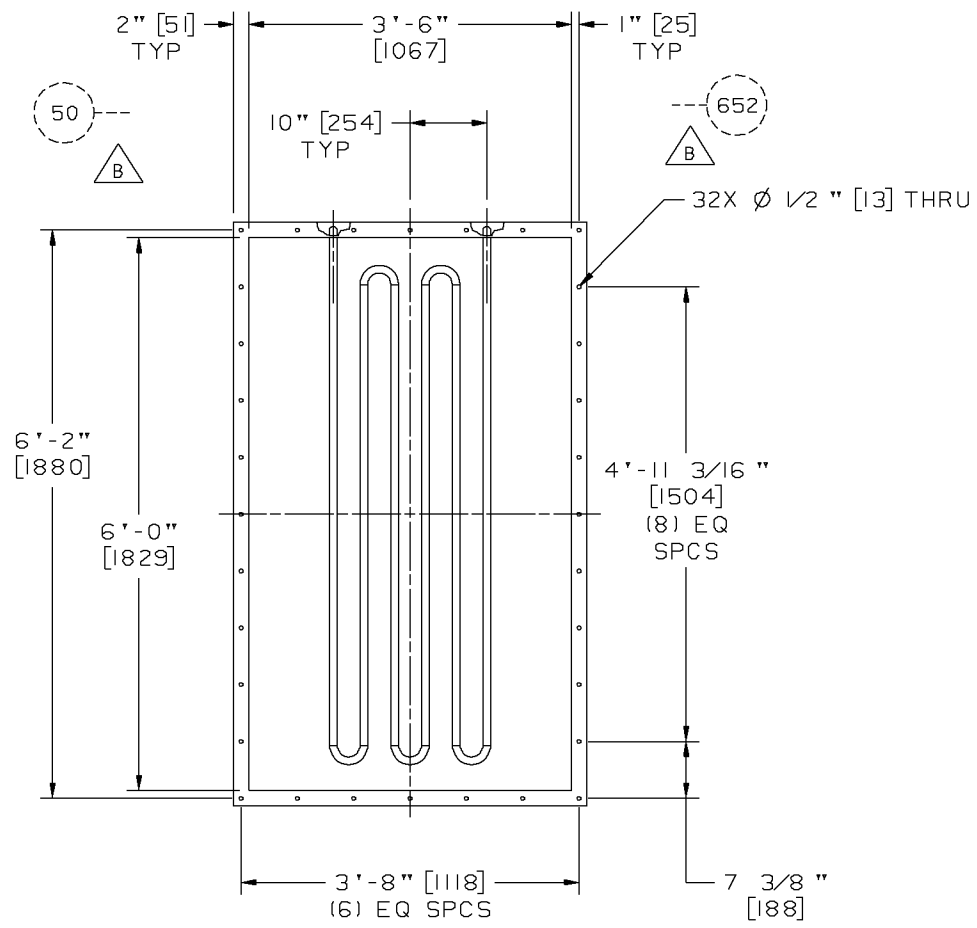
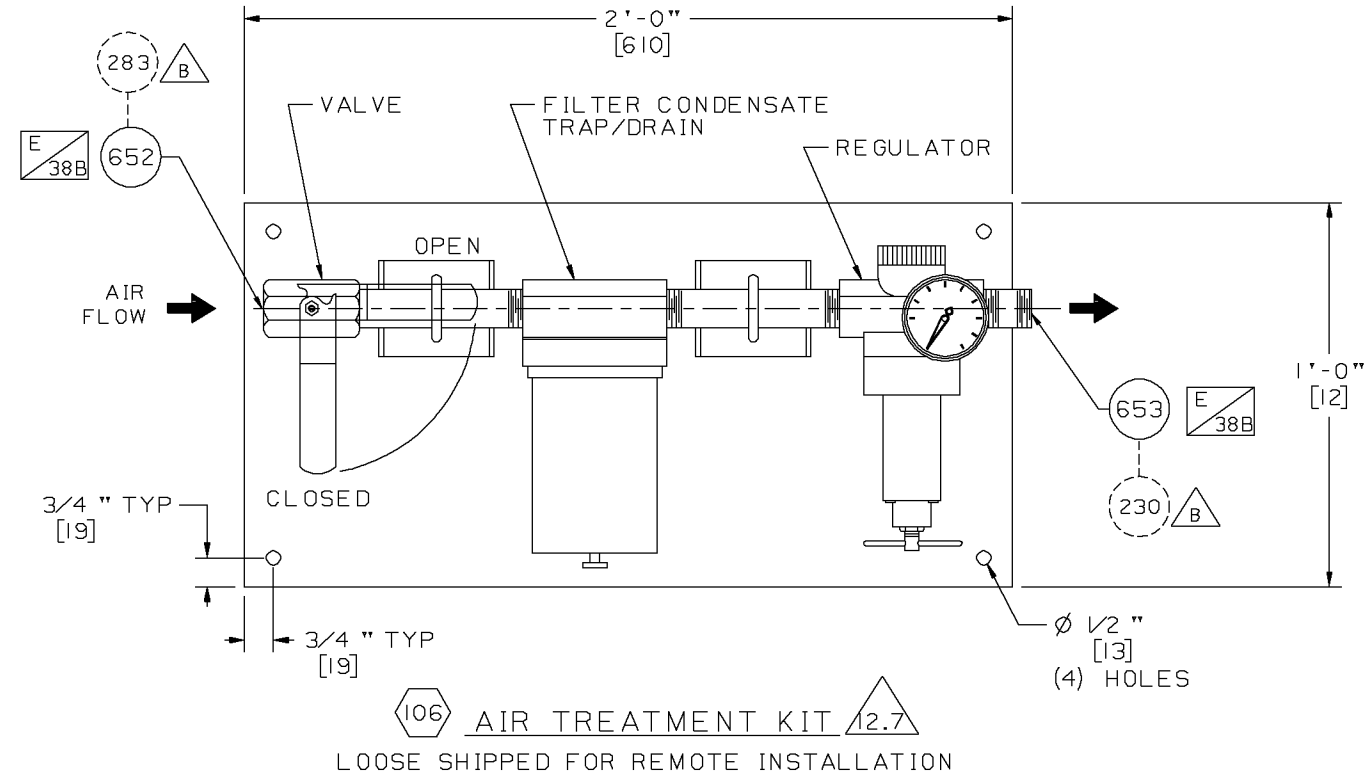


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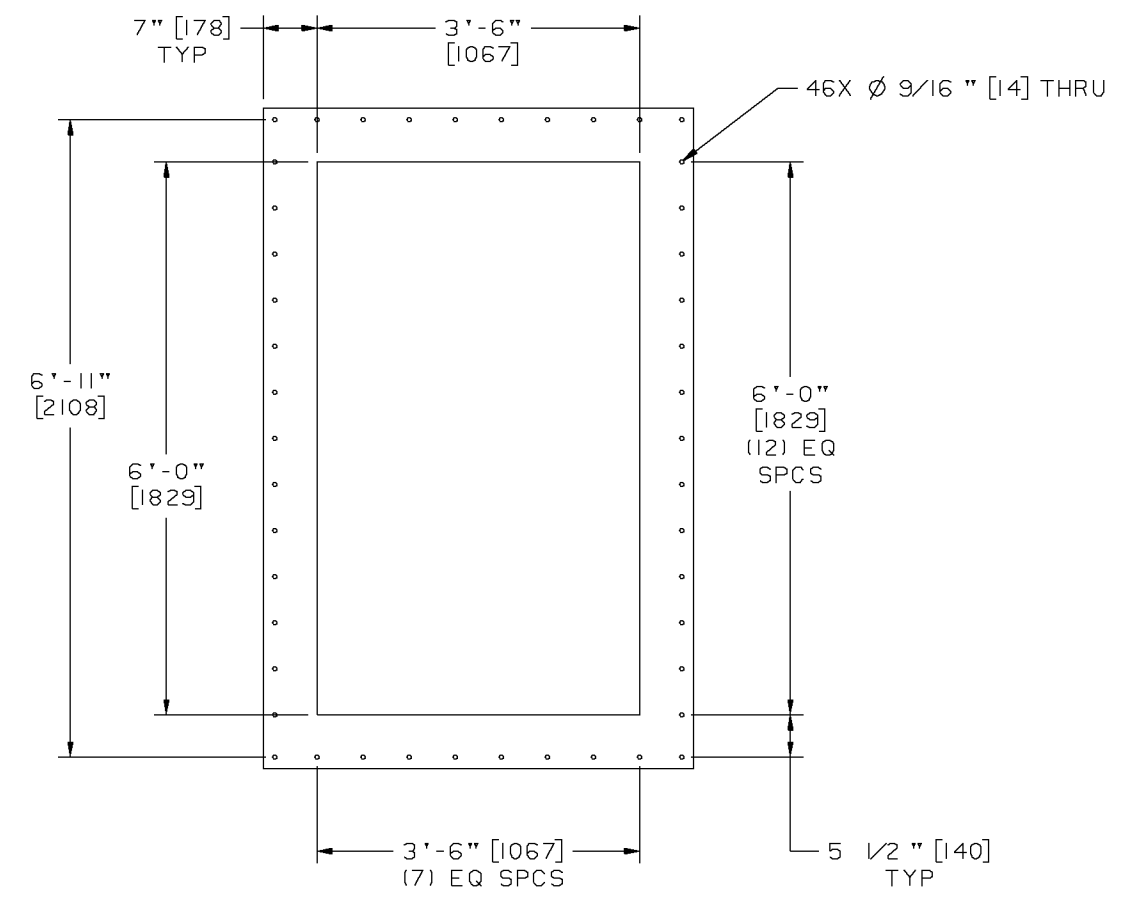
DRAWING NO. 52121-149746  
REV C  
SHEET 3B



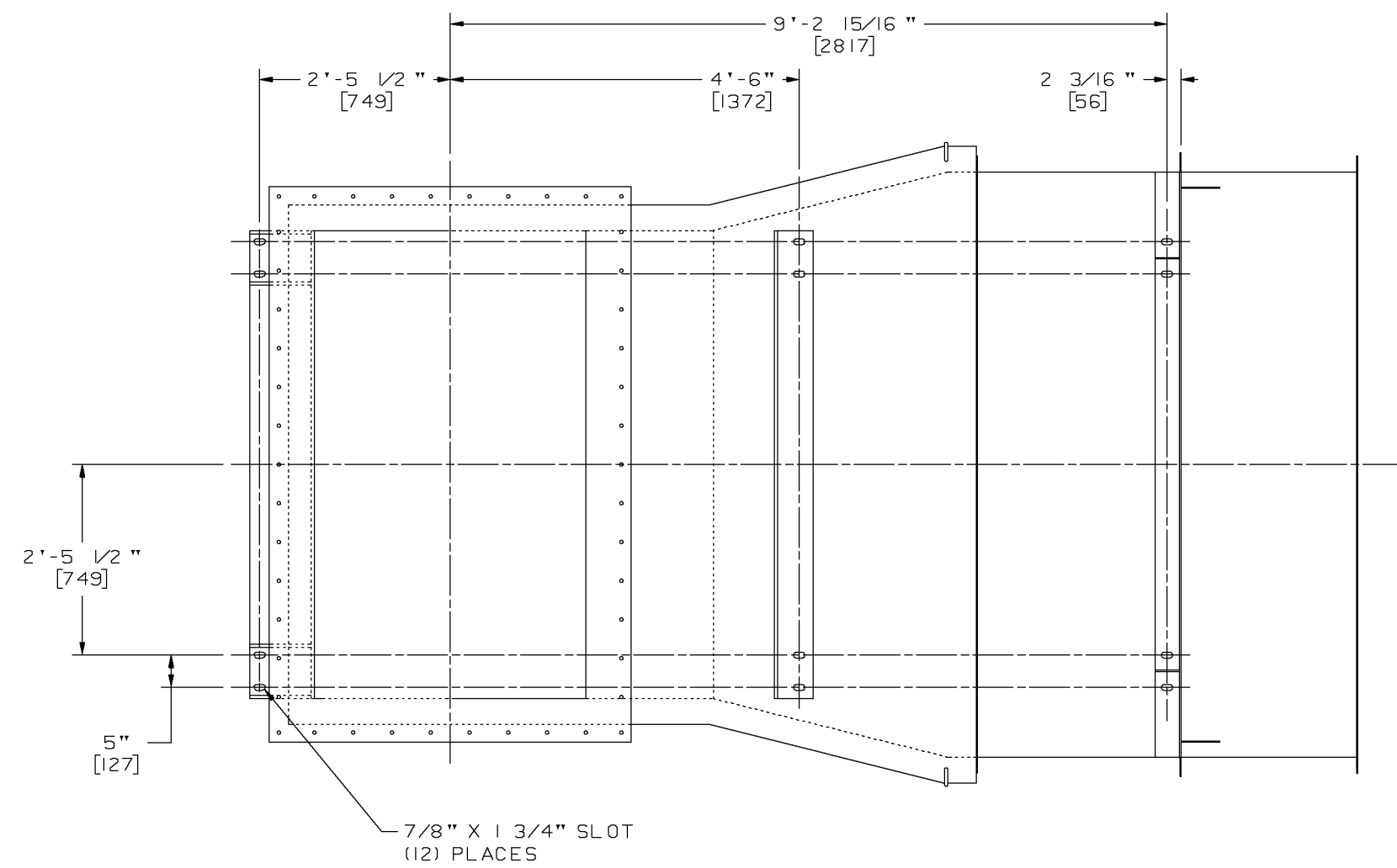
38C 37C 36C 35C 34C 33C 32C 31C



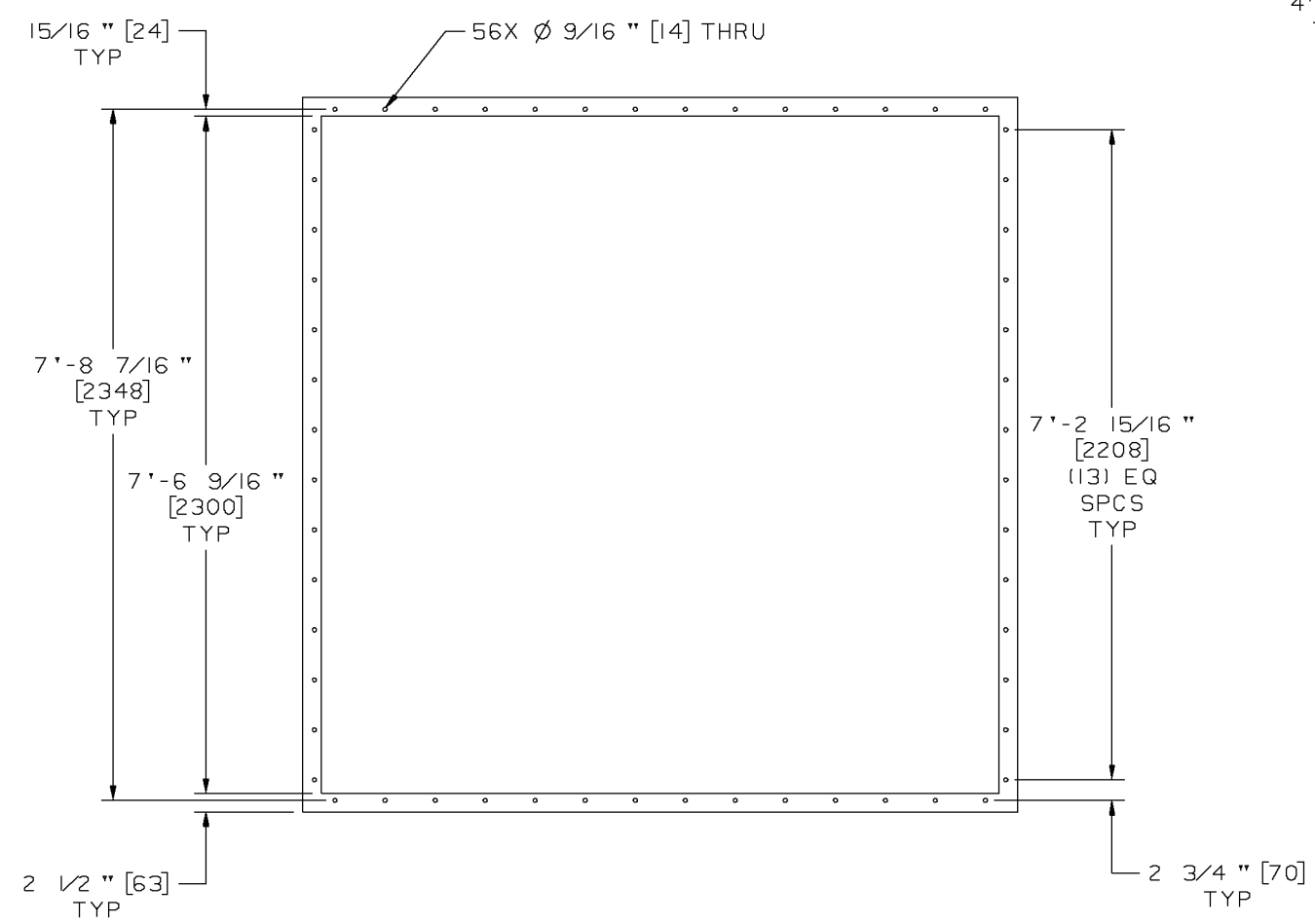
DETAIL AA



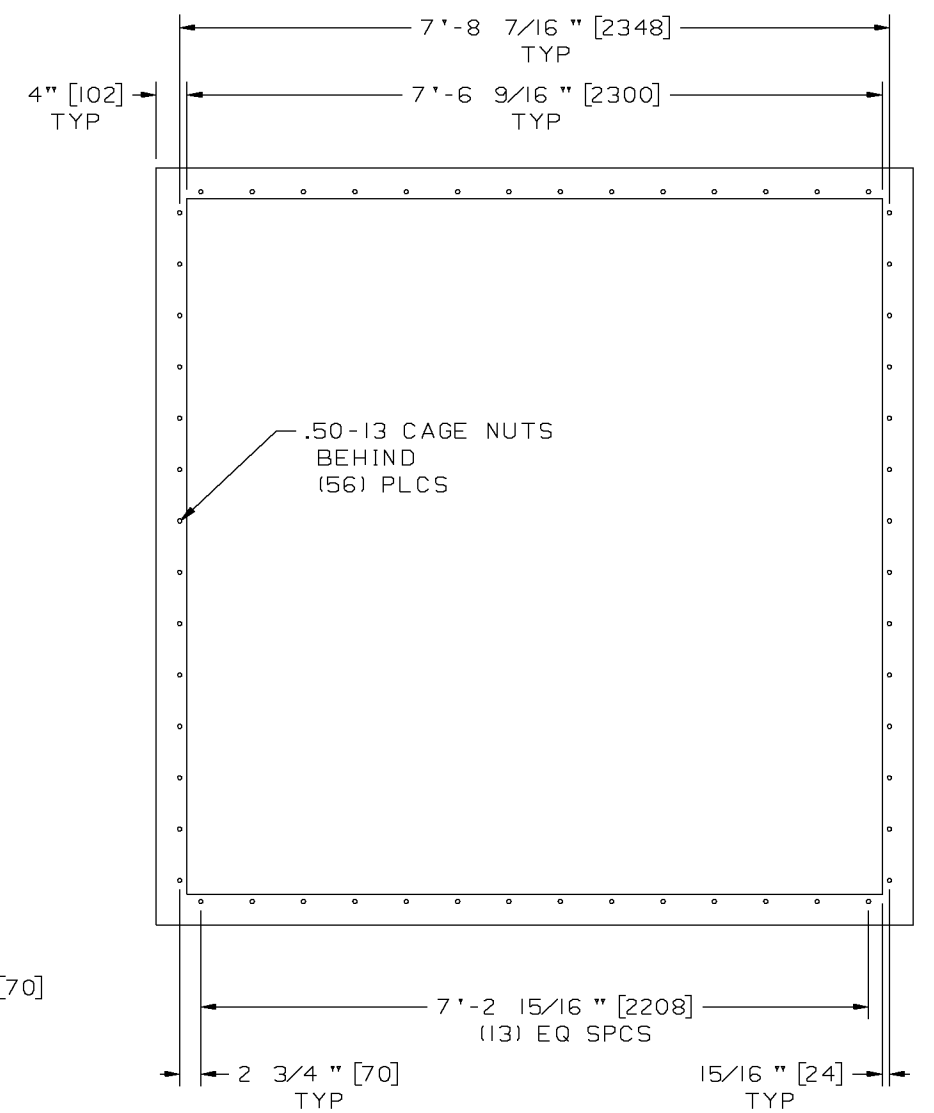
DETAIL AB



VIEW AC



DETAIL AD



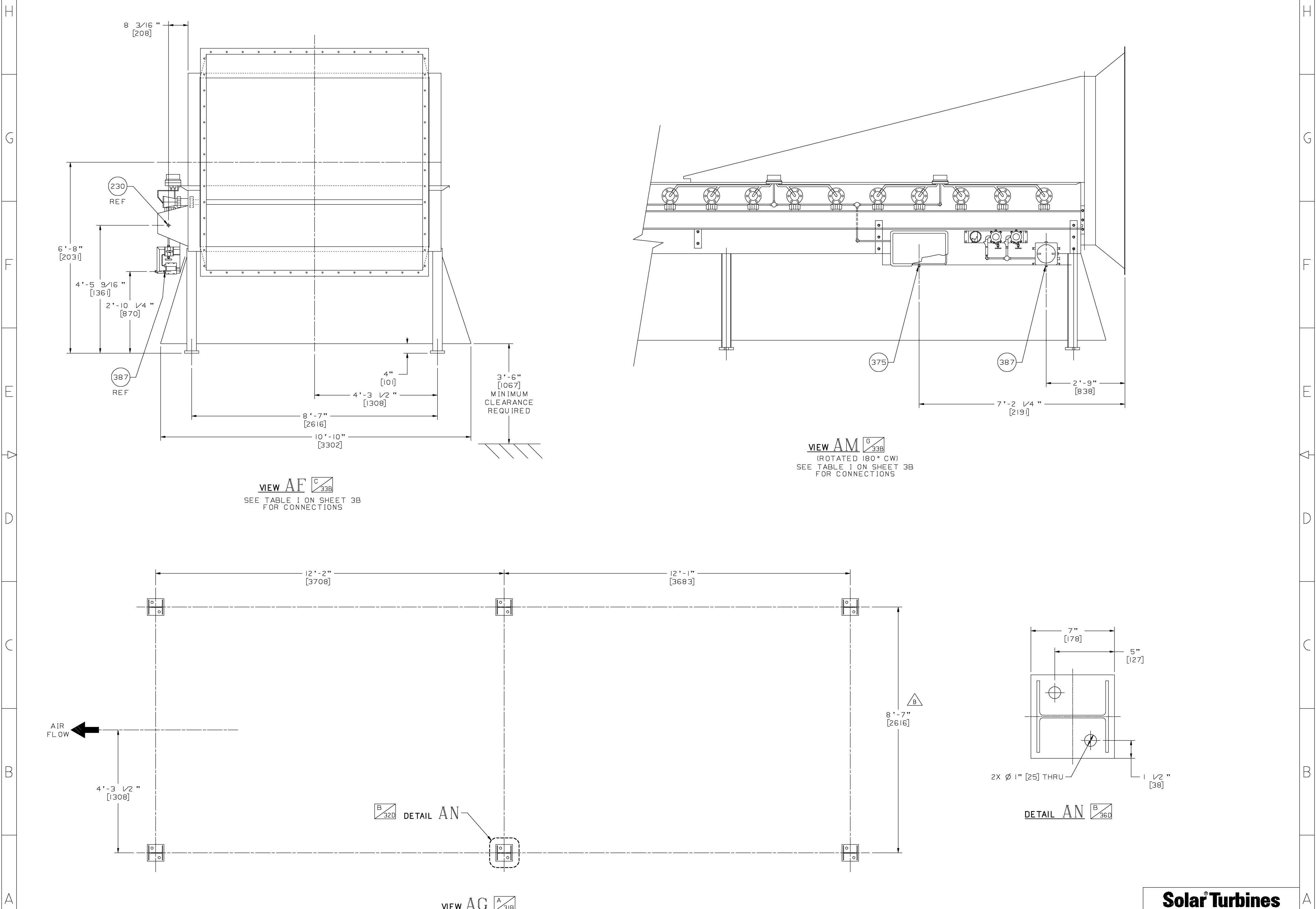
DETAIL AE

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DRAWING NO. 52121-149746 REV B SHEET 3C

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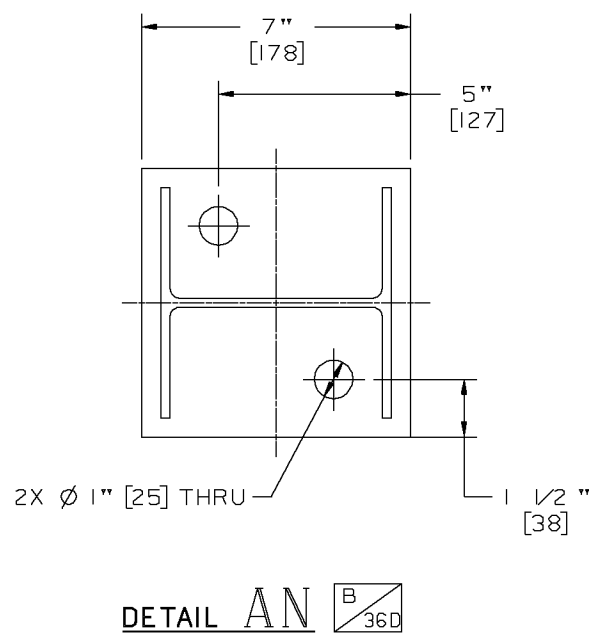
38D 37D 36D 35D 34D 33D 32D 31D



**VIEW AF** C  
33B  
SEE TABLE I ON SHEET 3B  
FOR CONNECTIONS

**VIEW AM** G  
33B  
(ROTATED 180° CW)  
SEE TABLE I ON SHEET 3B  
FOR CONNECTIONS

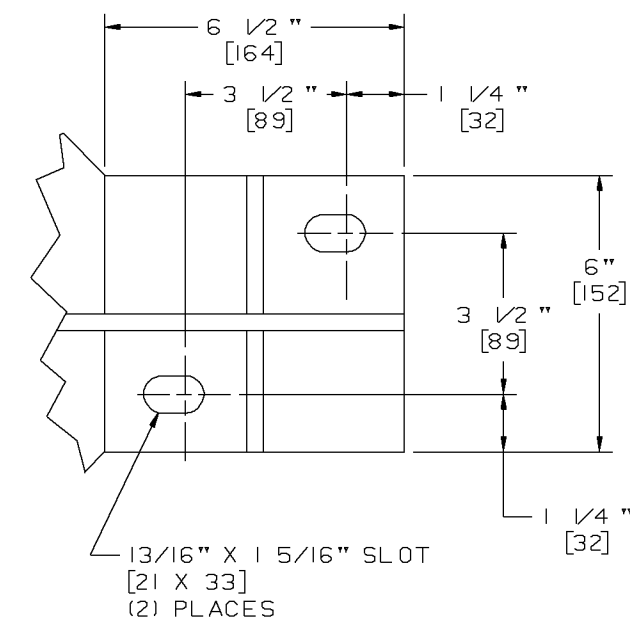
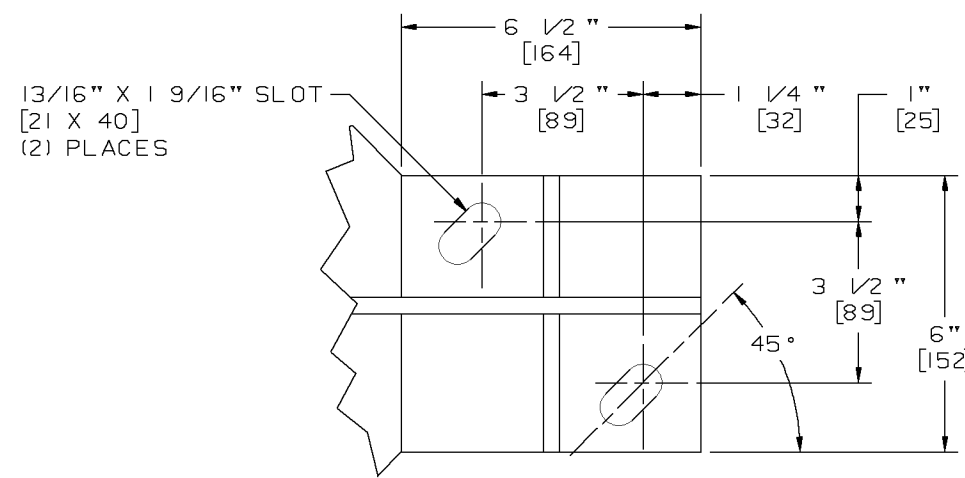
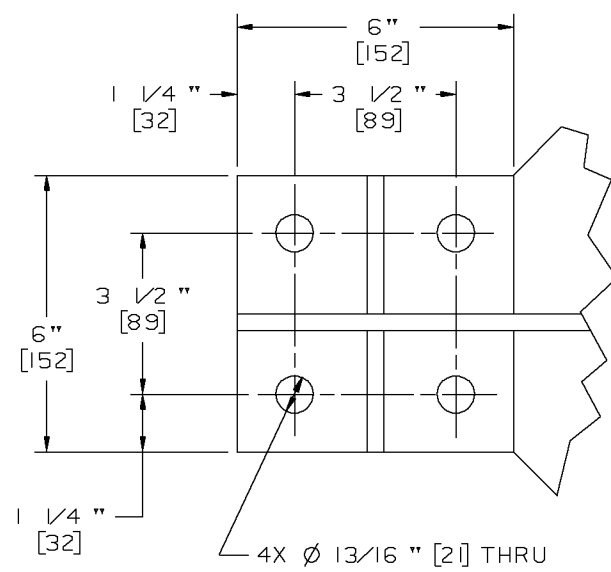
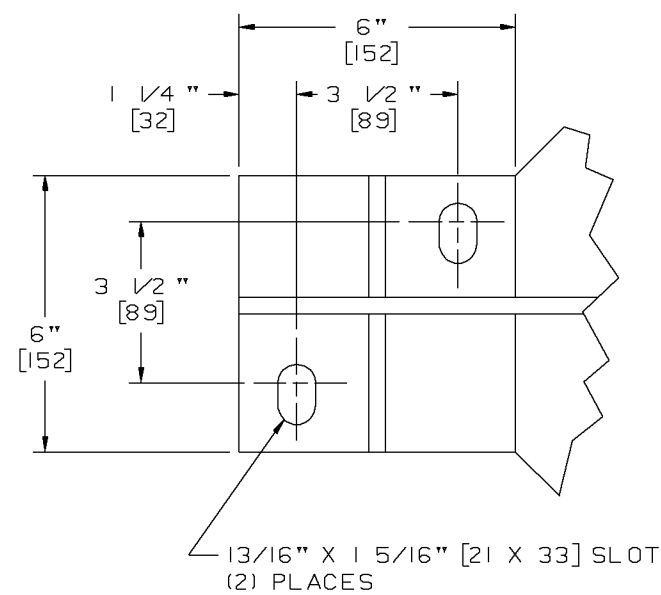
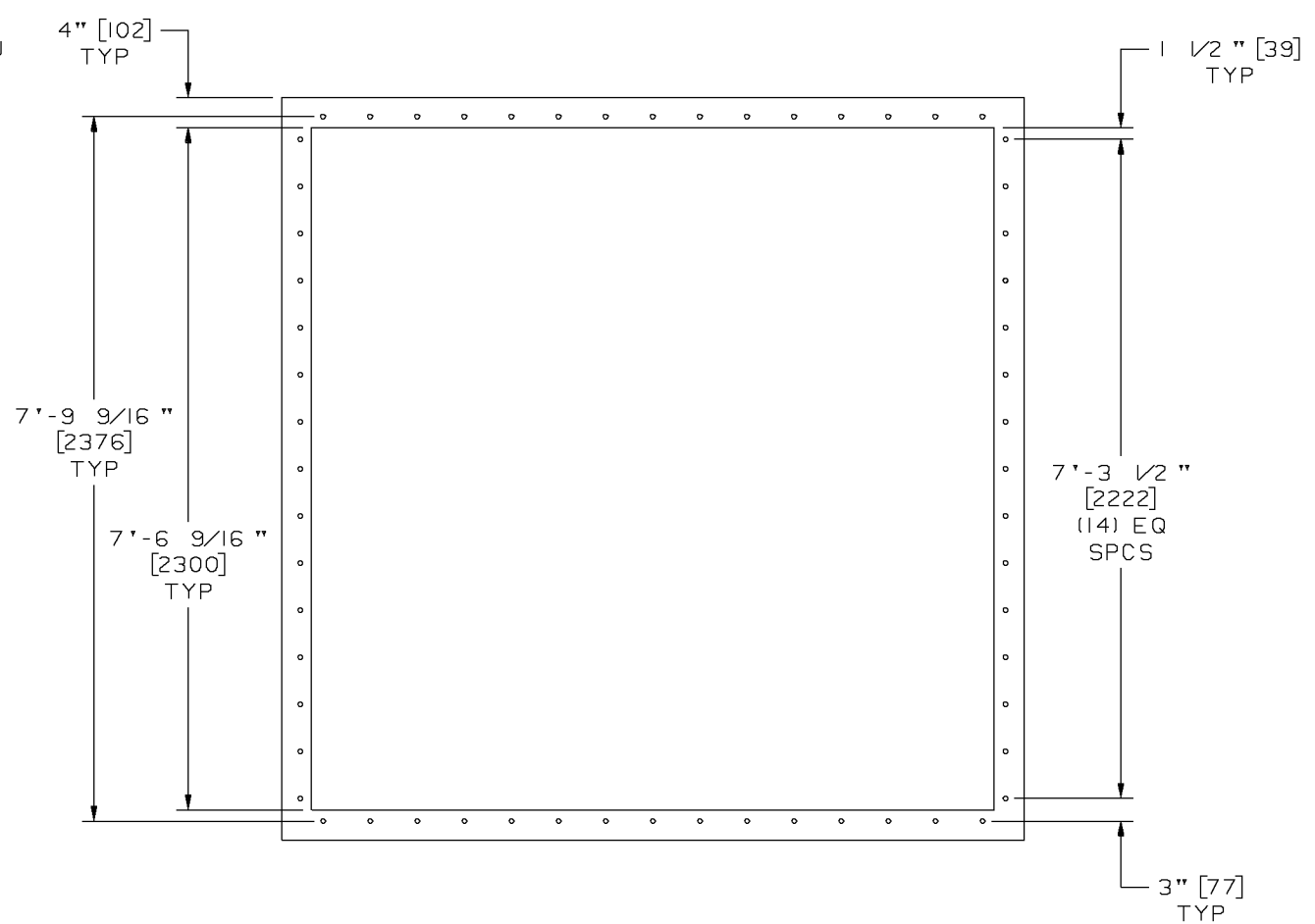
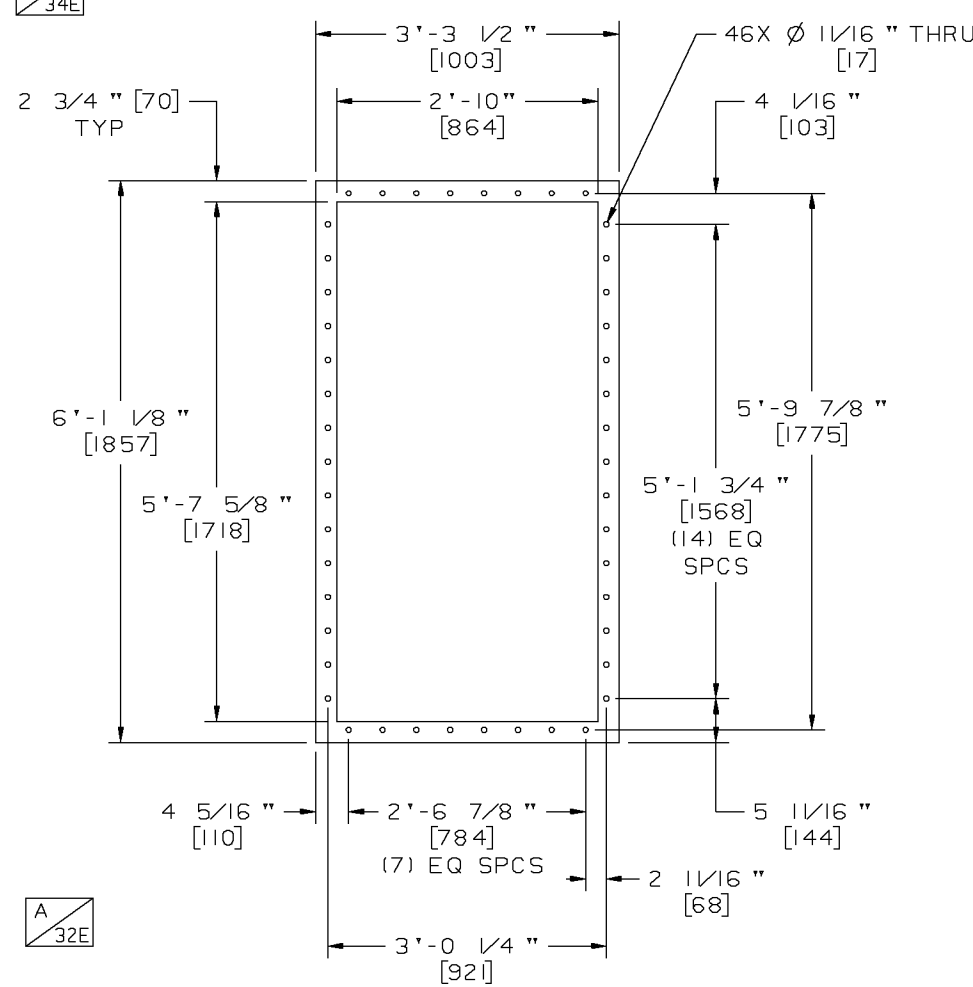
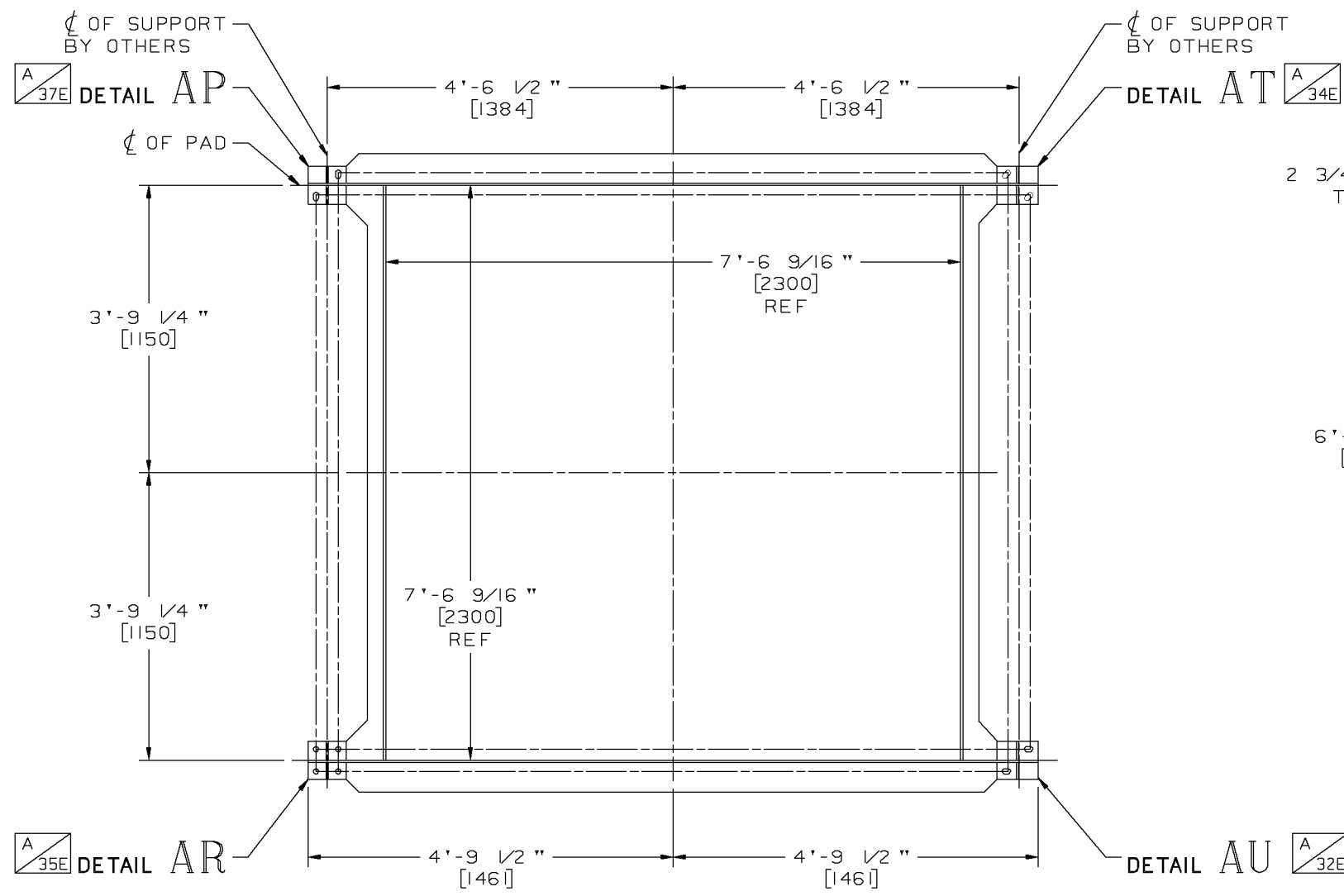
**VIEW AG** A  
31B



**Solar Turbines**  
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DRAWING NO.	REV
52121-149746	B
SHEET	3D

38E 37E 36E 35E 34E 33E 32E 31E

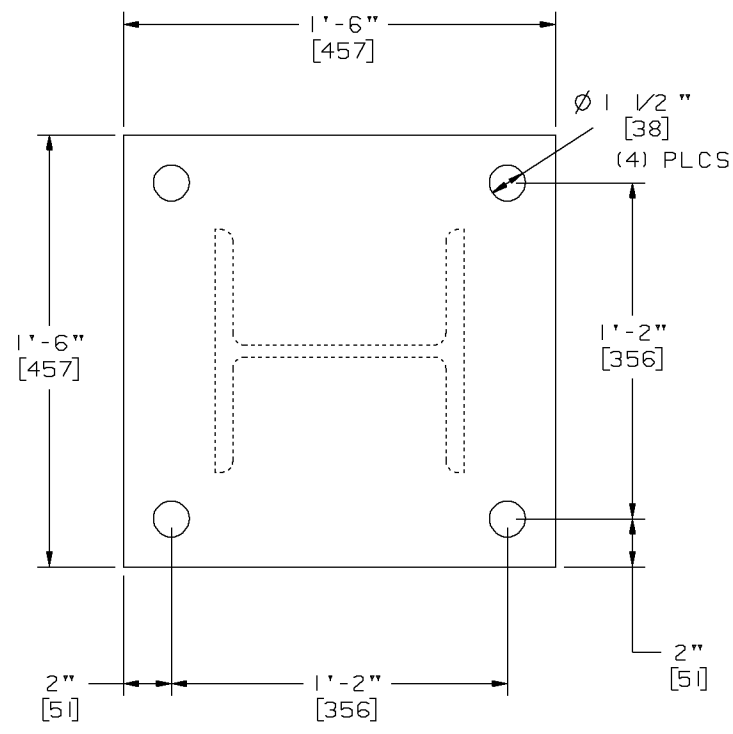


**Solar Turbines**  
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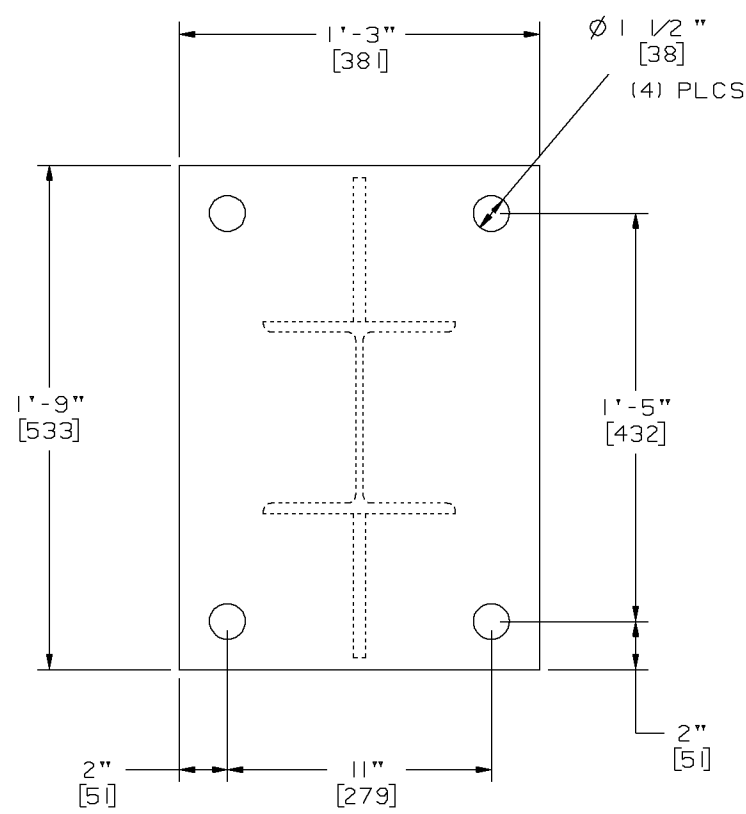
DRAWING NO. 52121-149746 REV A SHEET 3E

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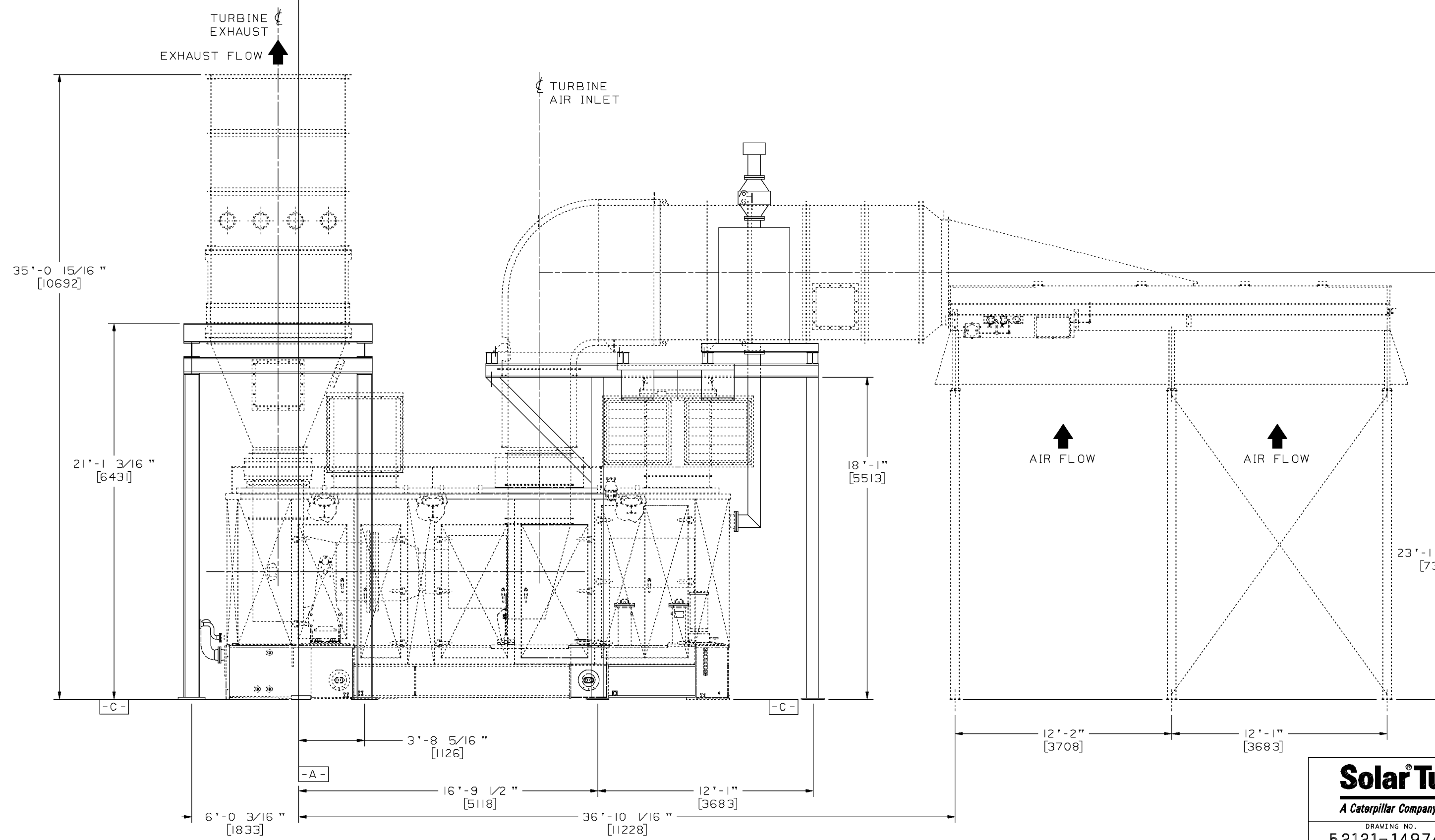
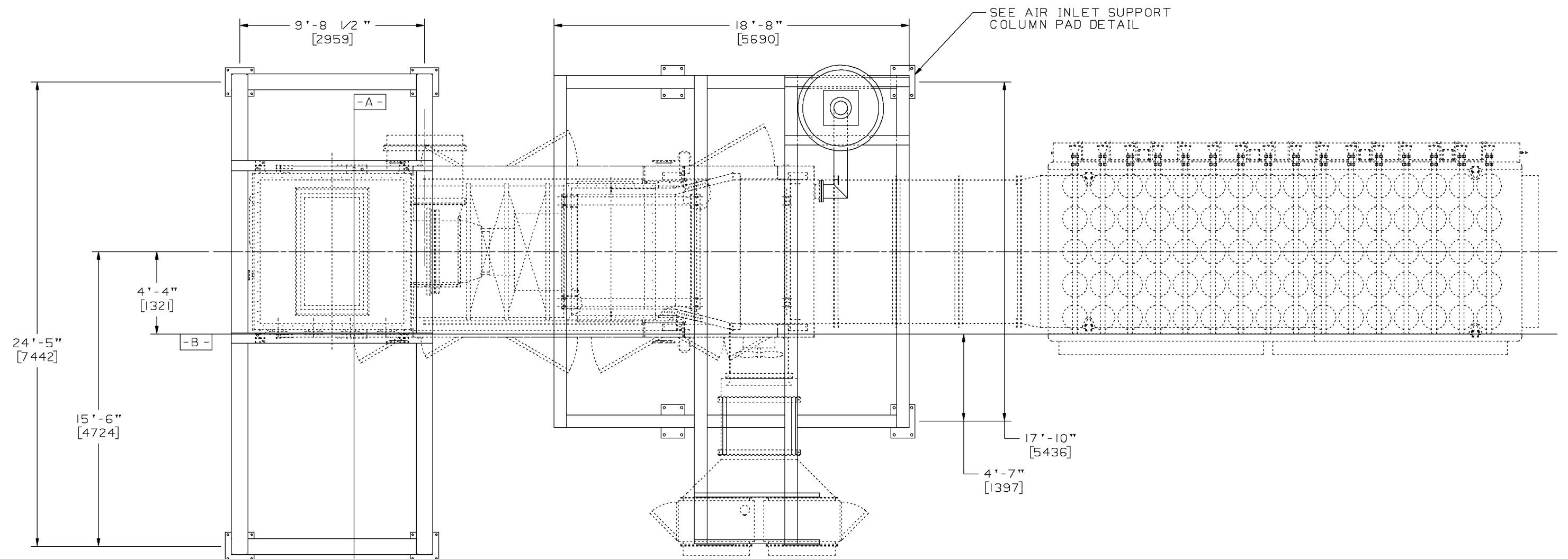
38F 37F 36F 35F 34F 33F 32F 31F



EXHAUST SUPPORT STRUCTURE COLUMN PAD  
 PLATE THICKNESS 1-1/2"  
 ESTIMATED MAXIMUM STATIC PAD LOAD  
 6,000 LBS (2725 KG) TYP



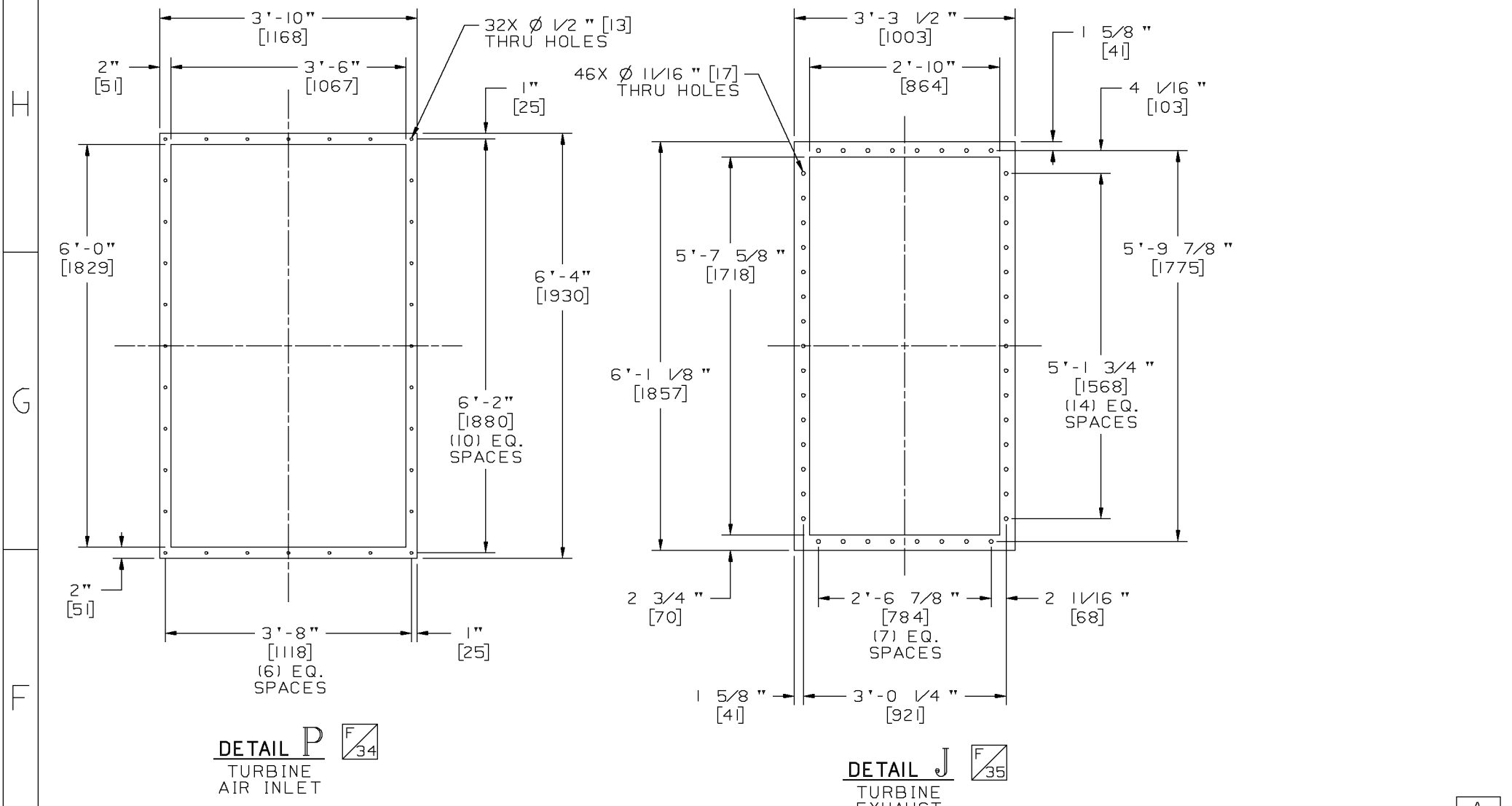
AIR INLET SUPPORT STRUCTURE COLUMN PAD  
 PLATE THICKNESS 3/4"  
 ESTIMATED MAXIMUM STATIC PAD LOAD  
 5,750 LBS (2610 KG) TYP



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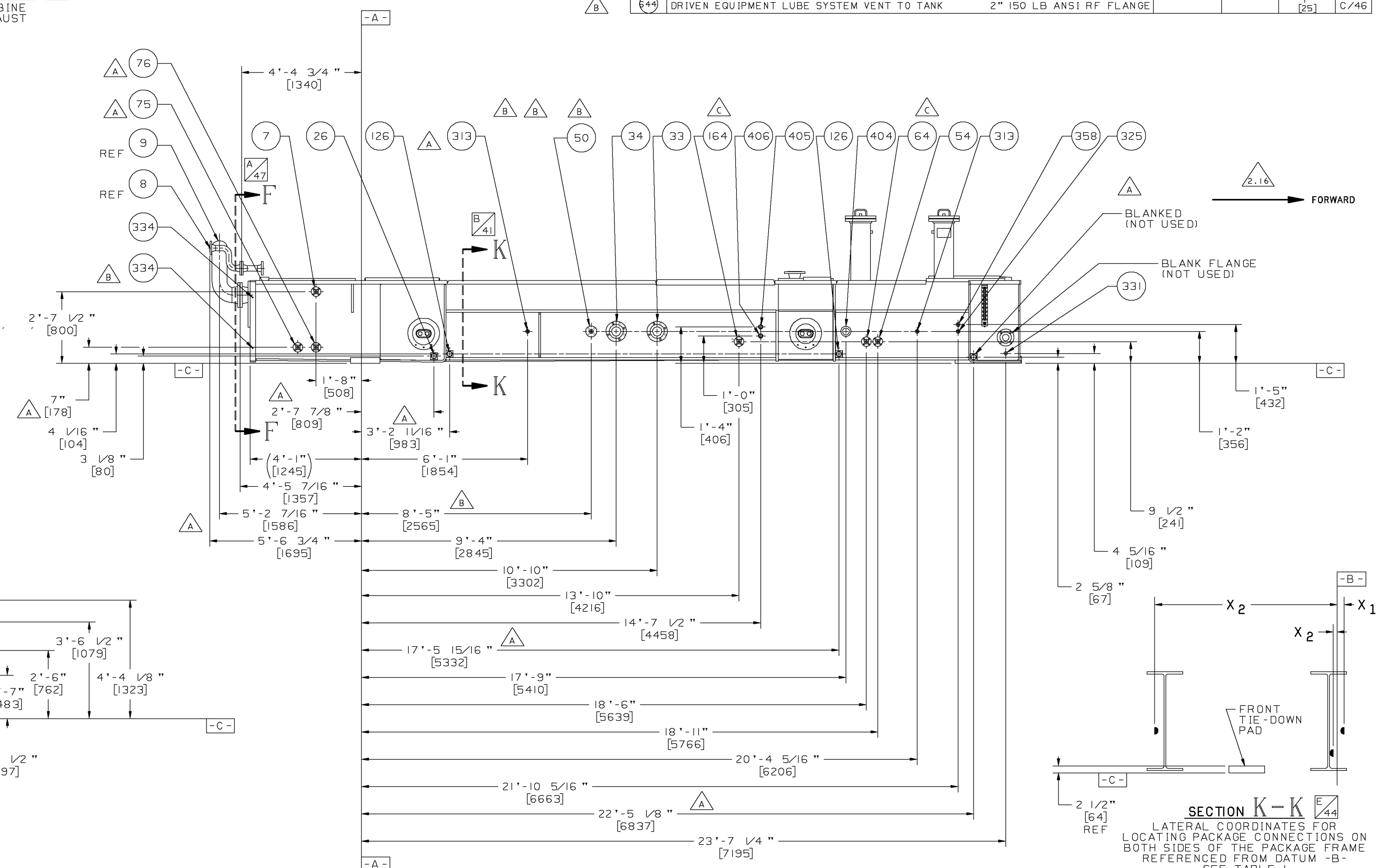
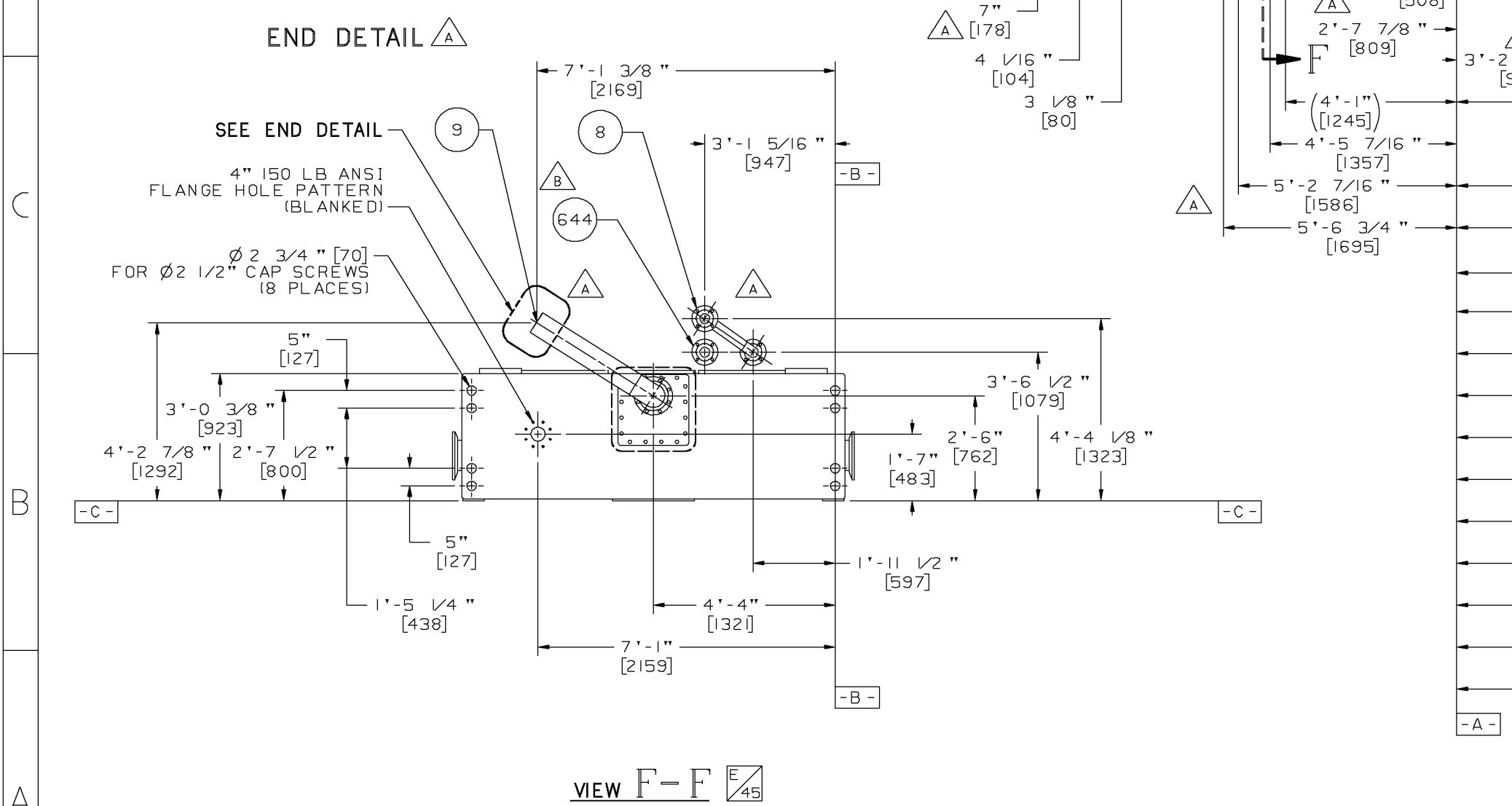
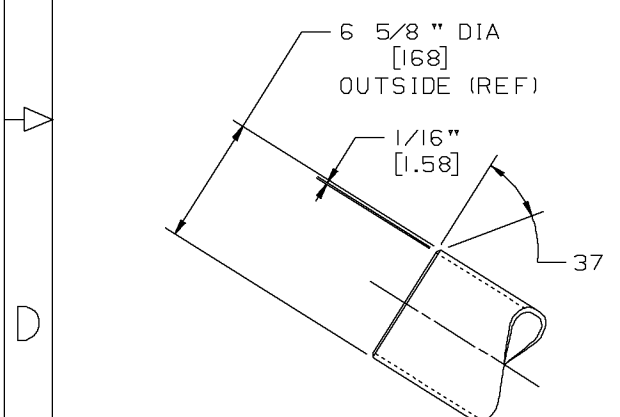
DRAWING NO. 52121-149746  
 REV A  
 SHEET 3F

48 47 46 45 44 43 42 41



**TABLE 1 (CONTINUED) - EXTERNAL CONNECTIONS**

ITEM	DESCRIPTION	REFERENCE NOTE	SECTION K-K		ZONE
			X <sub>1</sub>	X <sub>2</sub>	
7	LUBE OIL COOLER VENT	1" 150 LB ANSI RF FLANGE			E/45
8	LUBE OIL SUPPLY TO DRIVEN EQUIPMENT	2" 150 LB ANSI RF FLANGE			C/47
9	LUBE OIL RETURN FROM DRIVEN EQUIPMENT	6" SCHED 40 PIPE TO LUBE OIL DRAIN			C/47
26	LUBE OIL TANK DRAIN	2" NPT FEMALE			E/45
33	LUBE OIL TO COOLER	4" 150 LB ANSI RF FLANGE	5.2	1 3/4" [44]	E/43
34	LUBE OIL FROM COOLER	4" 150 LB ANSI RF FLANGE	5.2	1 3/4" [44]	E/44
50	COMPRESSOR AIR FOR SELF-CLEANING FILTERS	1" 300 LB ANSI RF FLANGE		1/8" [3]	E/44
54	LUBE OIL FILTER DRAIN	1" 150 LB ANSI RF FLANGE		1/8" [3]	E/42
64	LOW POINT DRAIN FROM LUBE OIL HEADER	1" 150 LB ANSI RF FLANGE		1/8" [3]	E/42
75	LUBE OIL CONDITIONING PORT/INLET TO TANK	1" 150 LB ANSI RF FLANGE			E/46
76	LUBE OIL CONDITIONING PORT/OUTLET TO TANK	1" 150 LB ANSI RF FLANGE			E/46
26	OIL DRAIN FROM DRIP PAN (2 PLACES)	2" NPT FEMALE			E/44
64	LUBE OIL HEADER LOW POINT DRAIN	1" 150 LB ANSI RF FLANGE		1/8" [3]	E/43
313	AC VOLTS, LUBE OIL TANK HEATER	1" NPT FEMALE CONDUIT		1" [25]	E/44
425	AC VOLTS, SERVO PUMP MOTOR	1" NPT FEMALE CONDUIT		1" [25]	E/42
33	GROUND, PACKAGE FRAME (2 PLACES)	1/2-13 UNC-2B	6.2	1" [25]	E/42
334	GROUND, FRAME TO FRAME	1/2-13 UNC-2B		1" [25]	E/45
458	AC VOLTS, ENCLOSURE LIGHTING	1" NPT FEMALE CONDUIT	8.5	1" [25]	E/42
404	AC VOLTS, STARTER MOTOR	3" NPT FEMALE CONDUIT		1" [25]	E/43
405	AC VOLTS, MAIN NO. 1 LUBE OIL PUMP MOTOR	1 1/2" NPT FEMALE CONDUIT		1" [25]	E/43
406	AC VOLTS, MAIN NO. 2 LUBE OIL PUMP MOTOR	1 1/2" NPT FEMALE CONDUIT		1" [25]	E/43
644	DRIVEN EQUIPMENT LUBE SYSTEM VENT TO TANK	2" 150 LB ANSI RF FLANGE		1" [25]	C/46



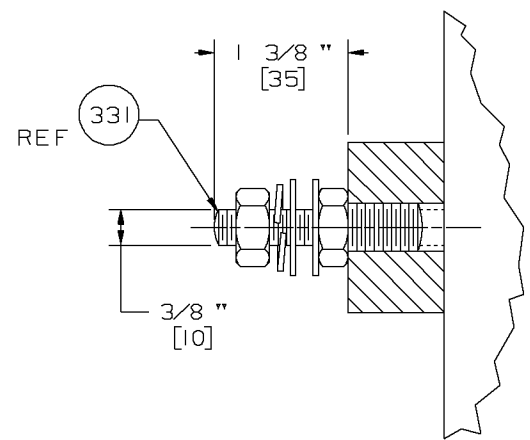
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DRAWING NO. 52121-149746  
 REV C  
 SHEET 4

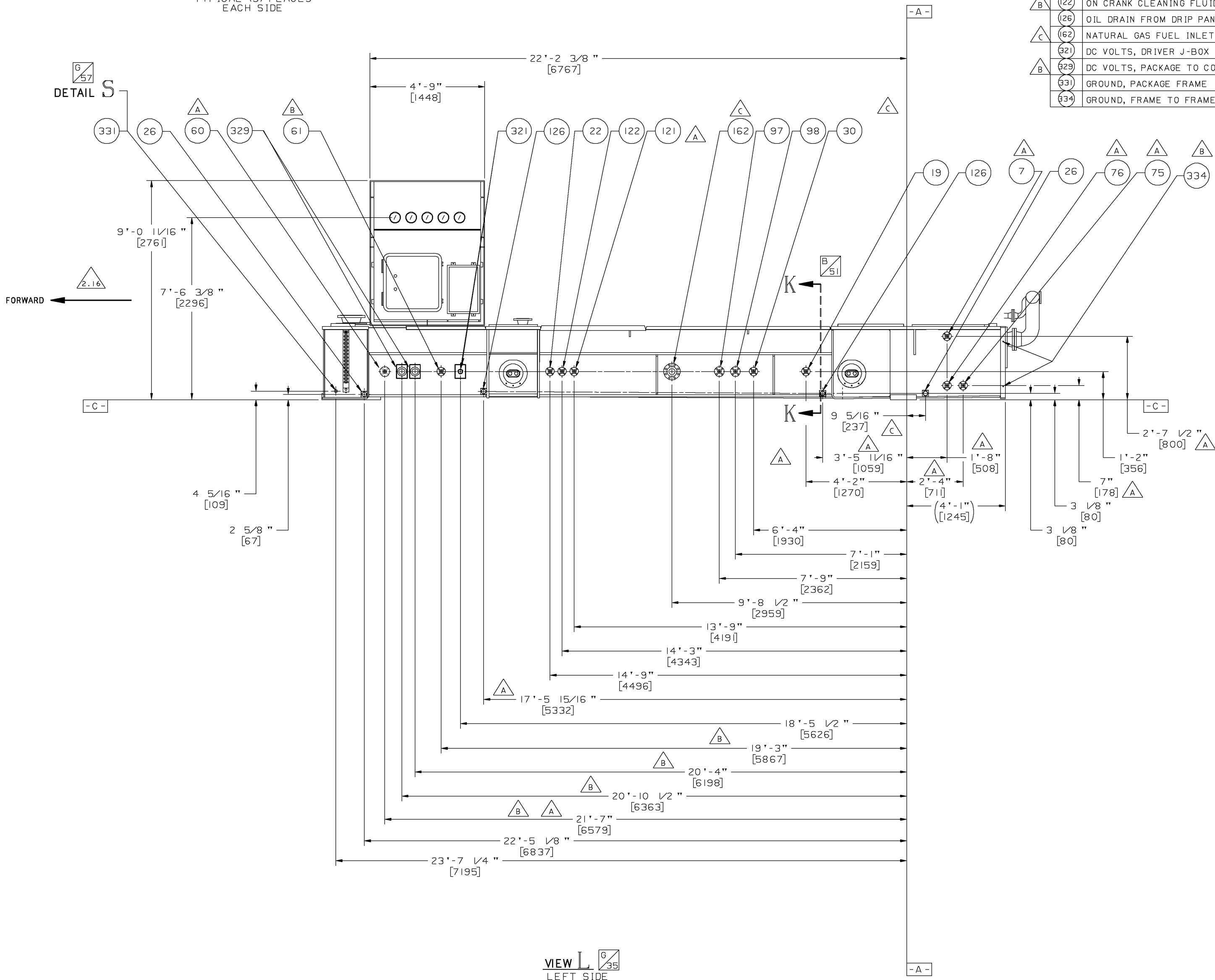
58 57 56 55 54 53 52 51

TABLE 1 (CONTINUED) - EXTERNAL CONNECTIONS

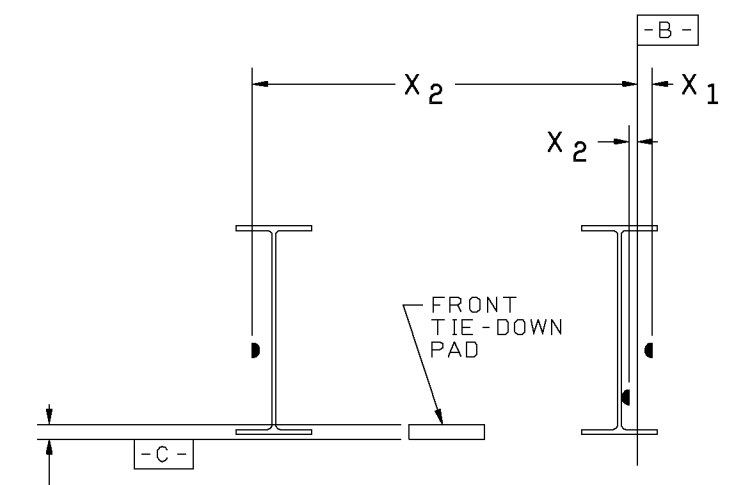
ITEM	DESCRIPTION	REFERENCE NOTE	SECTION K-K		ZONE
			X <sub>1</sub>	X <sub>2</sub>	
7	LUBE OIL COOLER VENT				F/54
19	ENGINE EXHAUST COLLECTOR AND COMBUSTOR DRAIN	2.18		8'-7 7/8" [2638]	F/54
22	ENGINE AIR INLET DUCT DRAIN	3.0		8'-7 7/8" [2638]	F/56
26	LUBE OIL TANK DRAIN (2 PLACES)				F/57
30	PILOT VALVES, AIR/GAS VENT, NO BACKPRESSURE	4.2, 10.2		8'-7 7/8" [2638]	F/55
60	PNEUMATIC INLET POST LUBE BACKUP	5.5		8'-7 7/8" [2638]	F/57
61	PNEUMATIC POST LUBE BACKUP VENT			8'-7 7/8" [2638]	F/57
75	LUBE OIL CONDITIONING PORT/INLET TO TANK			8'-7 7/8" [2638]	F/53
76	LUBE OIL CONDITIONING PORT/OUTLET TO TANK			8'-7 7/8" [2638]	F/53
97	ENCLOSURE FIRE EXTINGUISHANT MEDIUM INLET (MAIN)	8.1		8'-7 7/8" [2638]	F/55
98	ENCLOSURE FIRE EXTINGUISHANT MEDIUM INLET (EXTENDED)	8.1		8'-7 7/8" [2638]	F/55
121	ON LINE CLEANING FLUID INLET	9.0		8'-7 7/8" [2638]	F/55
122	ON CRANK CLEANING FLUID INLET	9.0, 9.1, 9.2		8'-7 7/8" [2638]	F/56
126	OIL DRAIN FROM DRIP PAN (2 PLACES)				F/54
162	NATURAL GAS FUEL INLET	4.0, 4.2, 4.3		8'-7 7/8" [2638]	F/56
321	DC VOLTS, DRIVER J-BOX I.S.	1.2		8'-7 7/8" [2916]	F/56
329	DC VOLTS, PACKAGE TO CONSOLE INON I.S.	1.2		8'-7 7/8" [2916]	F/57
331	GROUND, PACKAGE FRAME	1.2, 2.8			F/57
334	GROUND, FRAME TO FRAME	1/2-13 UNC-2B			F/53



DETAIL S  
PACKAGE GROUNDING  
TYPICAL (3) PLACES  
EACH SIDE



VIEW L  
LEFT SIDE  
EXTERNAL SERVICE CONNECTIONS  
(SKID SHOWN WITH DRIP PANS)

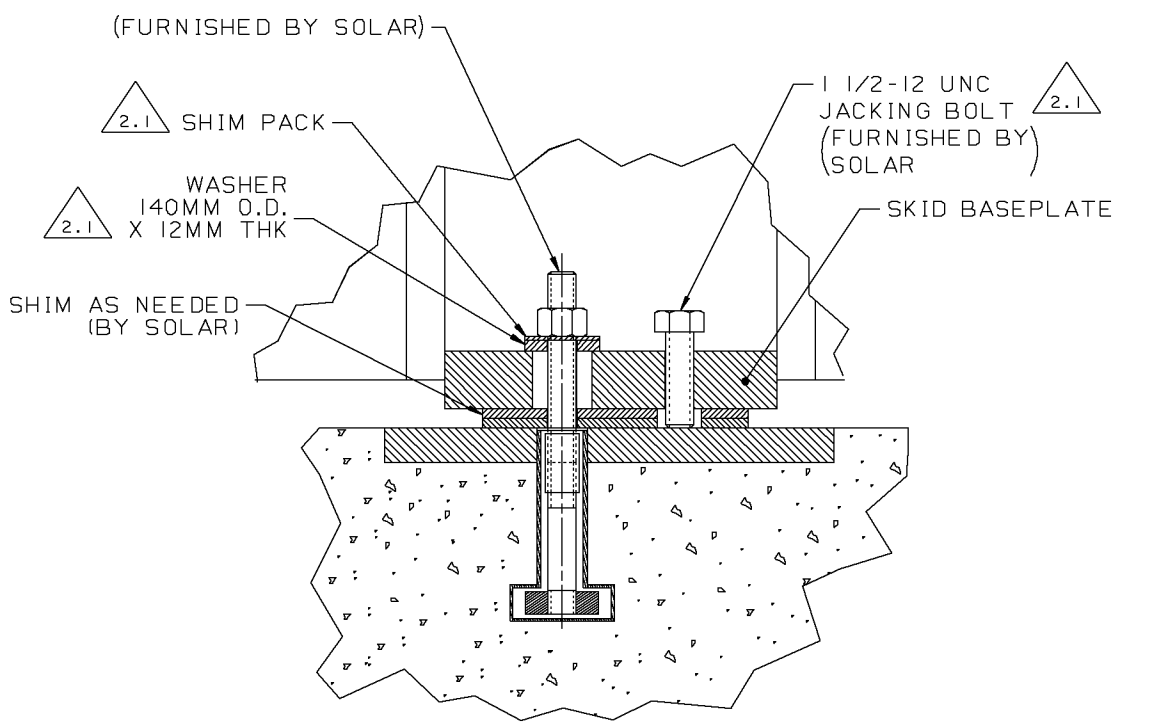
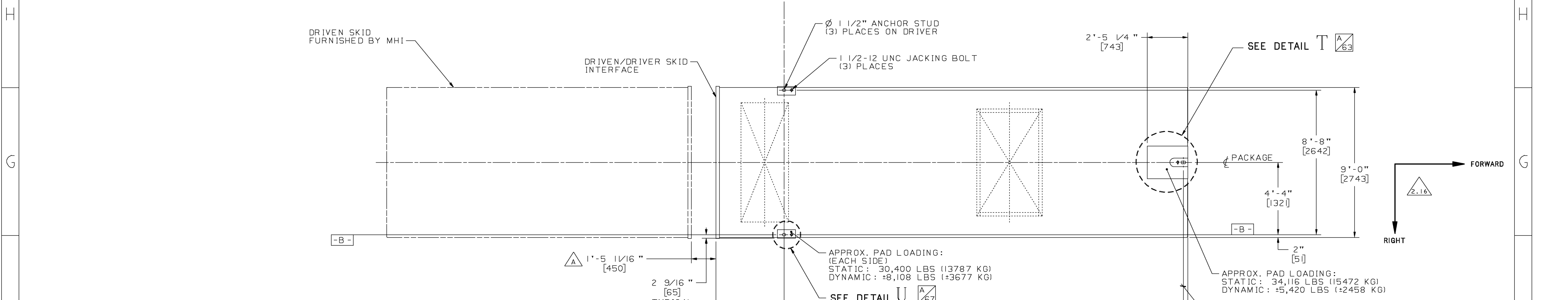


SECTION K-K  
LATERAL COORDINATES FOR  
LOCATING PACKAGE CONNECTIONS ON  
BOTH SIDES OF THE PACKAGE FRAME  
REFERENCED FROM DATUM -B-  
SEE TABLE 1

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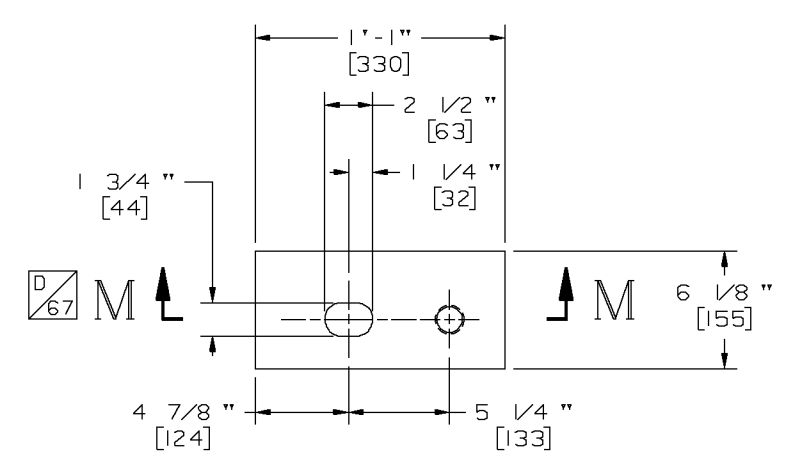
DRAWING NO.  
52121-149746  
REV C  
SHEET 5

68 67 66 65 64 63 62 61



**SECTION M-M** [68] [2.2] [2.5]  
 (TYPICAL 2 PLACES)  
 SHIM RETAINING BAR NOT SHOWN IN THIS VIEW

**SUGGESTED BOLT-DOWN FOR FOUNDATION PLAN USING FLOATING ANCHOR BOLT EMBEDDED IN FOUNDATION**



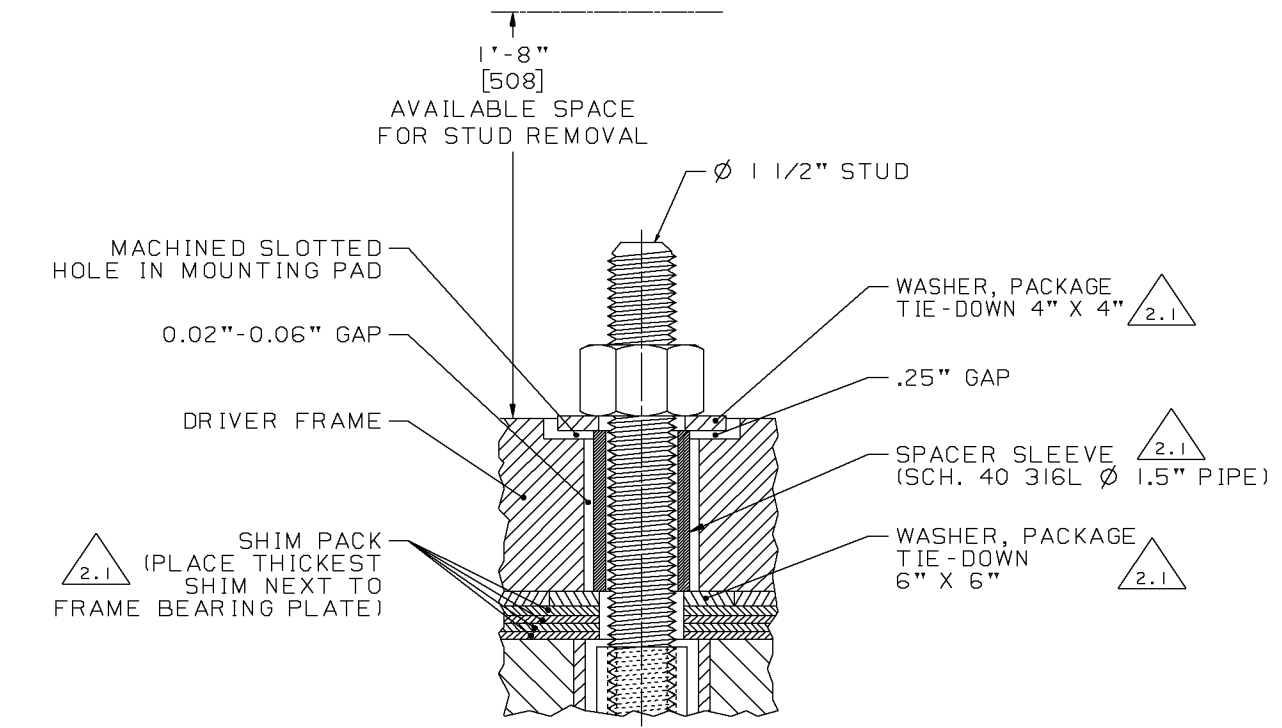
**DETAIL U** [64]  
 TYPICAL (2) PLACES  
 SHIM AS NEEDED UNDER ENTIRE SURFACE

3/8-16 UNC TAPPED HOLE FOR SHIM RETAINING BAR (REFERENCE SECTION W-W FOR EXAMPLE INSTALLATION)

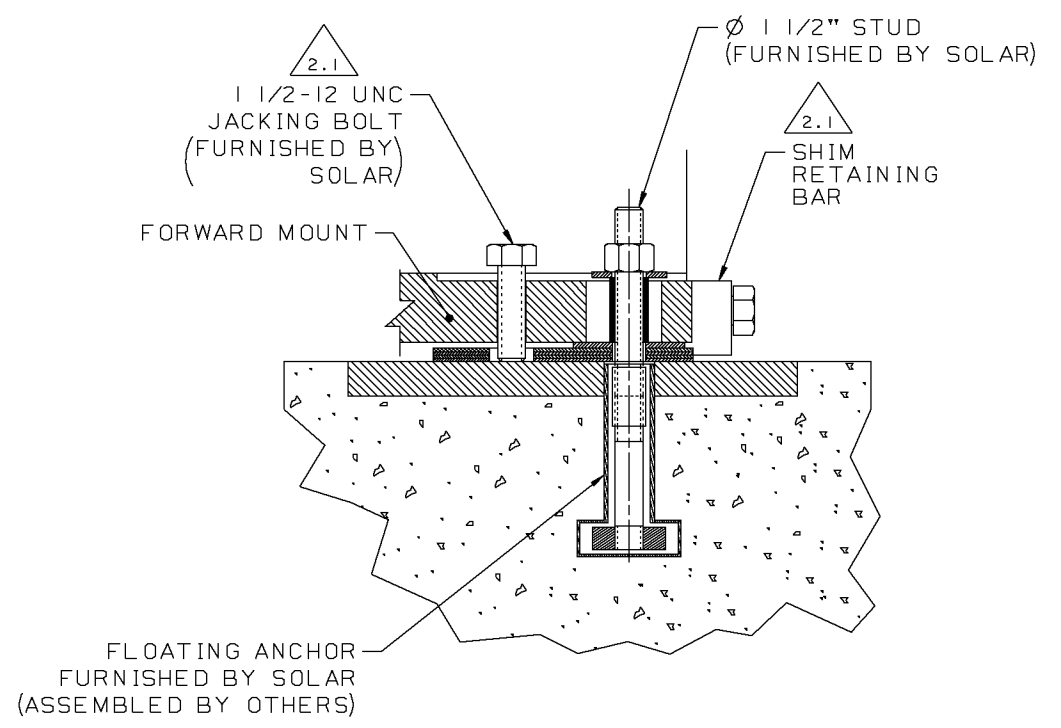
**VIEW B** [36] [2.2] [2.5]  
 EXTERNAL FOUNDATION PLAN

NOTE: WEIGHTS SHOWN INCLUDE LUBE OIL

NOTE: DYNAMIC LOADS ARE GIVEN AT SHUTDOWN VIBRATION LEVELS

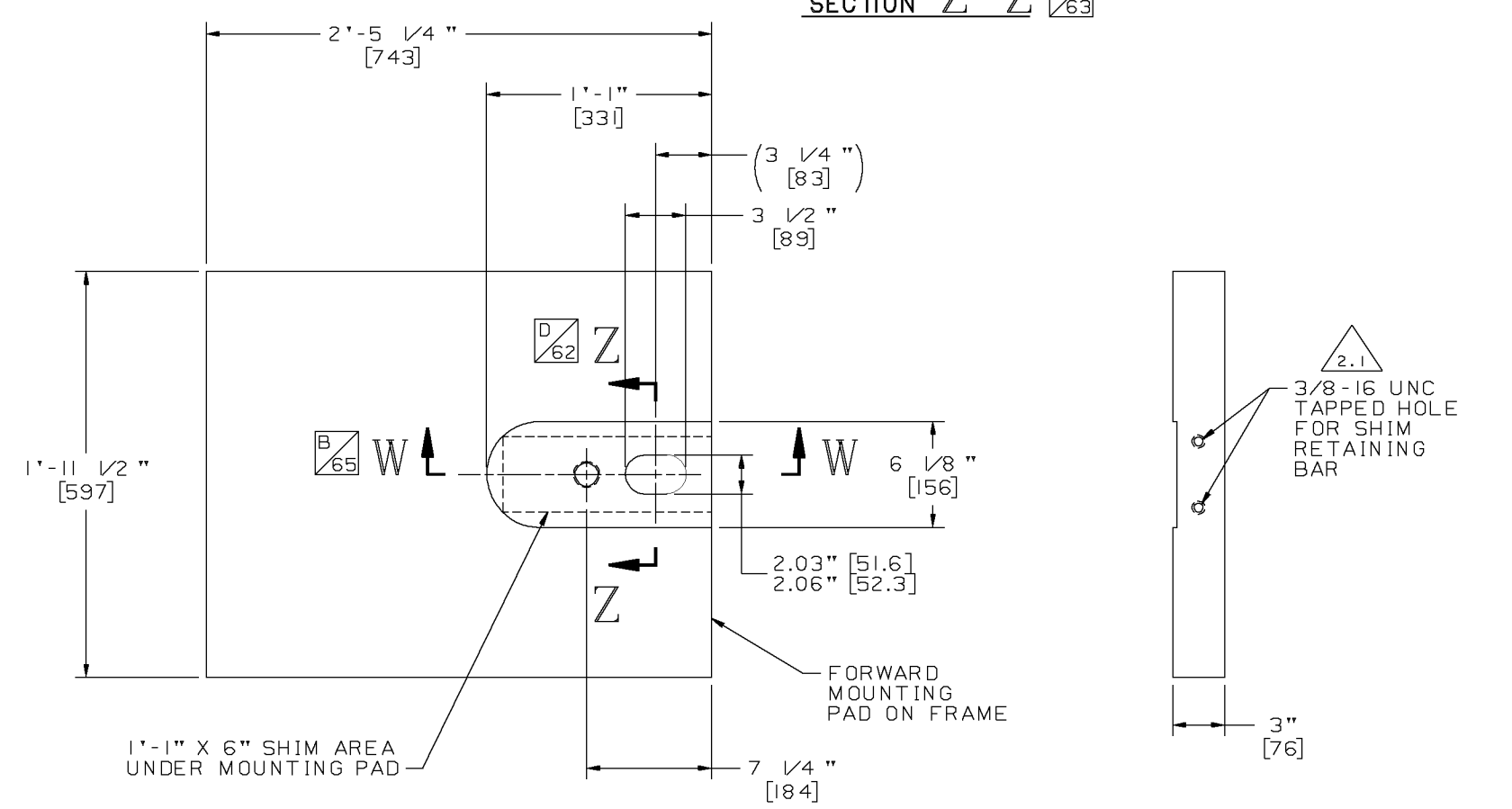


**SECTION Z-Z** [63]



**SECTION W-W** [63] [2.2] [2.5]

**SUGGESTED BOLT-DOWN FOR FOUNDATION PLAN USING FLOATING ANCHOR BOLT EMBEDDED IN FOUNDATION**



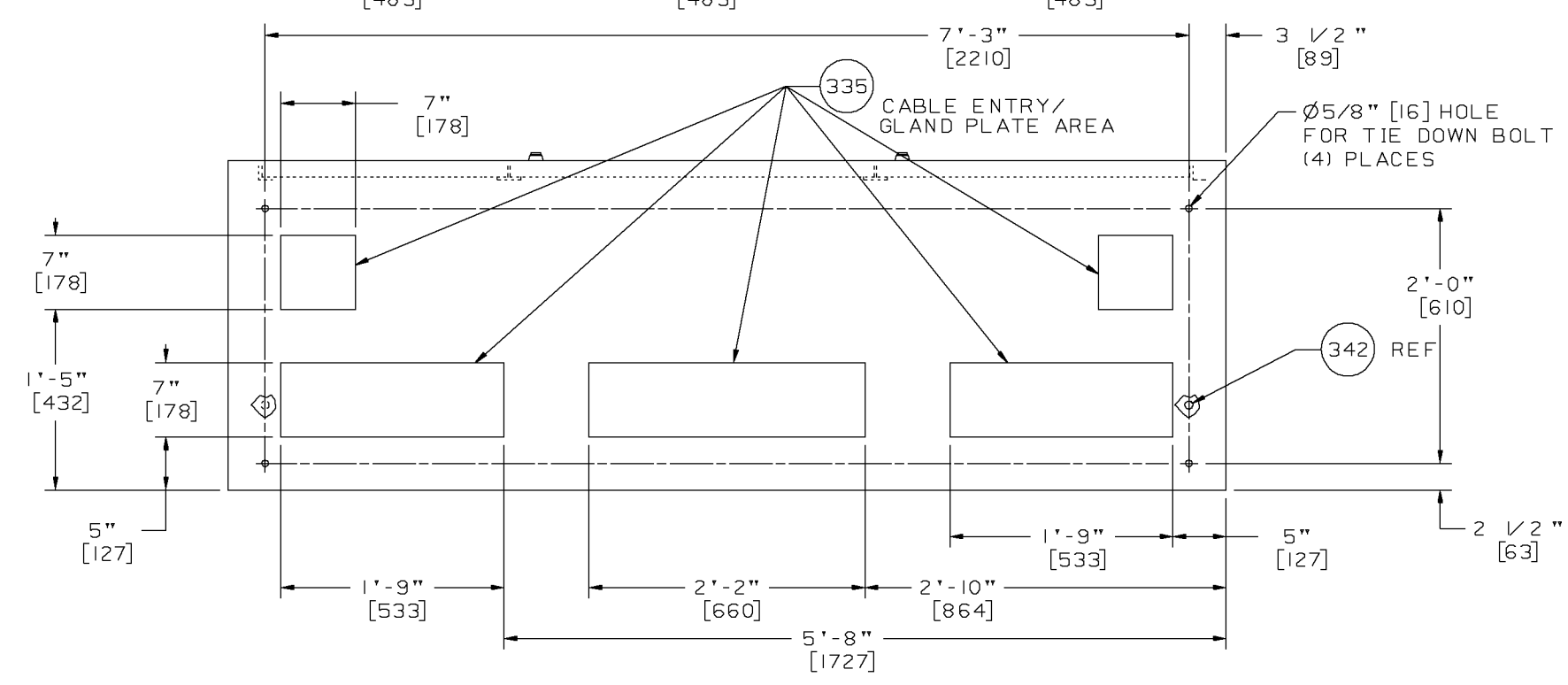
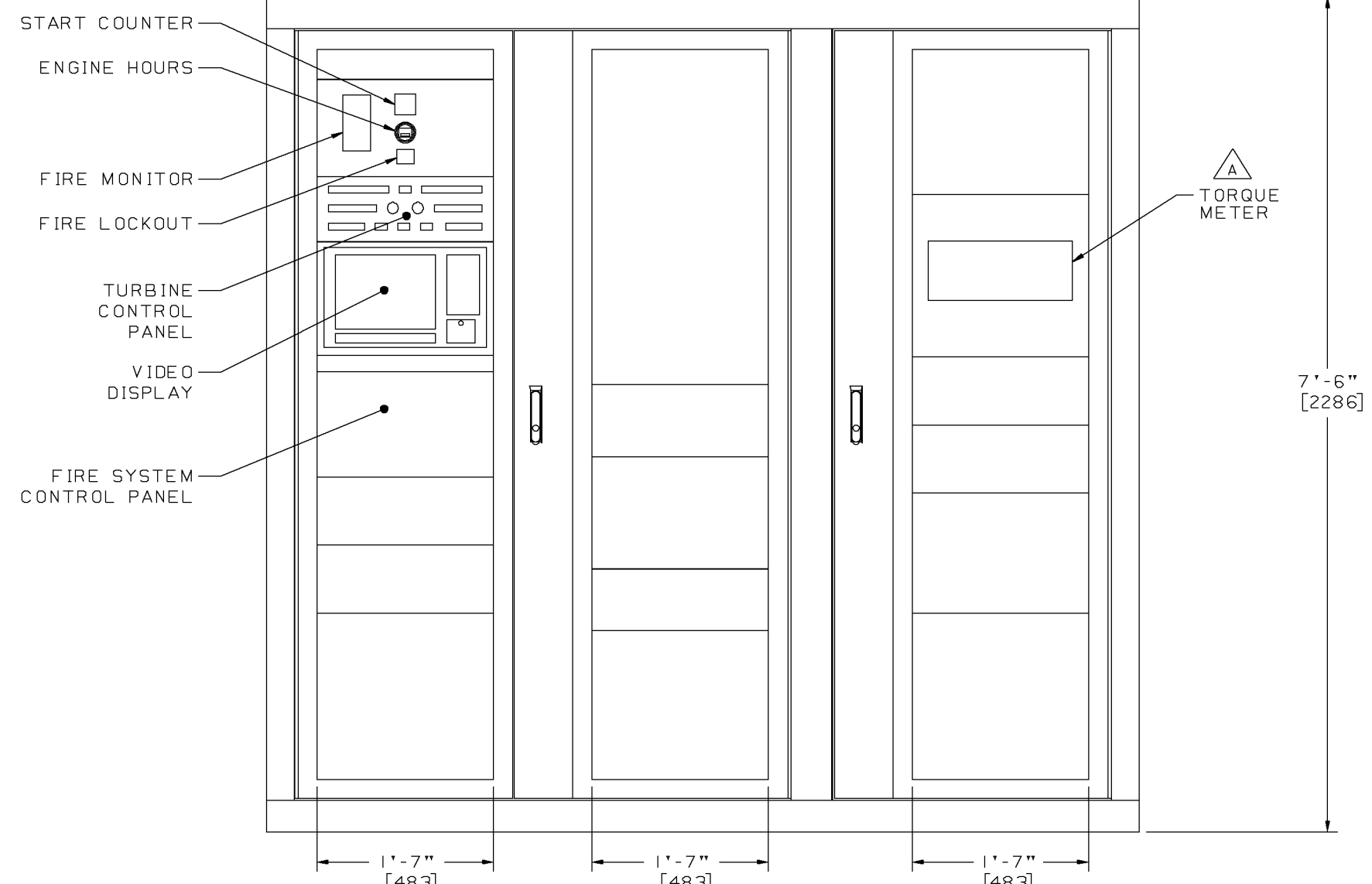
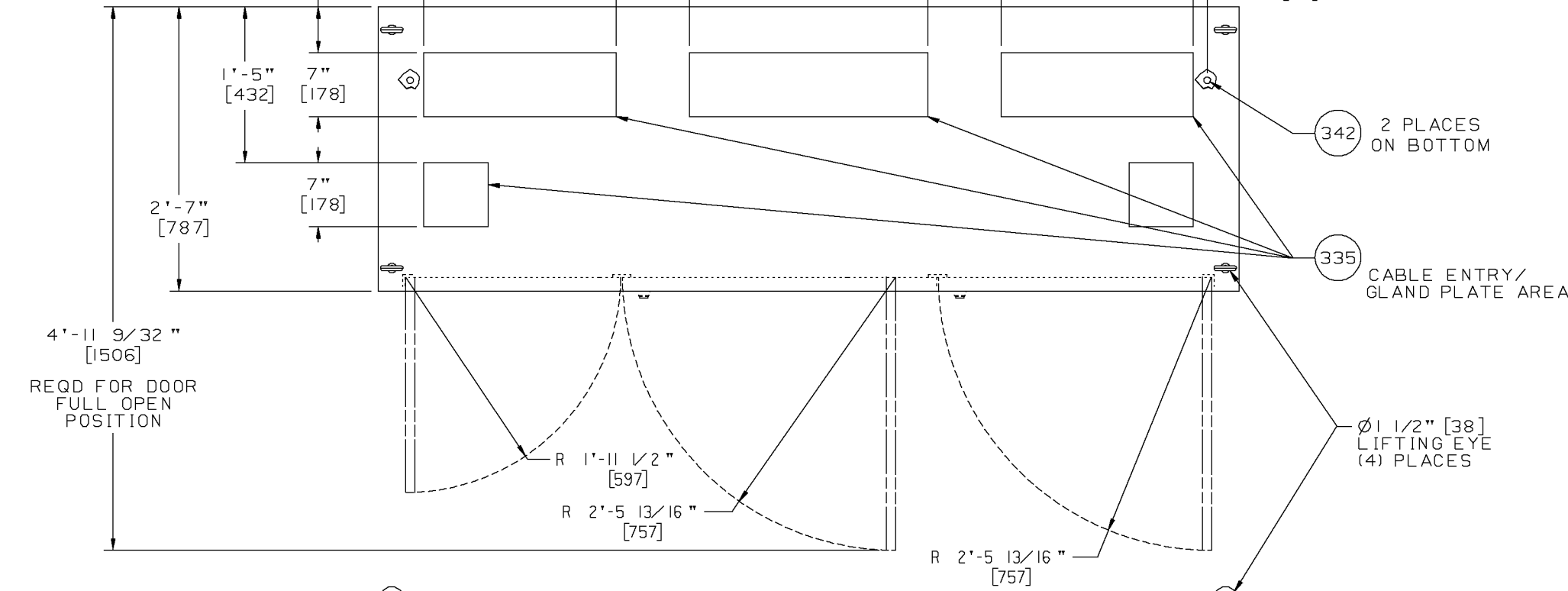
**DETAIL T** [61]  
 TIE DOWN SLOT SHIM ONLY UNDER SPECIFIED AREA

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DRAWING NO. 52121-149746

REV A SHEET 6

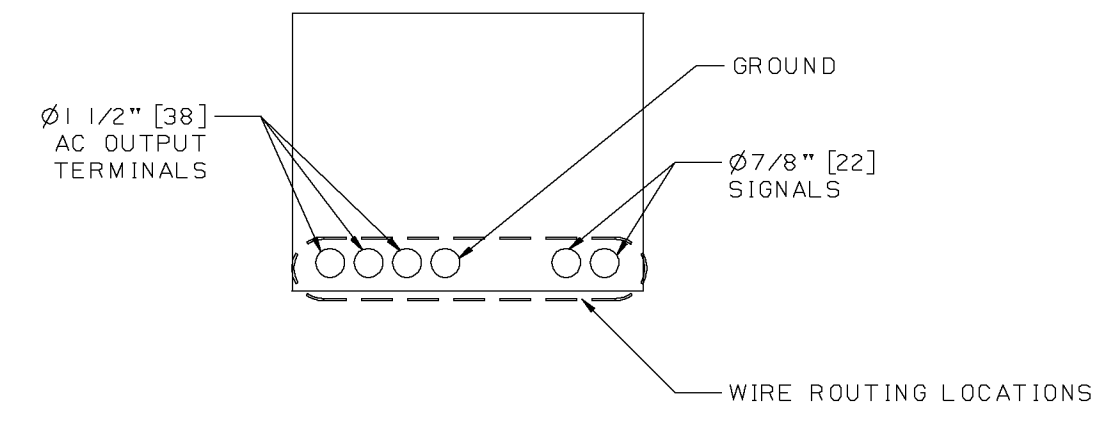
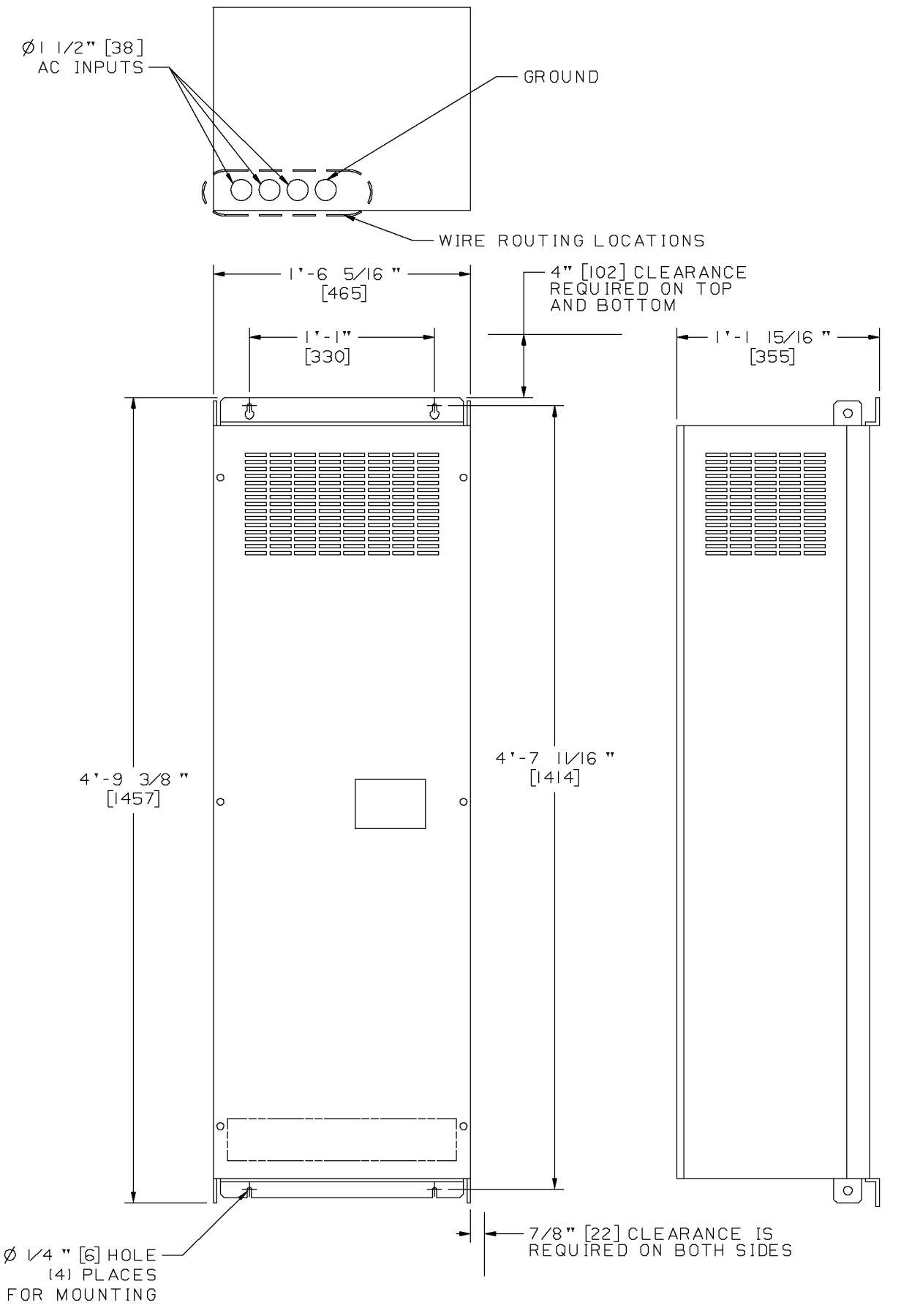
2" [51]  
MINIMUM TO WALL  
REQUIRED FOR VENTILATION



UNIT CONTROL CONSOLE 2.1 6.3

TABLE 1 (CONTINUED) - EXTERNAL CONNECTIONS

ITEM	DESCRIPTION	REFERENCE NOTE	ZONE
335	DC VOLTS, CONTROL CONSOLE	6.3	C/76
342	GROUND, CONSOLE FRAME BUS BAR	6.2	G/75



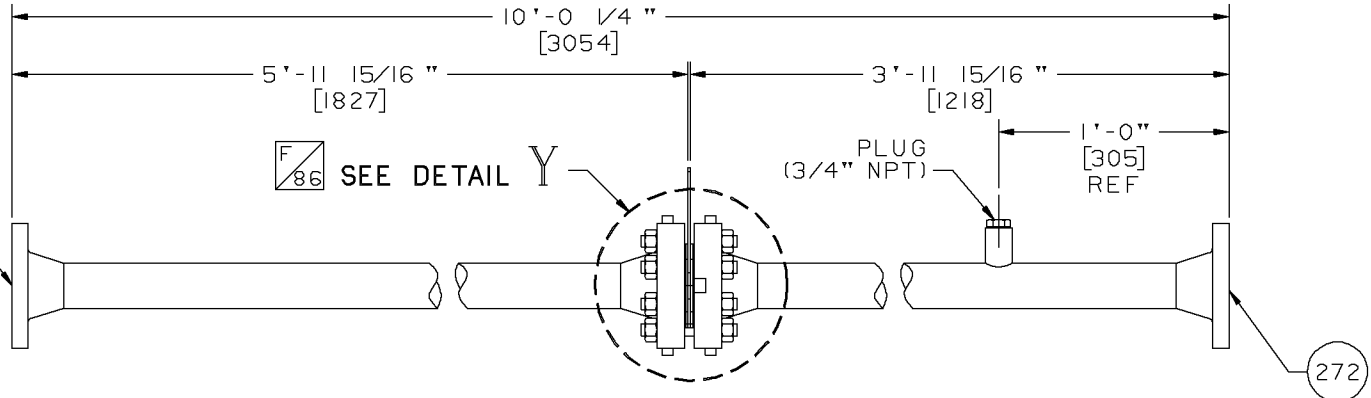
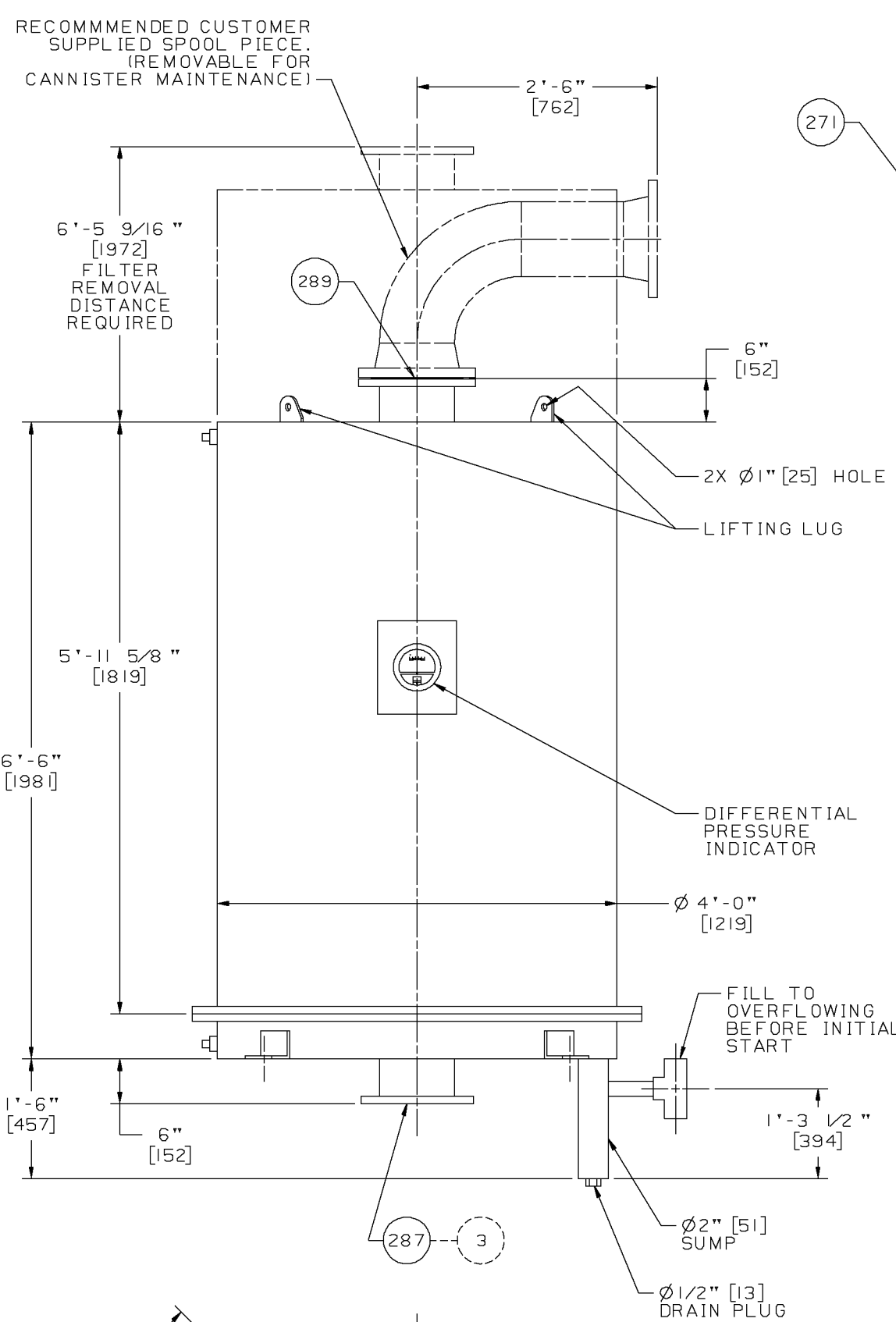
VARIABLE FREQUENCY DRIVE 2.1 3.1  
APPROXIMATE WEIGHT: 212 LBS [96 KG]  
DAC START SYSTEM MOTOR

**Solar Turbines**  
A Caterpillar Company

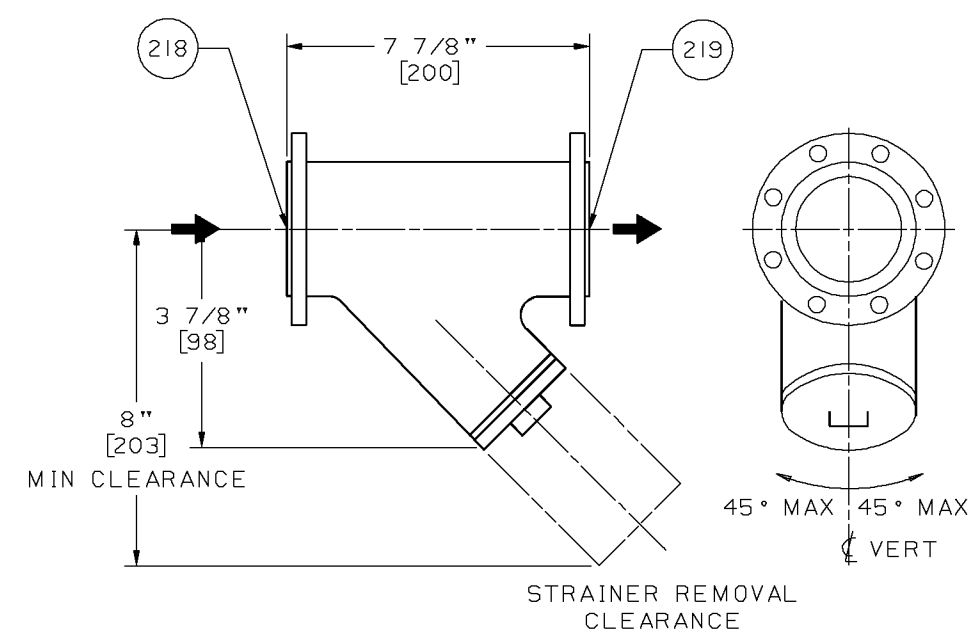
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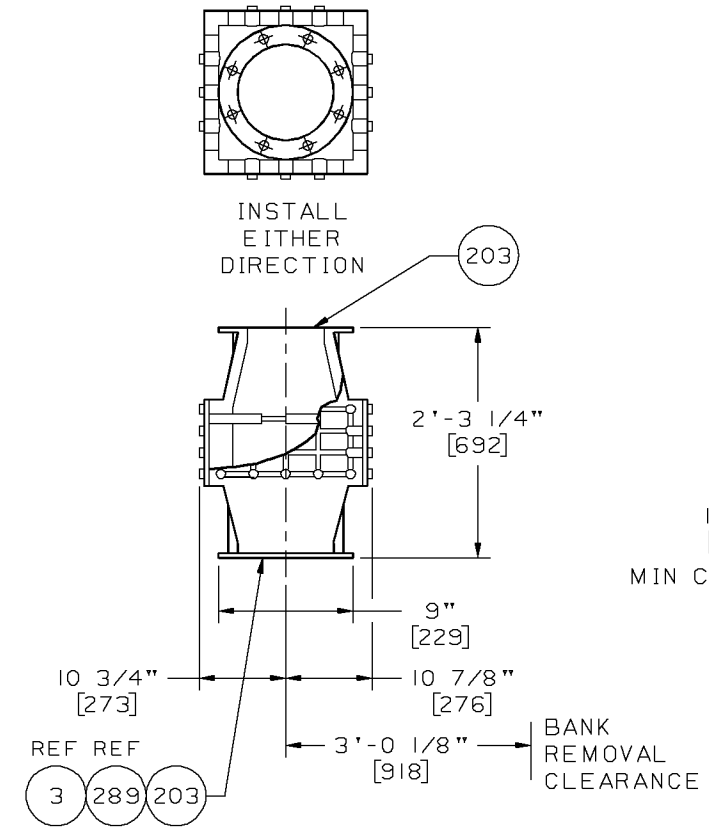
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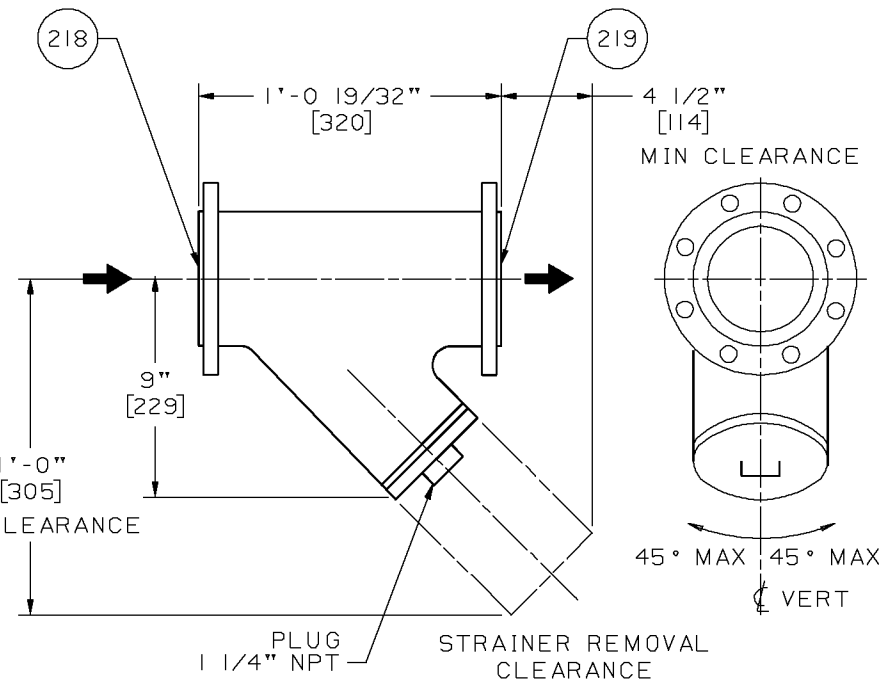
**FLOW METER RUN, GAS FUEL SYSTEM** 2.1  
 APPROXIMATE WEIGHT: 230 LBS [104 KG]  
 (RTD AND TRANSMITTERS PROVIDED)



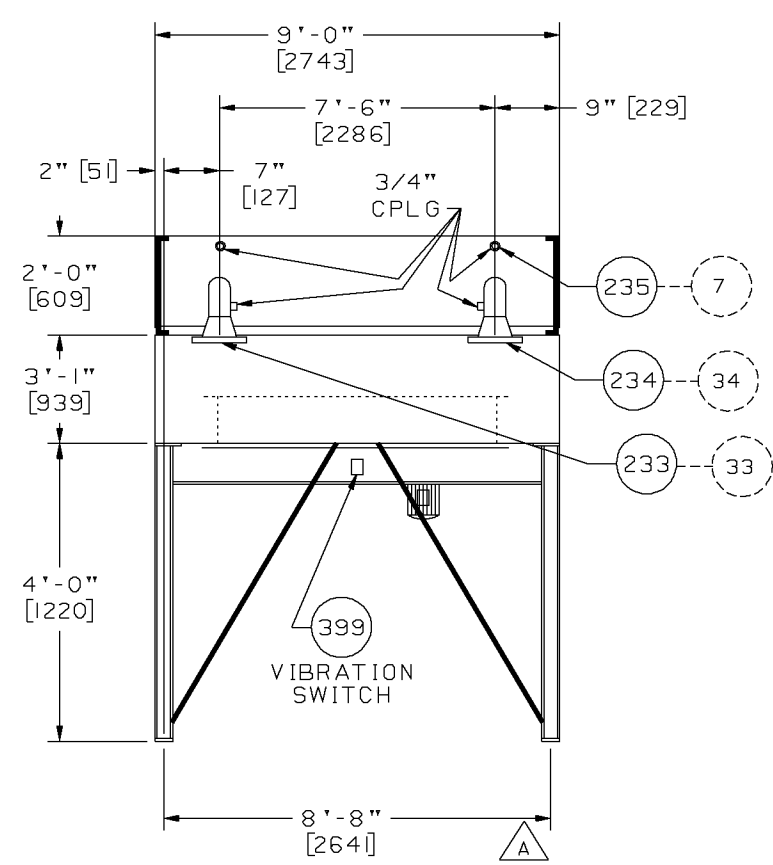
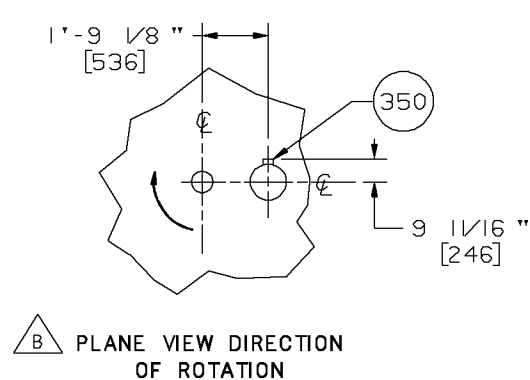
**FLANGED STRAINER** 2.1, 2.18  
 PNEUMATIC POST LUBE  
 NOTE: STRAINER IS INSTALLED EXTERNAL TO PACKAGE



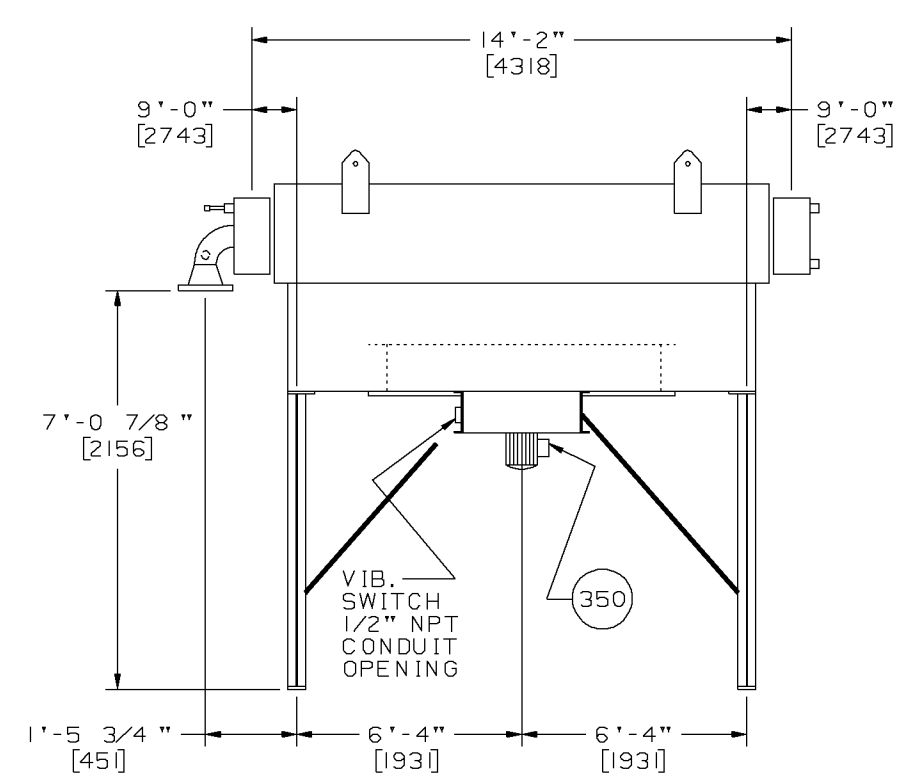
**FLAME ARRESTOR** 2.1, 5.7, 5.3  
 APPROXIMATE WEIGHT: 185 LBS [84 KG]  
 LUBE OIL TANK VENT



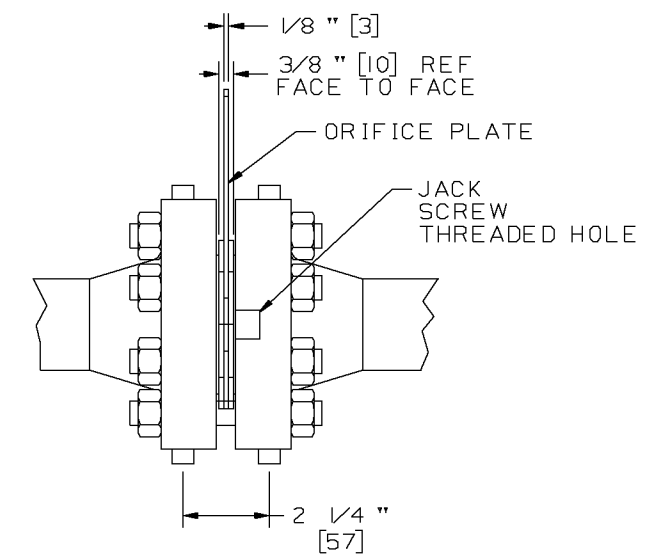
**FLANGED STRAINER** 2.1, 2.18  
 GAS FUEL SYSTEM INLET  
 NOTE: STRAINER IS INSTALLED EXTERNAL TO PACKAGE



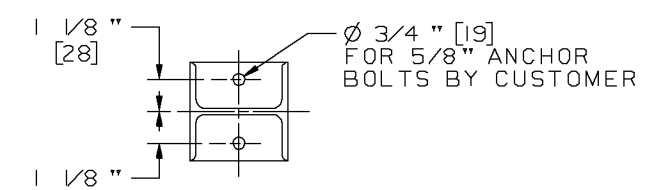
2.1 2.18



**LUBE OIL COOLER**  
 APPROXIMATE WEIGHT: 9,050 LBS [4105 KG]



**DETAIL Y** H 85



**ANCHOR BOLT LAYOUT**

**TABLE 1 - EXTERNAL CONNECTIONS (CONTINUED)**

ITEM	DESCRIPTION	REFERENCE NOTE	ZONE
203	FLAME ARRESTOR, LUBE OIL TANK VENT	8" 125 LB ANSI FF FLANGE	5.7 E/84
218	FLANGED STRAINER INLET (GAS FUEL)	3" 300 LB ANSI RF FLANGE	2.18 F/82
219	FLANGED STRAINER OUTLET (GAS FUEL)	3" 300 LB ANSI RF FLANGE	2.18 F/81
233	LUBE OIL COOLER OIL INLET	4" 150 LB ANSI RF FLANGE	5.2 B/84
234	LUBE OIL COOLER OIL OUTLET	4" 150 LB ANSI RF FLANGE	5.2 B/84
235	OIL COOLER VENT RETURN TO TANK	3/4" NPT FEMALE CONDUIT	B/84
271	FUEL FLOW METER RUN INLET	3" 300 LB ANSI RF FLANGE	H/86
272	FUEL FLOW METER RUN OUTLET	3" 300 LB ANSI RF FLANGE	G/83
287	LUBE OIL MIST ELIMINATOR INLET	8" 150 LB ANSI RF FLANGE	5.3, 5.6 C/87
289	LUBE OIL MIST ELIMINATOR OUTLET	8" 150 LB ANSI RF FLANGE	5.3, 5.6, 10.2 F/88
350	AC VOLTS, LUBE OIL COOLER MOTOR	1 1/4" NPT FEMALE CONDUIT	5.8 D/85
399	DC VOLTS, LUBE OIL COOLER VIBRATION SWITCH	1/2" NPT FEMALE CONDUIT	A/85
218	FLANGED STRAINER INLET PNEUMATIC POST LUBE IN	1" 300 LB ANSI RF FLANGE	F/85
219	FLANGED STRAINER OUTLET PNEUMATIC POST LUBE OUT	1" 300 LB ANSI RF FLANGE	F/84

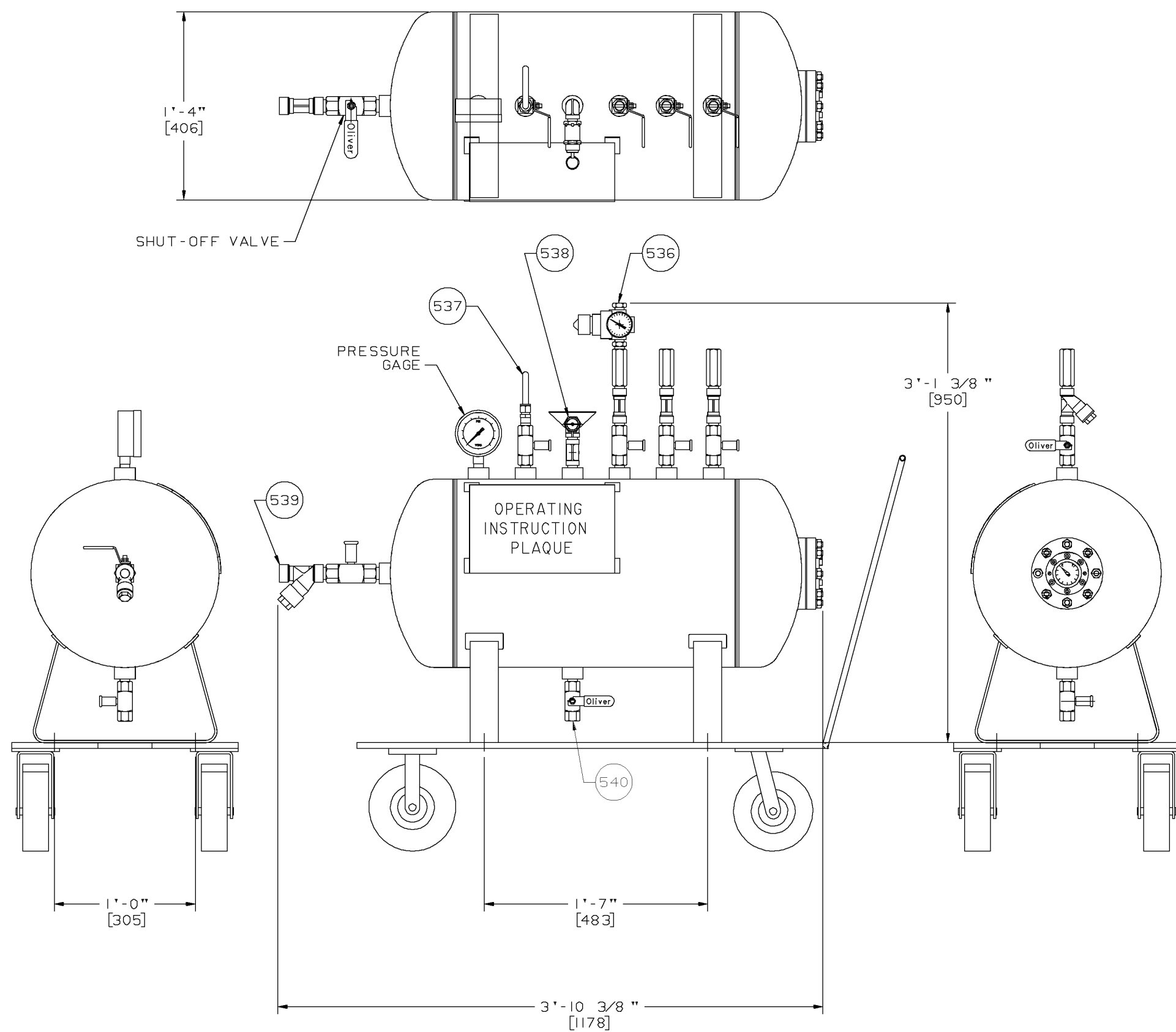
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88A 87A 86A 85A 84A 83A 82A 81A

TABLE 1 - EXTERNAL CONNECTIONS (CONTINUED)

ITEM	DESCRIPTION	REFERENCE NOTE	ZONE
536	ON-LINE/CRANK CLEANING TANK AIR SUPPLY	9.3	G/86A
537	ON-LINE/CRANK CLEANING TANK VENT		G/87A
538	ON-LINE/CRANK CLEANING TANK FLUID INLET		G/86A
539	ON-LINE/CRANK CLEANING TANK FLUID OUTLET		F/87A
540	ON-LINE/CRANK CLEANING TANK DRAIN		E/86A



**△ ON-CRANK/ON-LINE WATER WASH CART**  
 APPROXIMATE NET WEIGHT: 140 LBS (64 KG)

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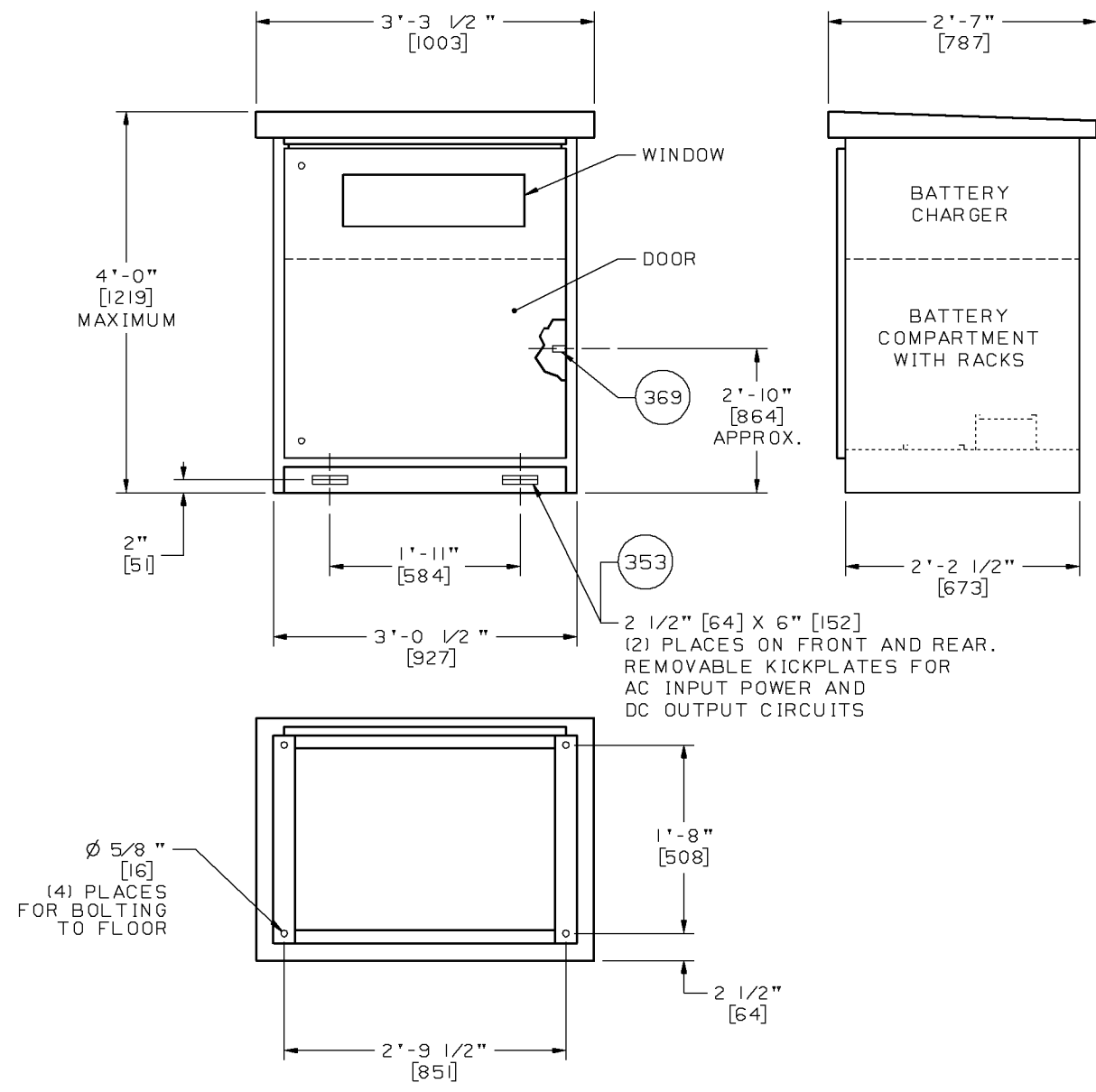
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88B 87B 86B 85B 84B 88B 82B 81B

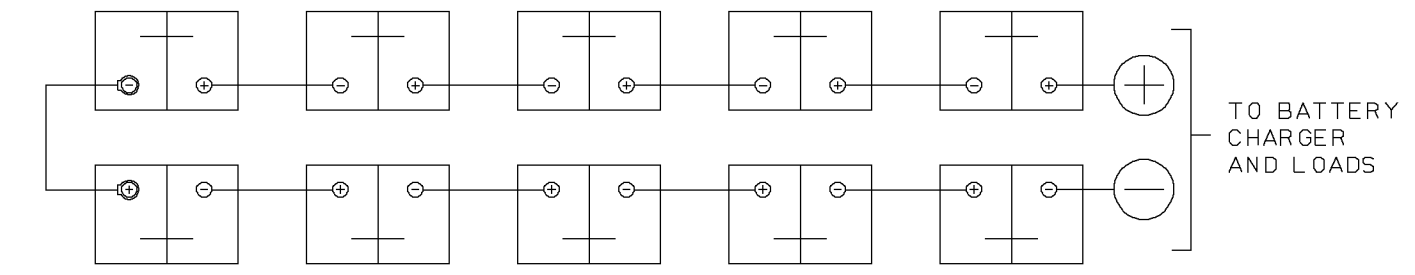
**TABLE 1 - EXTERNAL CONNECTIONS (CONTINUED)**

ITEM	DESCRIPTION	REFERENCE NOTE	ZONE
363	GROUND STUD	3/8"-16 UNC THREAD	6.2
353	AC VOLTS, BATTERY CHARGER		6/87B



**24 VDC BATTERY CHARGER ASSEMBLY**

APPROXIMATE WEIGHT: 330 LBS [150 KG]  
 APPROXIMATE WEIGHT W/BATTERIES: 552 LBS [251 KG]  
 NOTE: ALLOW 2" [50] BEHIND ENCLOSURE AND  
 10" [250] ABOVE ENCLOSURE FOR VENTILATION  
 (SUITABLE FOR OUTDOOR USE)



**24 VDC BATTERY LAYOUT, NI-CAD (214AH)**

CONTROLS SYSTEM  
 HEIGHT = 15.9" [404] WIDTH = 7.7" [196] LENGTH = 6.2" [157] PER CELL BLOCK  
 APPROXIMATE WEIGHT: 21.8 LBS [10 KG] PER CELL BLOCK (10 BLOCKS)  
 APPROXIMATE TOTAL WEIGHT: 222 LBS [101 KG]

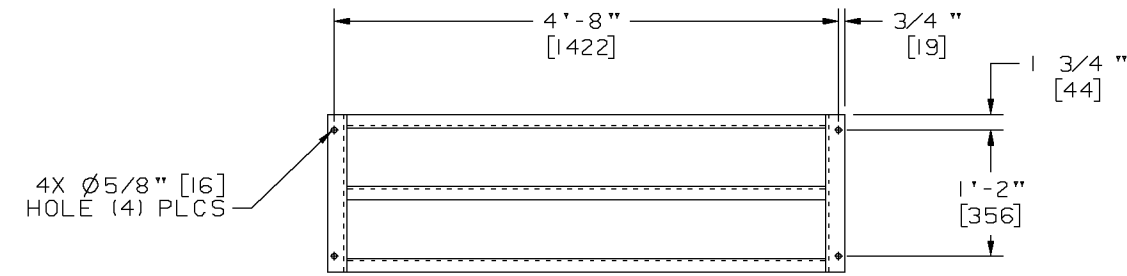
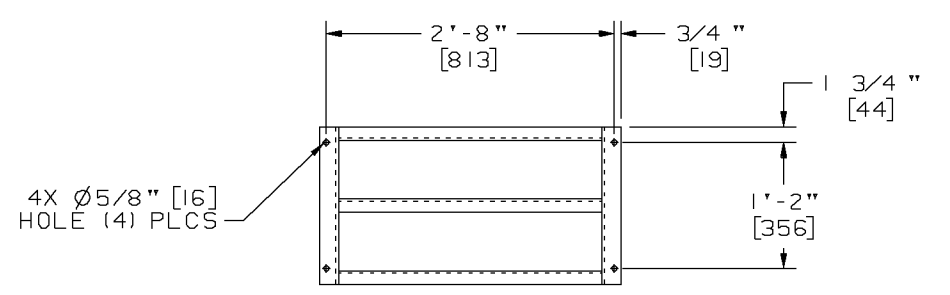
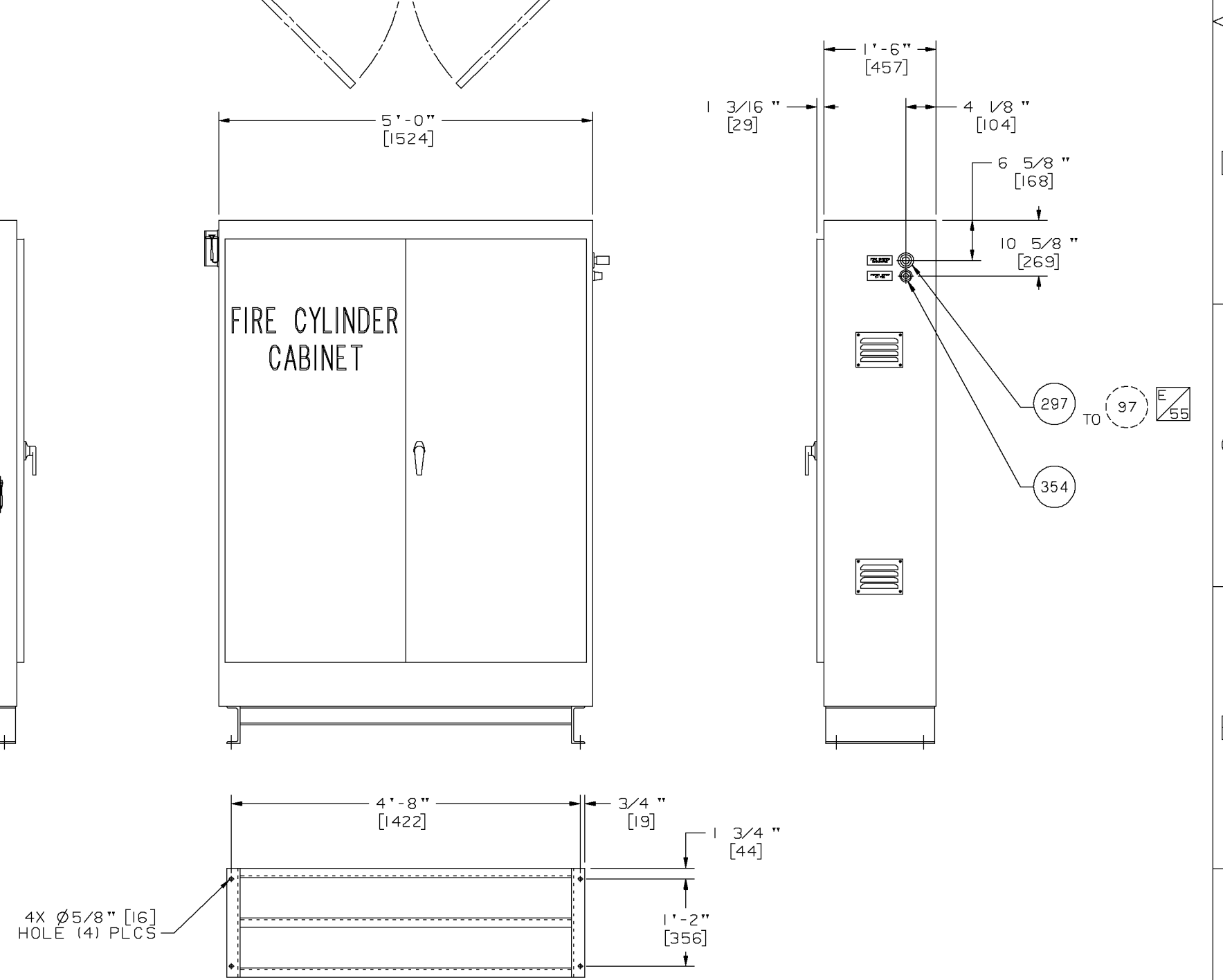
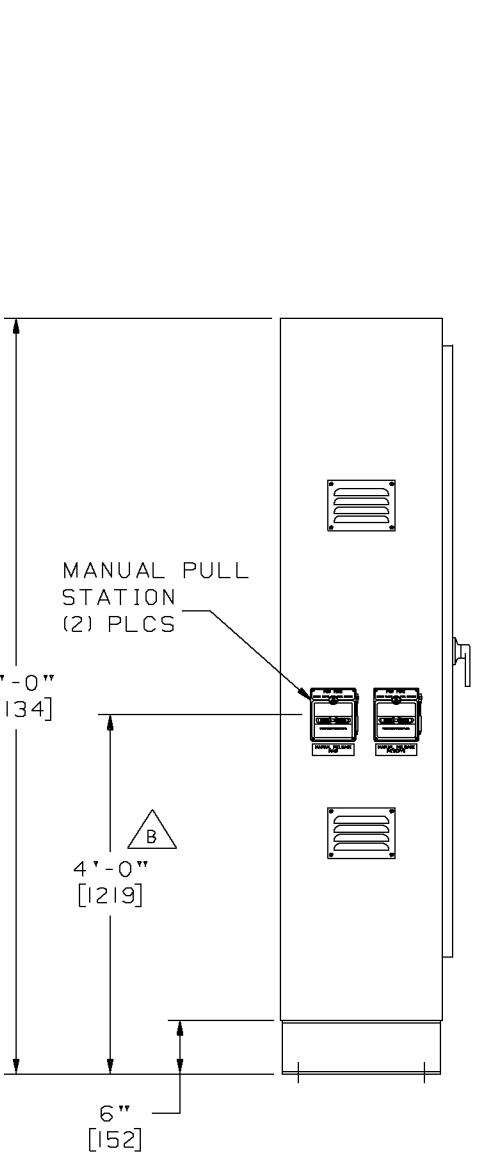
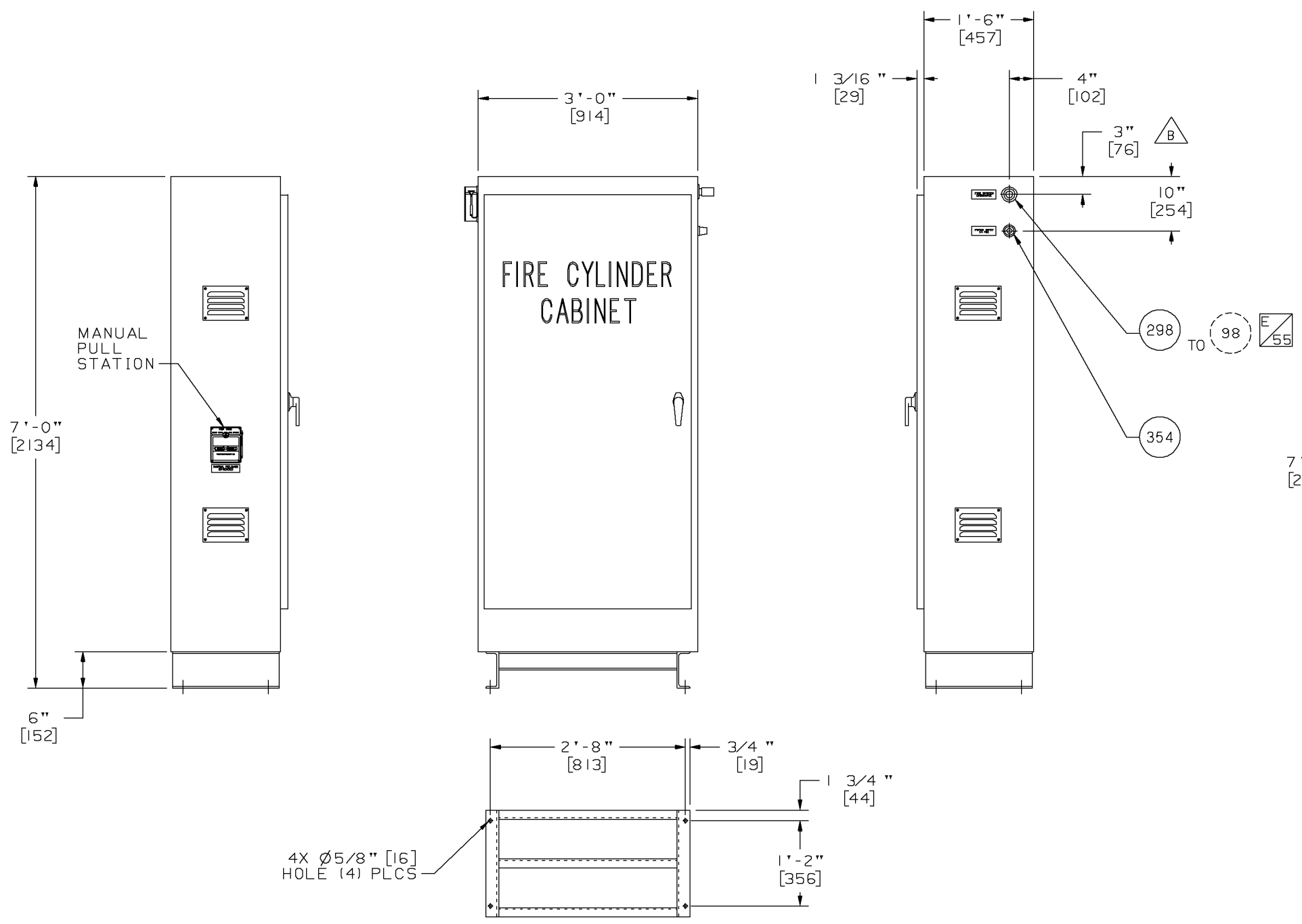
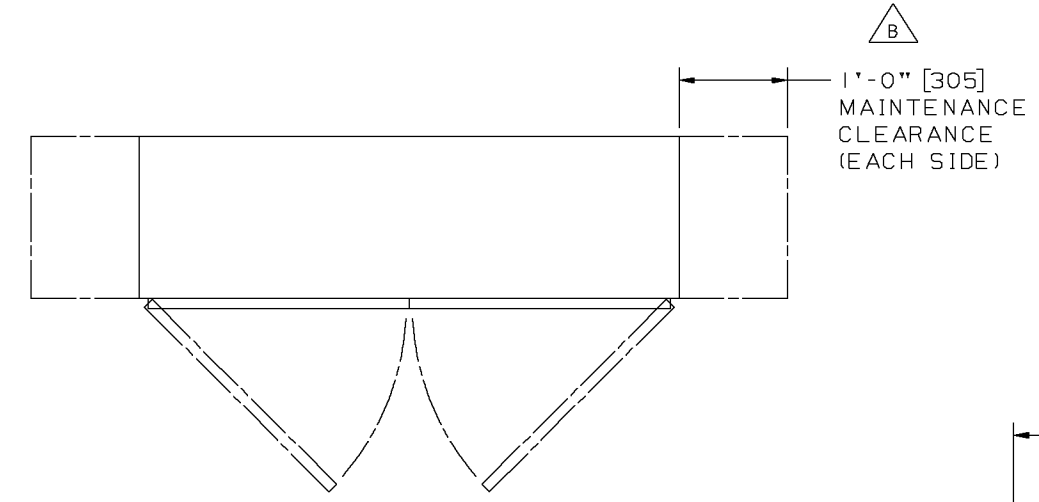
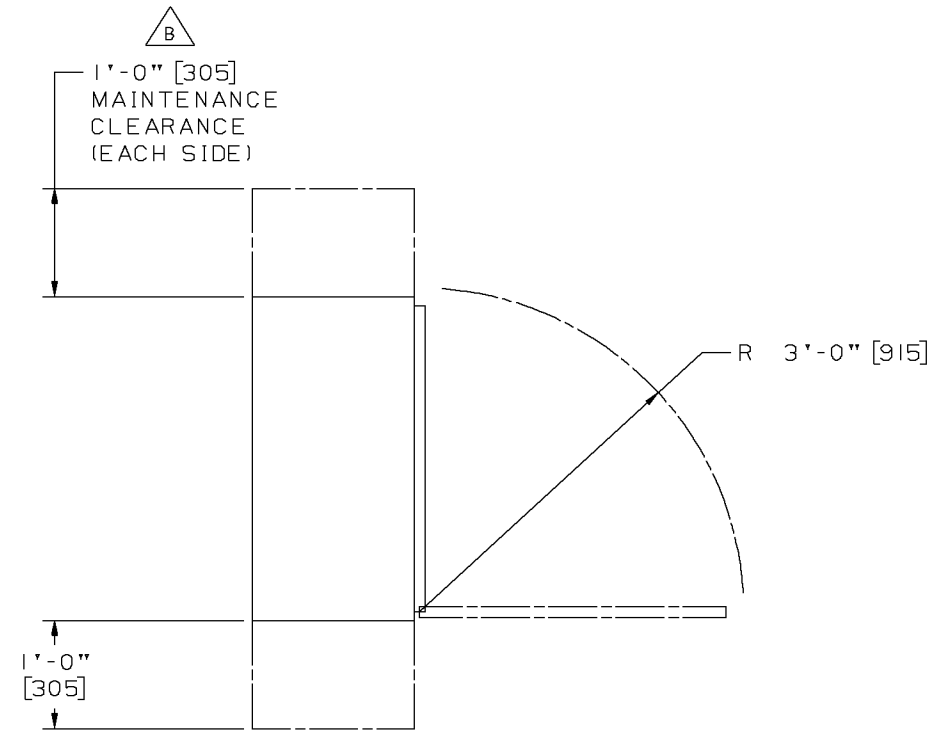
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DRAWING NO. 52121-149746  
 REV A  
 SHEET 8B

98 97 96 95 94 93 92 91

**TABLE 1 - EXTERNAL CONNECTIONS (CONTINUED)**

ITEM	DESCRIPTION	REFERENCE NOTE	ZONE
297	FIRE EXTINGUISHANT DISCHARGE - PRIMARY	1" NPT FEMALE CONDUIT	8.1 C/91
298	FIRE EXTINGUISHANT DISCHARGE - EXTENDED	1/2" NPT FEMALE CONDUIT	8.1 C/95
354	DC VOLTS, FIRE SYSTEM	1/2" NPT FEMALE CONDUIT	C/91 C/95



**FIRE CYLINDER CABINET (EXTENDED)** 2.1 8.1  
 (2) 100 LB CYLINDERS  
 APPROXIMATE WEIGHT: 900 LBS [408 KG]

**FIRE CYLINDER CABINET (PRIMARY)** 2.1 8.1  
 (4) 100 LB CYLINDERS  
 APPROXIMATE WEIGHT: 1,440 LBS [635]

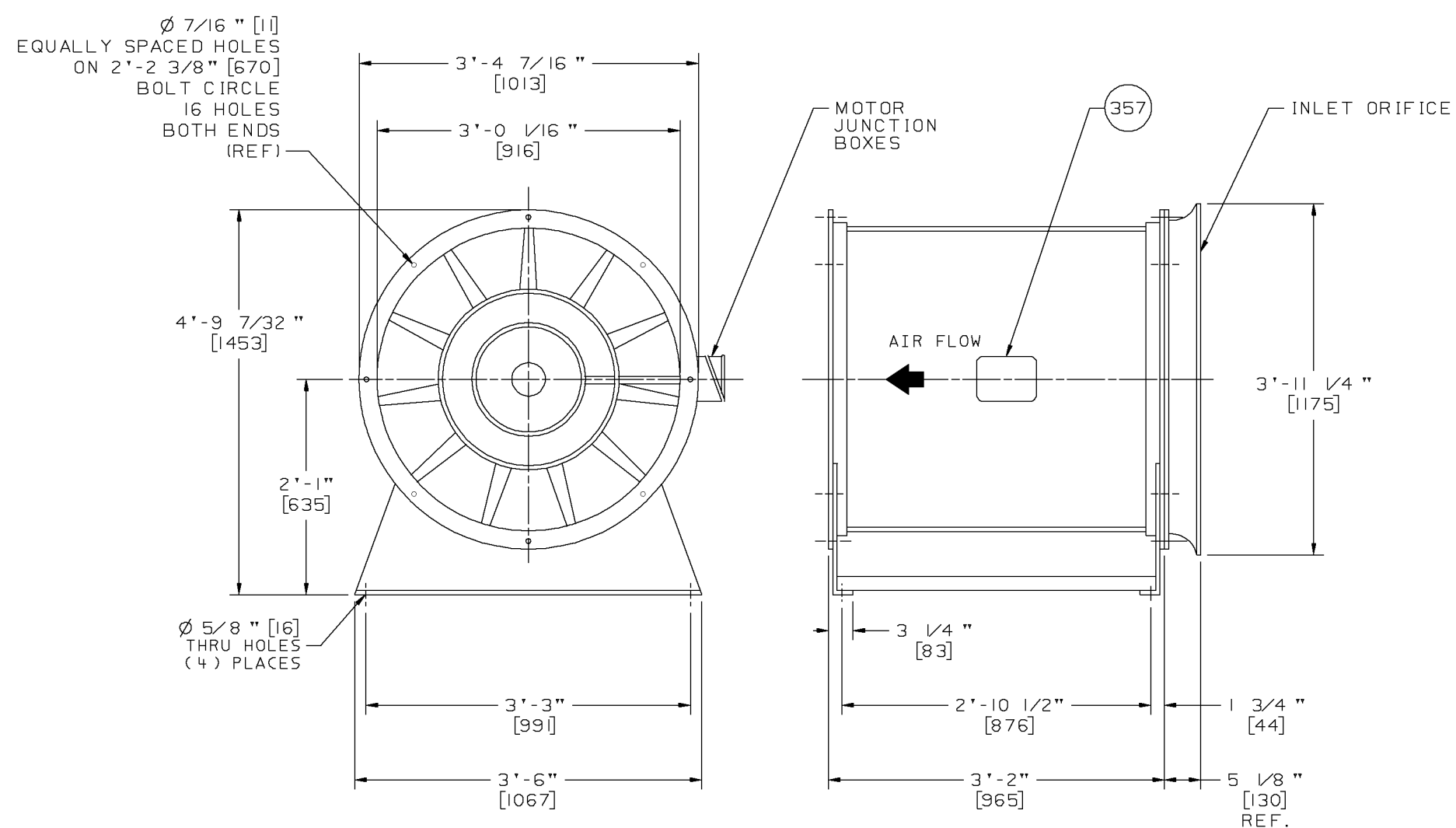
**Solar Turbines**  
 A Caterpillar Company

DRAWING NO. 52121-149746  
 REV B  
 SHEET 9

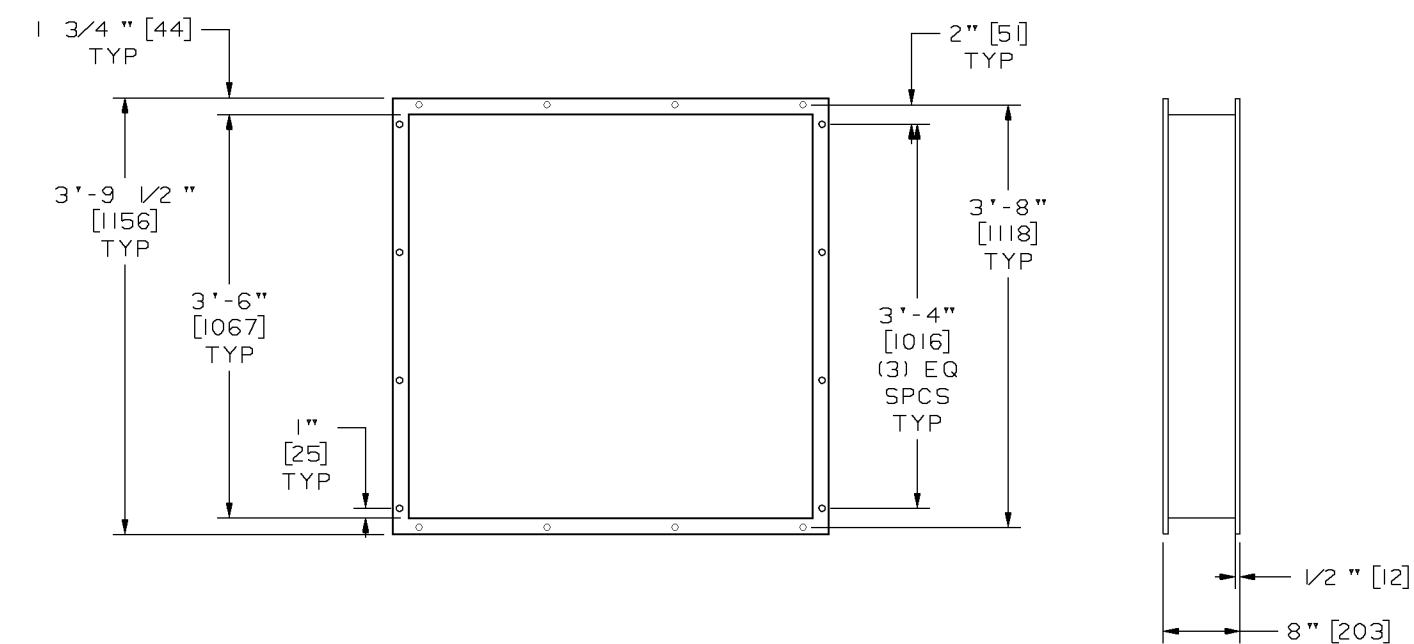
98A 97A 96A 95A 94A 93A 92A 91A

TABLE 1 - EXTERNAL CONNECTIONS (CONTINUED)

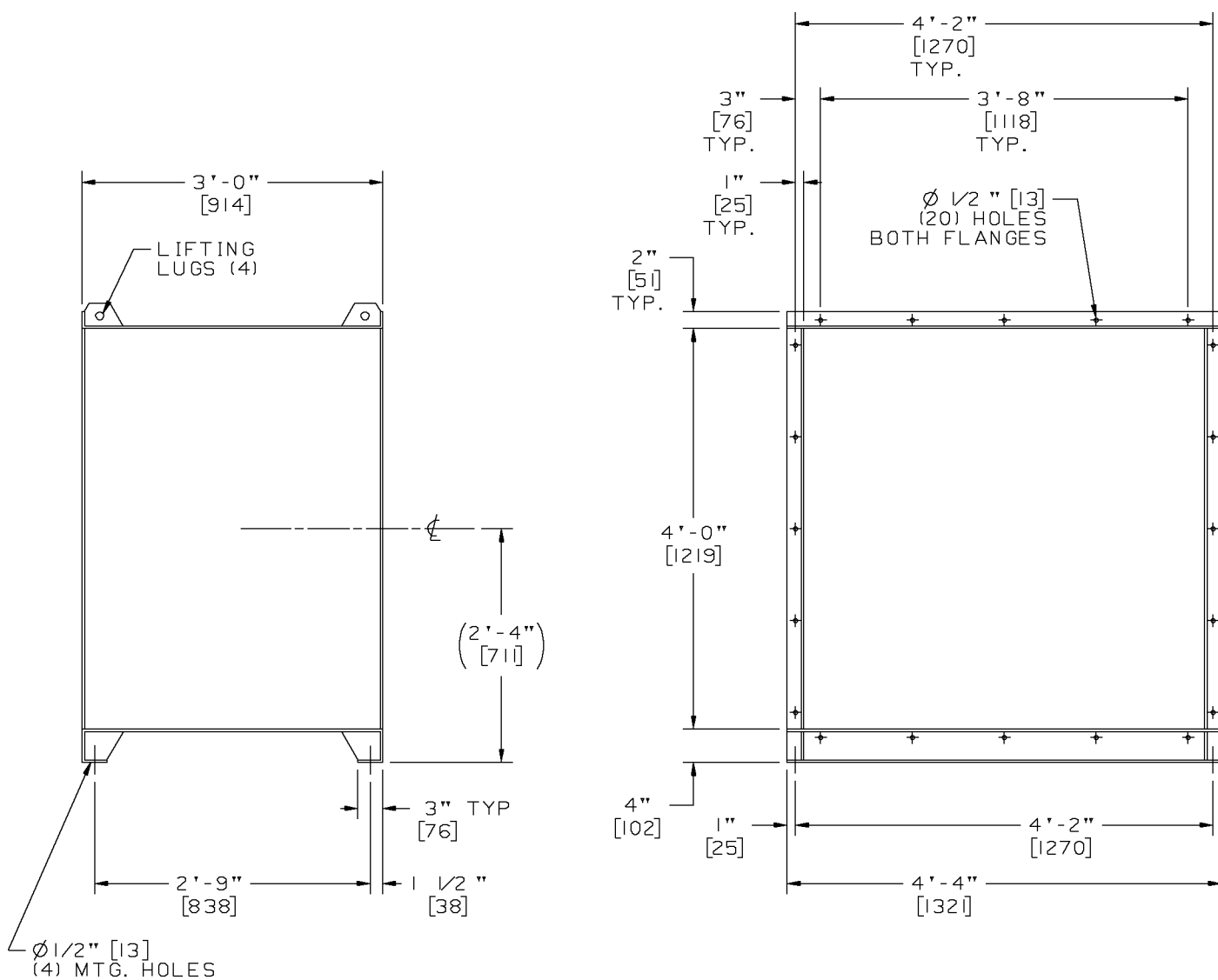
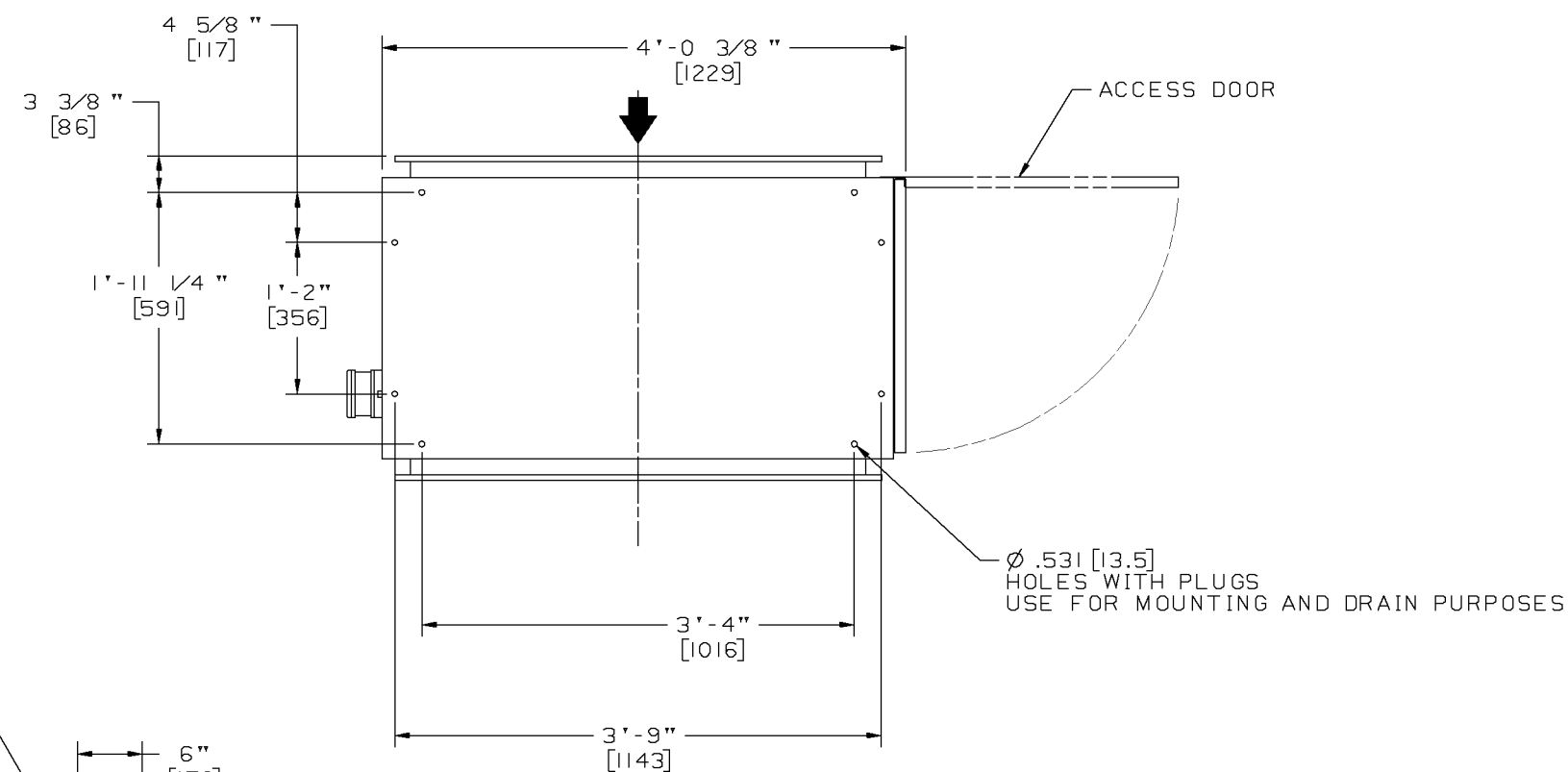
ITEM	DESCRIPTION	REFERENCE NOTE	ZONE
957	AC VOLTS, ENCLOSURE VENT FAN	1 1/4" NPT CONDUIT FEMALE	8.4
979	DC VOLTS, ENCLOSURE VENT PRESSURE SWITCH	1/2" NPT CONDUIT FEMALE	D/94B



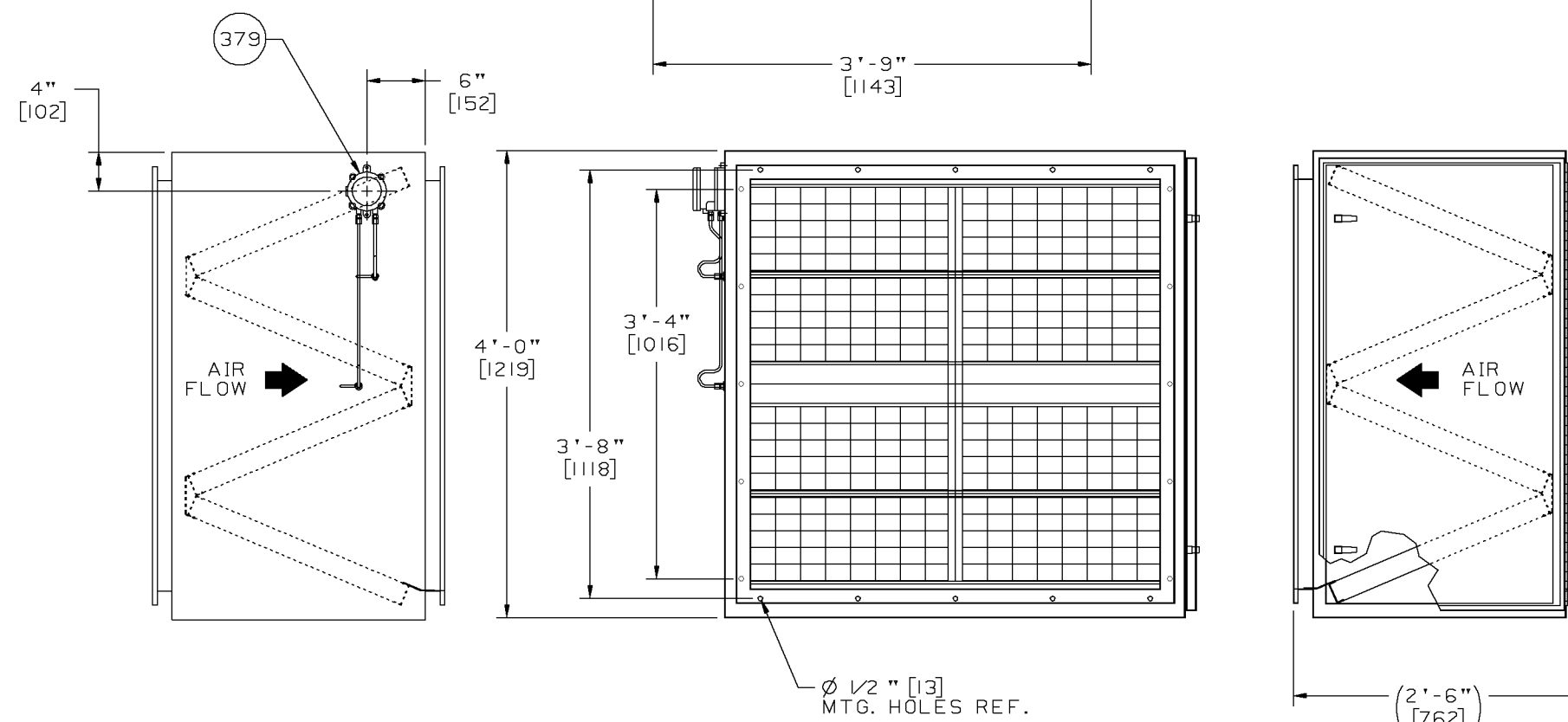
ENCLOSURE VENT FAN  
APPROX. WT. 800 LBS [363 KG]



FIRE DAMPER DETAIL



ENCLOSURE VENT SILENCER DETAIL  
APPROX. WT. 700 LBS [318]  
(AIR INLET & EXH SILENCER ARE THE SAME)



ENCLOSURE VENT FILTER DETAIL  
APPROX. WT. 200 LBS [91 KG]

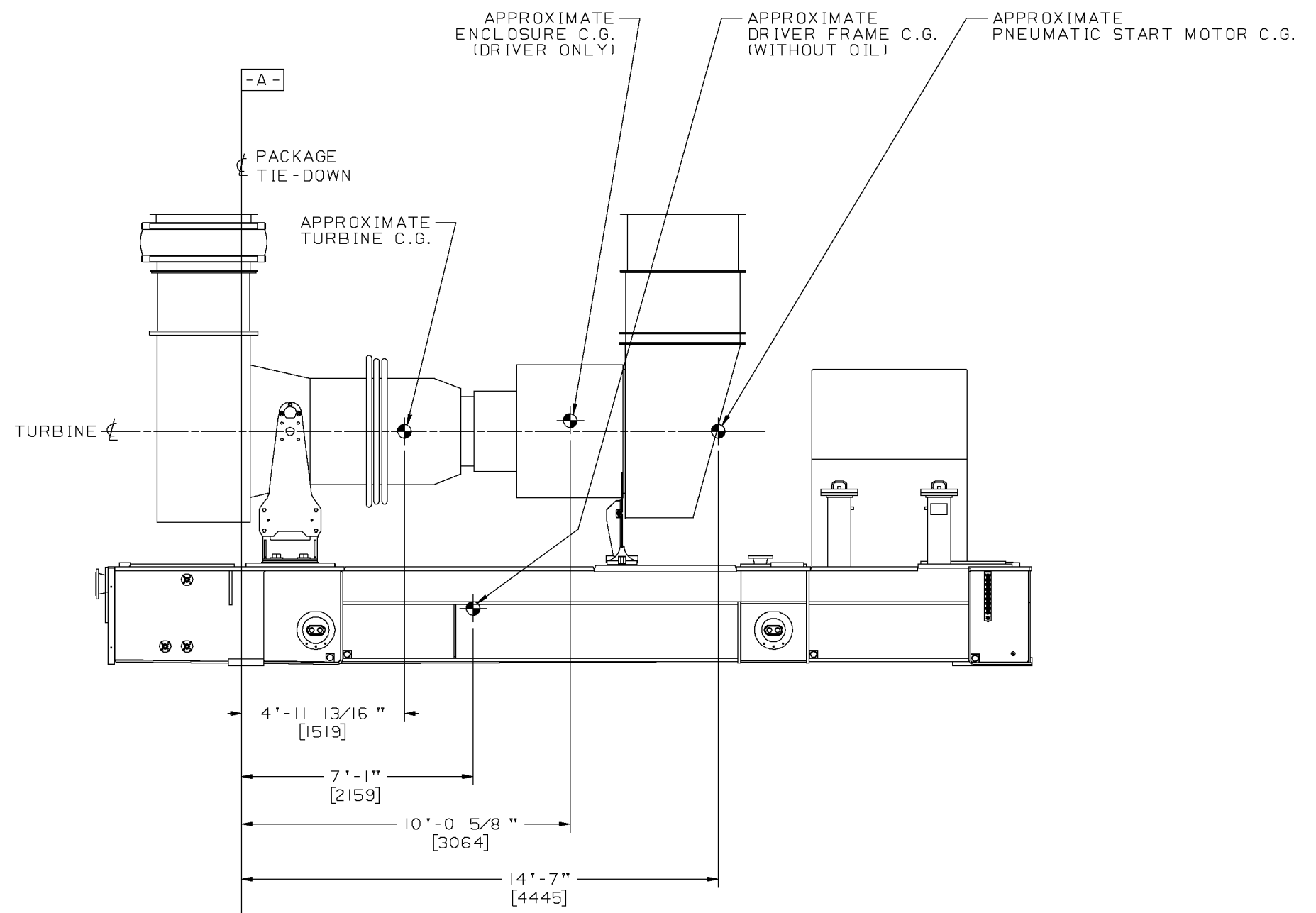
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A Caterpillar Company

DRAWING NO. 52121-149746 REV B SHEET 9A

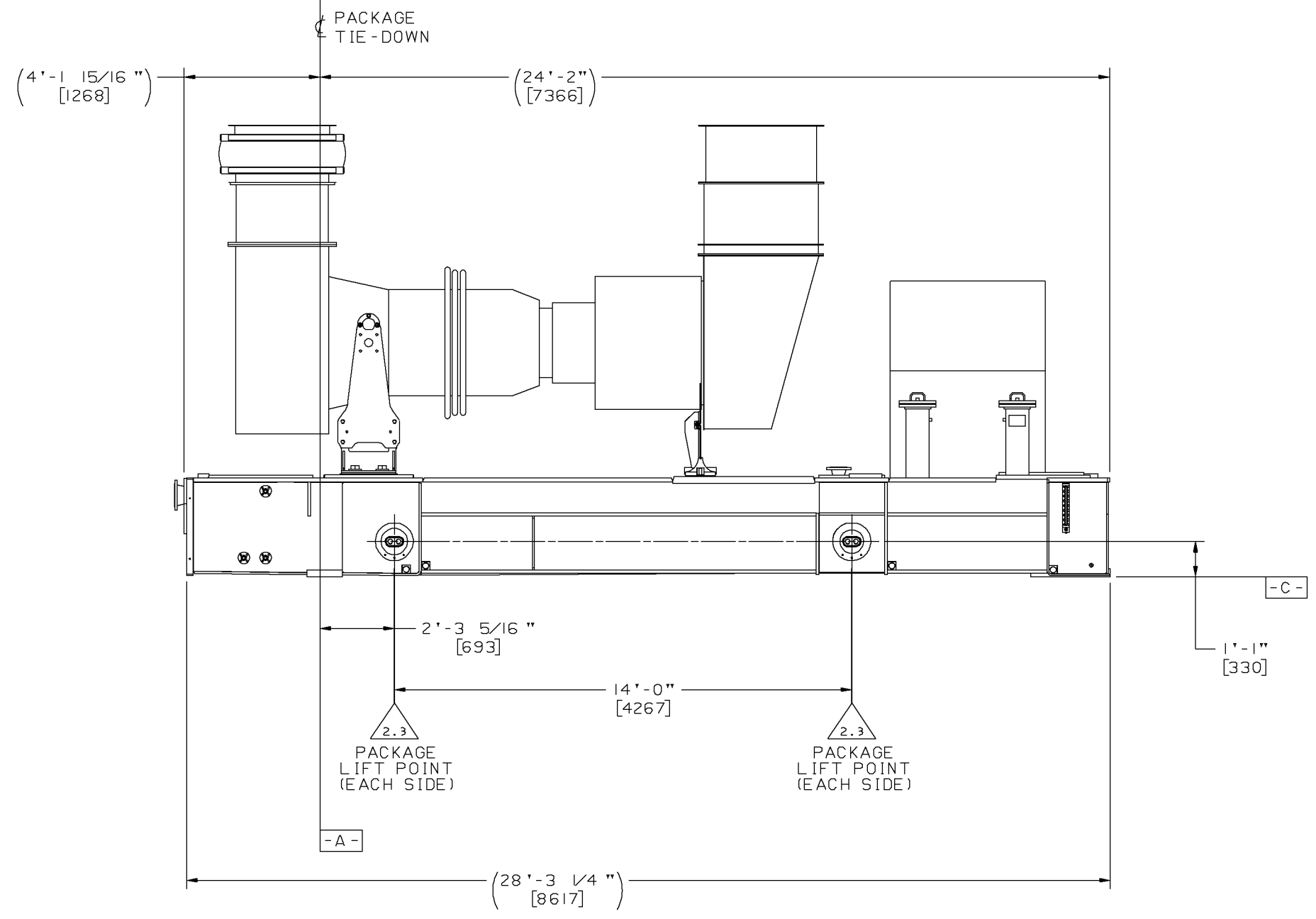
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108 107 106 105 104 103 102 101

H  
G  
F  
E  
D  
C  
B  
A



**CENTER OF GRAVITY INFORMATION**  
NOTE: ENGINE C.G. LOCATION WILL VARY DEPENDING ON ACCESSORIES INSTALLED



**LIFT POINT INFORMATION**

**Solar Turbines**  
A Caterpillar Company

DRAWING NO.	REV
52121-149746	10
SHEET	10

**EQUIPMENT ALIGNMENT**

**PRELIMINARY ALIGNMENT CONSIDERATIONS:**

**PRELIMINARY ALIGNMENT CHECKS ARE ESSENTIAL. THEY MUST BE COMPLETED BEFORE ALIGNMENT**

THIS ALIGNMENT PROCEDURE ASSUMES THAT NO SOFT FOOT OR SHORT FOOT CONDITION EXISTS ON ANY OF THE MACHINES AND THE BASE(S) HAVE BEEN QUALIFIED IN ACCORDANCE WITH SOLAR QUALITY ASSURANCE PROCEDURES. DIAL INDICATORS ARE CALIBRATED AND IN GOOD WORKING ORDER.

**BASE LEVELING PROCEDURE:**

THE PURPOSE OF LEVELING BASE IS TO PLACE THE BASE IN THE SAME POSITION AS DURING FACTORY ALIGNMENT AND TESTING. BASE/PACKAGE LEVELING IS ACCOMPLISHED BY ADJUSTING BASE JACKING BOLTS ON EACH SIDE OF THE BASE.

**SEPARATE SKIDS: (FOR 2 PIECE SKIDS ONLY)**

DRIVER AND DRIVEN SHOULD NOT BE BOLTED TOGETHER AT THIS TIME. THE INTERFACE PADS SHOULD ONLY BE TOUCHING. WHEN THE DRIVER AND DRIVEN SKIDS ARE SHIPPED FROM THE FACTORY BOLTED TOGETHER, THE PACKAGE IS CONSIDERED ONE PIECE AND SHOULD NOT BE UNBOLTED. THE FINAL LEVELING SEQUENCE SHOULD BE FOLLOWED IN BOTH SITUATIONS.

**FINAL LEVELING:**

LEVEL DRIVEN BASE FIRST AND THEN BRING LEVELED DRIVER TO DRIVEN SKID FOR MATING.

USE A PRECISION LEVEL OF .0005" (.0127) RESOLUTION OR EQUIVALENT ON THE MACHINED MOUNTING PAD SURFACES. THE LEVELING TOOL MUST BE CAPABLE OF MEASURING THE REQUIRED TOLERANCES ON THE MOUNTING PADS. THE BASE/PACKAGE IS CONSIDERED LEVEL WHEN THE MACHINED PADS AT THE CONTACT AREA UNDER THE ENGINE ARE LEVEL WITHIN .005" (.0127). SHIMS MAY BE USED UNDER THE BASE MOUNTING PADS AT THE JACKING BOLT LOCATIONS TO ACHIEVE EQUIPMENT PAD LEVELING.

**JOINING THE DRIVER AND DRIVEN SKID: (FOR 2 PIECE SKIDS ONLY)**

AFTER BOTH SKIDS HAVE BEEN LEVELLED, THE TWO CAN BE BOLTED AND TORQUED TOGETHER. USE THE FACTORY INSTALLED DRIVER/DRIVEN MATCH MARKS ON THE INTERFACE PADS AS A GUIDE FOR DRIVER & DRIVEN BASE ALIGNMENT.

**SITE INSTALLATION:**

SECURE THE BASE/PACKAGE TO THE FOUNDATION VIA ANCHOR BOLTS AT ALL BASE TIE-DOWN POINTS AND TORQUE TO THE SPECIFIED VALUE. RECHECK MOUNTING PADS FOR LEVELNESS. PROCEED WITH ROTATING EQUIPMENT ALIGNMENT AND COUPLING FIT.

**PAD CLEANLINESS:**

VERIFY THAT THE SHIMMABLE EQUIPMENT PADS ARE CLEAN AND FREE OF OIL, GREASE AND DEBRIS.

**SHIPPING BRACES:**

REMOVE SHIPPING BRACES BEFORE STARTING ALIGNMENT.

**RUNNING POSITION THRUSTS:**

THE PURPOSE OF "RUNNING POSITION THRUSTS" IS TO PLACE THE ROTORS OF ALL THE MACHINES IN THEIR OPERATING THRUST POSITION TO SET THE PROPER DISTANCE.

**POWER TURBINE THRUSTS:**

MOVE THE POWER TURBINE SHAFT AFT AGAINST ITS THRUST BEARING. IF AN AXIAL PROBE IS PROVIDED, ITS GAP VOLTAGE CAN BE USED TO VERIFY THAT THE POWER TURBINE IS AGAINST THE THRUST COLLAR.

**COMPRESSOR THRUSTS:**

FOR MECHANICAL DRIVE APPLICATION, CONSULT VENDOR OR VENDOR DRAWINGS.

**MARS POWER TURBINE TOOL: (DETAIL II AND FIGURE II)**

INSTALL THE POWER TURBINE LEVELING TOOL (FT-30635) TO THE POWER TURBINE HOUSING USING THE TOP THREE (3) BOLT HOLES OF THE POWER TURBINE HOUSING. VERIFY LEVELING TOOL IS FREE TO MOVE UP AND DOWN ITS GUIDES WITHOUT BINDING. TURN HAND KNOB ON LEVELING TOOL UNTIL ROLLERS OF TOOL COME INTO CONTACT WITH THE POWER TURBINE SHAFT. WHEN ROLLERS ARE IN CONTACT WITH SHAFT CONTINUE TURNING HAND KNOB AN ADDITIONAL ONE AND ONE HALF (1-1/2) TURNS. THIS ACTION WILL LOWER THE POWER TURBINE SHAFT BY .008" TO .013" AND POSITION THE SHAFT AGAINST THE BOTTOM OF BOTH NUMBER 4 AND NUMBER 5 BEARING PADS. **-DO NOT EXCEED 1-1/2 TURNS-**

**NEUTRAL VERIFICATION OF DRY HUBS:**

IF THE HUBS ADJUSTMENT AND LOCKDOWN SCREWS (YELLOW AND RED RESPECTIVELY) HAVE NOT BEEN TAMPED WITH, THEN THE HUB FACE CAN BE ASSUMED TO BE IN NEUTRAL POSITION. OTHERWISE, USE THE CENTERING TOOL OR ADJUST THE HUBS FACE BY USING THE YELLOW ADJUSTMENT SCREWS TO ADJUST THE TRUENESS OF THE FACE BY MONITORING THE FLANGES' RUNOUT USING DIAL INDICATORS. LOCK THE HUBS IN PLACE USING THE RED SCREWS.

**COLD ALIGNMENT:**

ALL MEMBERS NEED 36 HOURS TO COOL FROM OPERATING TEMPERATURE.

**OIL TANK:**

IT IS PREFERABLE TO HAVE OIL TANK FILLED TO ITS OPERATING LEVEL AT THIS TIME.

**ALIGNING OUTDOORS:**

WHEN ALIGNING OUTDOORS OR IN ENVIRONMENTS WITH VARYING TEMPERATURE CONDITIONS, BE AWARE OF THERMAL GROWTH EFFECTS ON THE PACKAGE AND ALIGNMENT TOOLING. WHEN PRACTICAL, ALIGNMENT SHOULD TAKE PLACE DURING THE MOST STABLE TEMPERATURE CONDITIONS.

**MANIFOLDS/DUCTING:**

VERIFY THAT ALL MANIFOLDS ABOVE TANK LUBE OIL LEVEL (E.G. LUBE OIL, COMPRESSOR SUCTION AND DISCHARGE, ETC.) ARE LOOSENED TO ALLOW FOR FREE MOVEMENT OF THE COMPRESSOR AND GAS TURBINE MACHINES. REMOVE SUCTION AND DISCHARGE HEADERS.

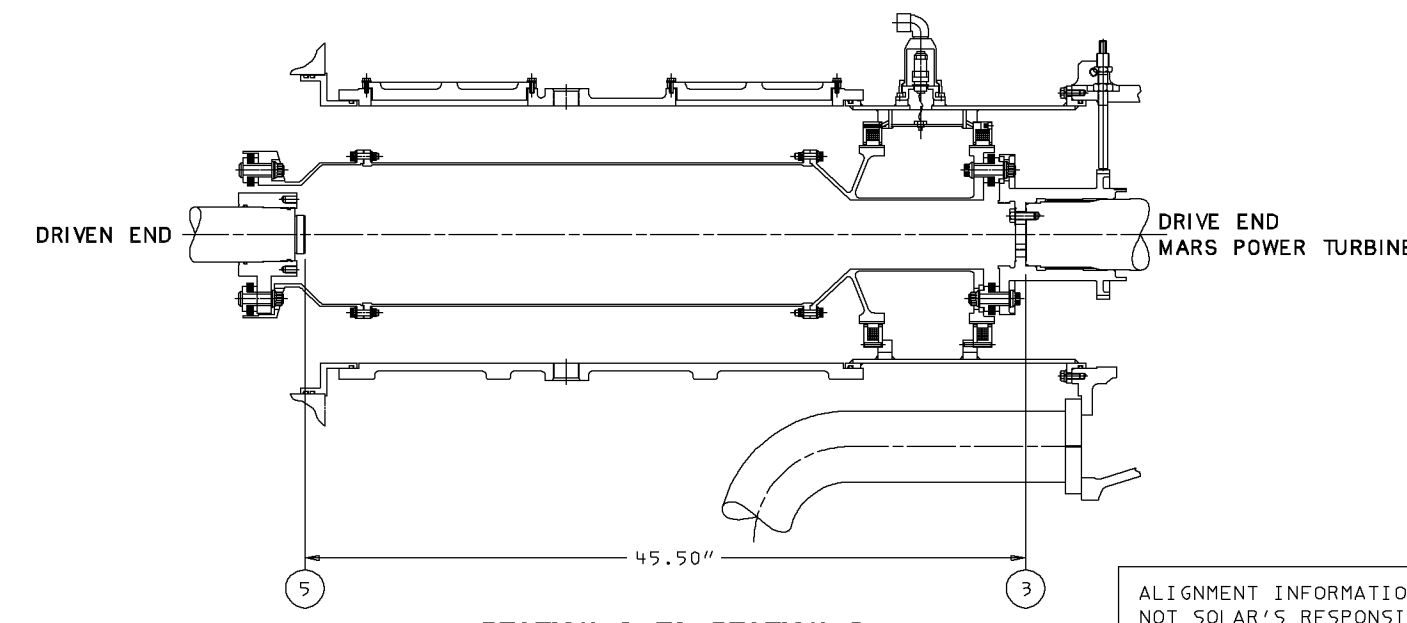
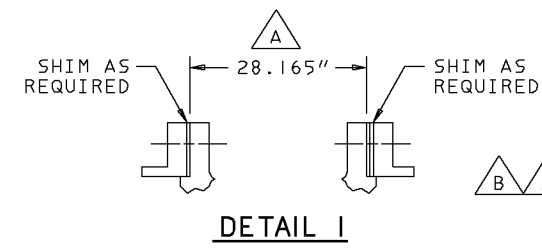
**MARS AIR INLET DUCTING:**

THE AIR INLET BELLOWS SHOULD BE LOOSENED AND THE WEIGHT OF THE DUCT SUPPORTED BY THE ENGINE.

**MARS EXHAUST DUCTING:**

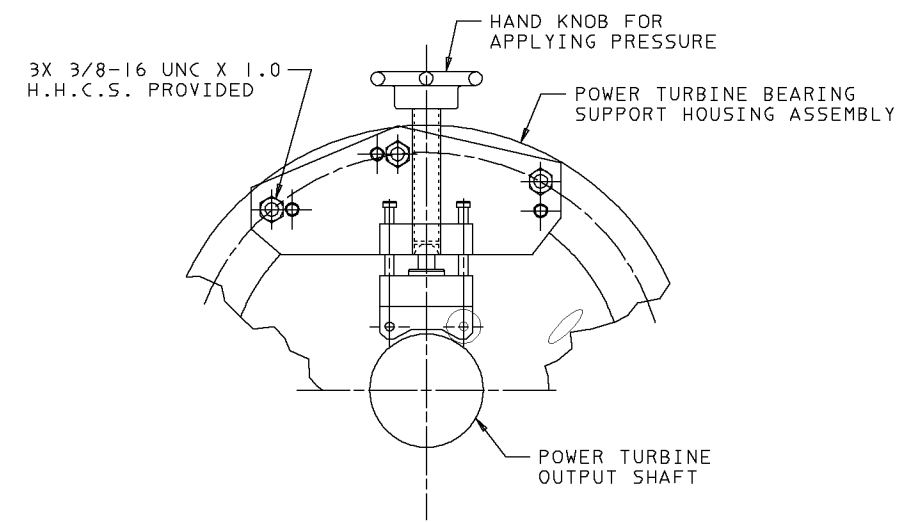
THE TOP FLANGE OF THE EXHAUST FLEXIBLE DUCT SHOULD BE LOOSENED TO ALLOW MOVEMENT BETWEEN IT AND DUCTING.

STATION LOCATION	SPACER LENGTH	CALCULATED FLANGE TO FLANGE	DISTANCE BETWEEN SHAFT ENDS	PRE-STRETCH
4 TO 6	28.165" [715.4]	28.325" [719.5]	45.500"	.100"

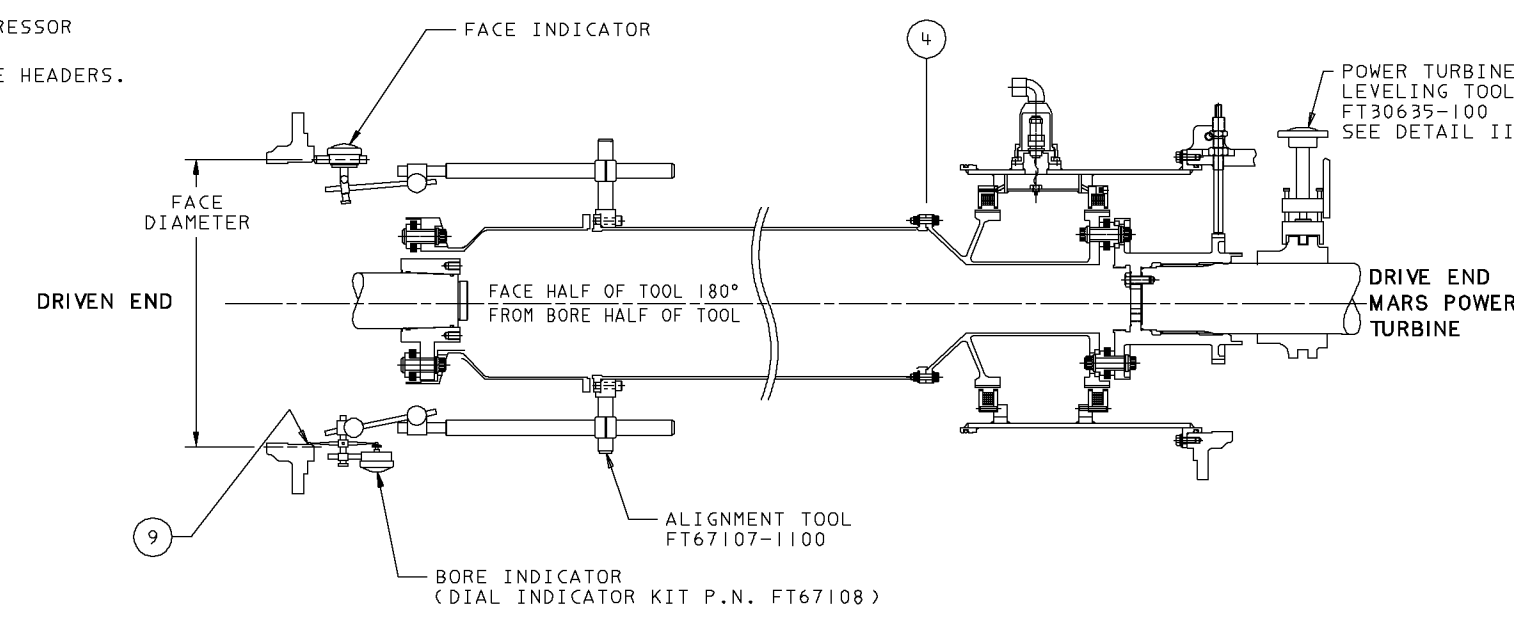


STATION 3 TO STATION 5  
FIGURE I

- VERIFY DISTANCE:**  
USE AN INSIDE MICROMETER TO VERIFY DISTANCE TOP AND BOTTOM AND SIDES OF FLANGES.
- JACKING BOLTS:**  
AFTER DISTANCE IS SET, VERIFY THAT ALL VERTICAL, HORIZONTAL AND AXIAL JACKING BOLTS ARE FULLY BACKED OUT.
- TIEDOWN BOLTS:**  
VERIFY THAT ALL TIEDOWN BOLTS ARE LUBRICATED WITH ANTI-SEIZE LUBRICANT.
- MOUNTING OF ALIGNMENT TOOL:**  
FOR THE STATION UNDERGOING ALIGNMENT, MOUNT THE APPROPRIATE TOOLING AS SHOWN IN FIGURE II AND FIGURE IIA.



DETAIL II  
FT30635-100 ALIGNMENT PRESSURE JACK SCREW  
APPROXIMATE WEIGHT: 12 LBS (5 KG)



STATION 4 TO STATION 6  
FIGURE II  
MOUNT ALIGNMENT TOOL ON INTERCONNECT SPACER FLANGE AND SWEEP BEARING HOUSING BORE AND FACE

**TOOLING SAG VERIFICATION:**

THE PURPOSE IS TO PERFORM AN INITIAL BORE SWEEP WITH THE TOOLING TO CHECK FOR EXCESSIVE TOOLING SAG. SET THE DIAL INDICATOR TO 0.0 AT THE 12 O'CLOCK POSITION. SWEEP THE BORE AND RECORD THE BL, BR AND BB READINGS. VERIFY: BL + BR = BB ± .005". IF BL + BR - BB IS GREATER THAN .005", LOCATE AND CORRECT PROBLEM OF EXCESSIVE SAG.

**ALIGNMENT CONVENTIONS:**

**DIAL INDICATOR SETUP:**

TYPICAL DIAL INDICATOR SETUP FOR TAKING BORE AND FACE READINGS AS SHOWN IN FIG III.

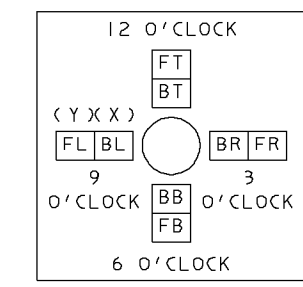


FIGURE III

VIEW LOOKING BOTH FORWARD AND AFT  
IMPORTANT: ACCURATELY LOCATE THE 90° CLOCKING POSITIONS

**IDENTIFICATION OF ALIGNMENT STATIONS:**  
ALIGNMENT STATIONS AS IDENTIFIED IN FIGURE IV.

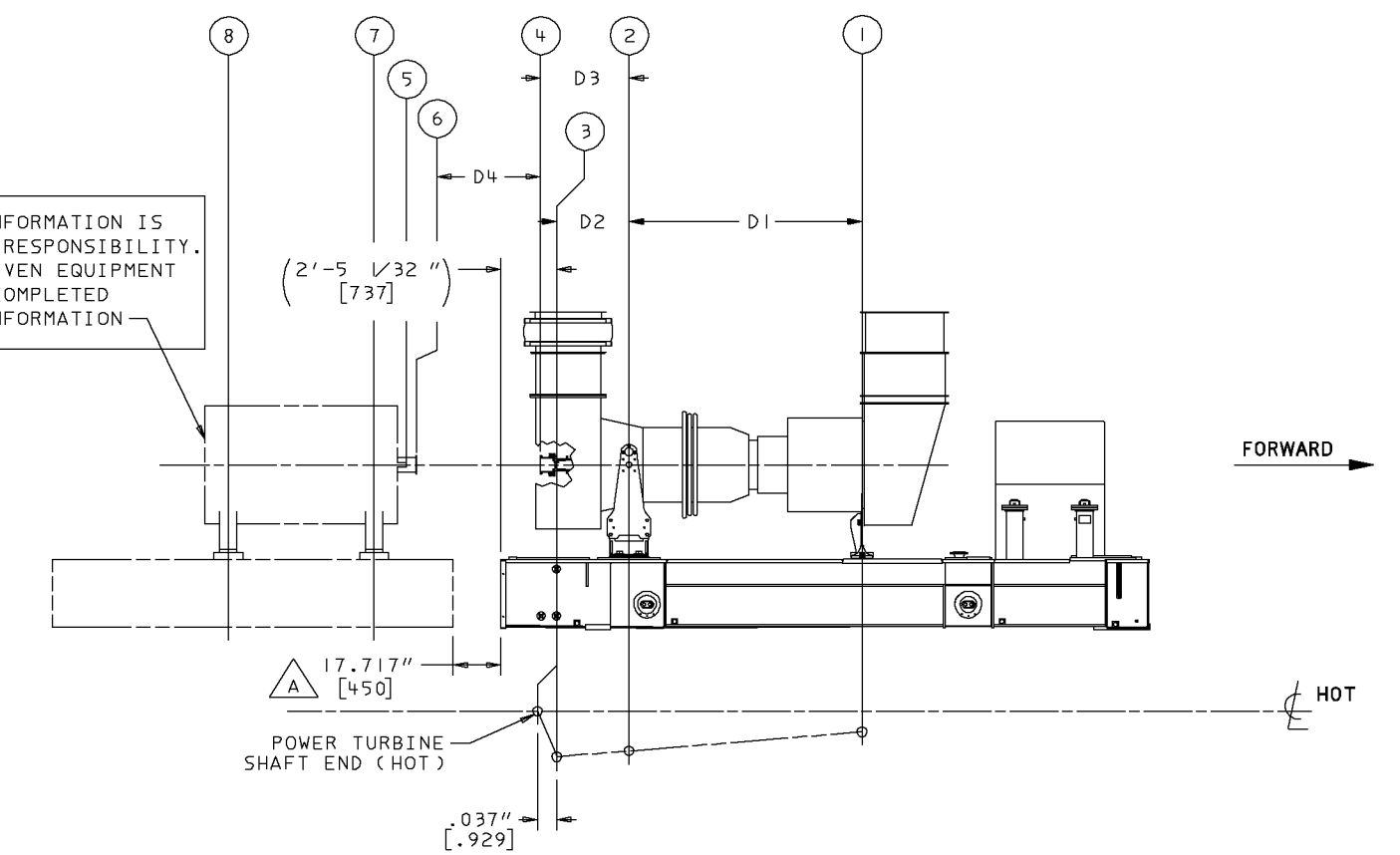


FIGURE IV  
COLD SHAFT RELATIONSHIPS

THIS FIGURE IS USED TO TRANSMIT RELATIVE POSITIONS DUE TO THERMAL GROWTH ONLY AND IS NOT INTENDED TO SHOW EXACT PACKAGE CONFIGURATION

DISANCE	DISCRPTION	INCHES (mm)
D1	FEET DISTANCE MARS TURBINE	122.000 (3098.80)
D2	TRUNNION MOUNT TO POWER TURBINE SHAFT END	37.829 (960.85)
D3	TRUNNION MOUNT TO COUPLING ADAPTER FACE	51.374 (1304.90)
D4	COUPLING ADAPTER FACE TO COUPLING ADAPTER FACE	28.325 (719.5)

STATION	VERTICAL THERMAL GROWTH	INCHES (mm)
1	FORWARD FOOT MARS TURBINE	+ .024 (.609)
2	TRUNNION MOUNT MARS TURBINE	+ .069 (1.752)
3	POWER TURBINE SHAFT END	+ .082 (2.107)
4	COUPLING ADAPTER FACE (DRIVER)	+ .0889 (2.259)
6	COUPLING ADAPTER FACE (DRIVEN EQUIPMENT)	+ .1377 (3.50)
5	END OF DRIVEN EQUIPMENT INPUT SHAFT	TBD (TBD) (BY CUSTOMER)
7	NEAR FOOT	TBD (TBD) (BY CUSTOMER)
8	FAR FOOT	TBD (TBD) (BY CUSTOMER)
9	HOUSING BORE DRIVEN EQUIPMENT	TBD (TBD) (BY CUSTOMER)

NOTE: THERMAL GROWTHS ARE BASED ON FULL LOAD OPERATING CONDITIONS.

**MEASUREMENTS:**

ALL MEASUREMENTS ARE GIVEN IN INCHES AND MILLIMETERS.

**DIAL INDICATOR READINGS:**

DIAL INDICATOR READINGS ARE ALWAYS "TOTAL INDICATOR READINGS" (T.I.R.).

**NEAR FOOT/FAR FOOT:**

NEAR FOOT IS FOOT OR PAD CLOSEST TO THE MACHINES SHAFT END. FAR FOOT IS FOOT OR PAD FARTHEST AWAY FROM MACHINES SHAFT END.

**SIGHT/FROM MACHINE:**

MACHINE WITH ALIGNMENT TOOL ATTACHED.

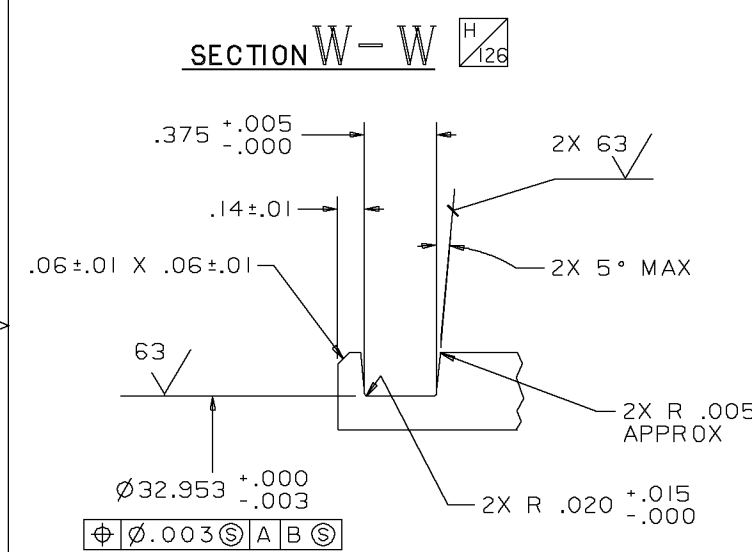
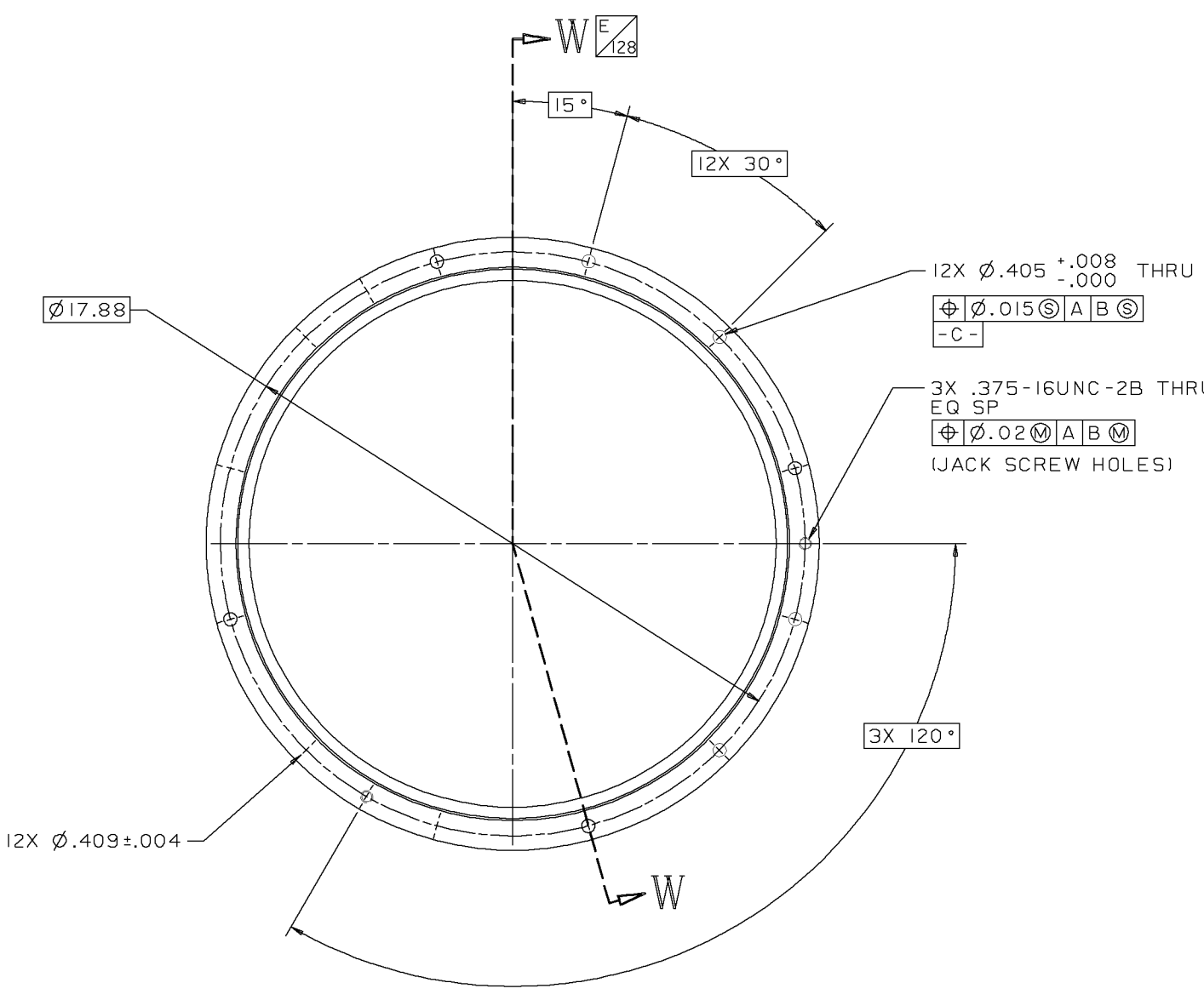
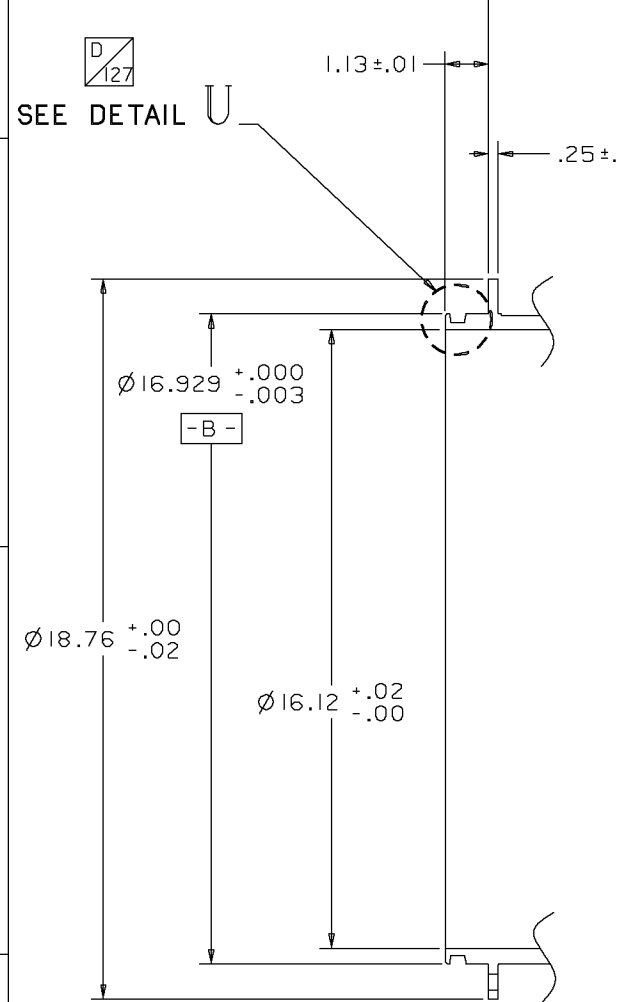
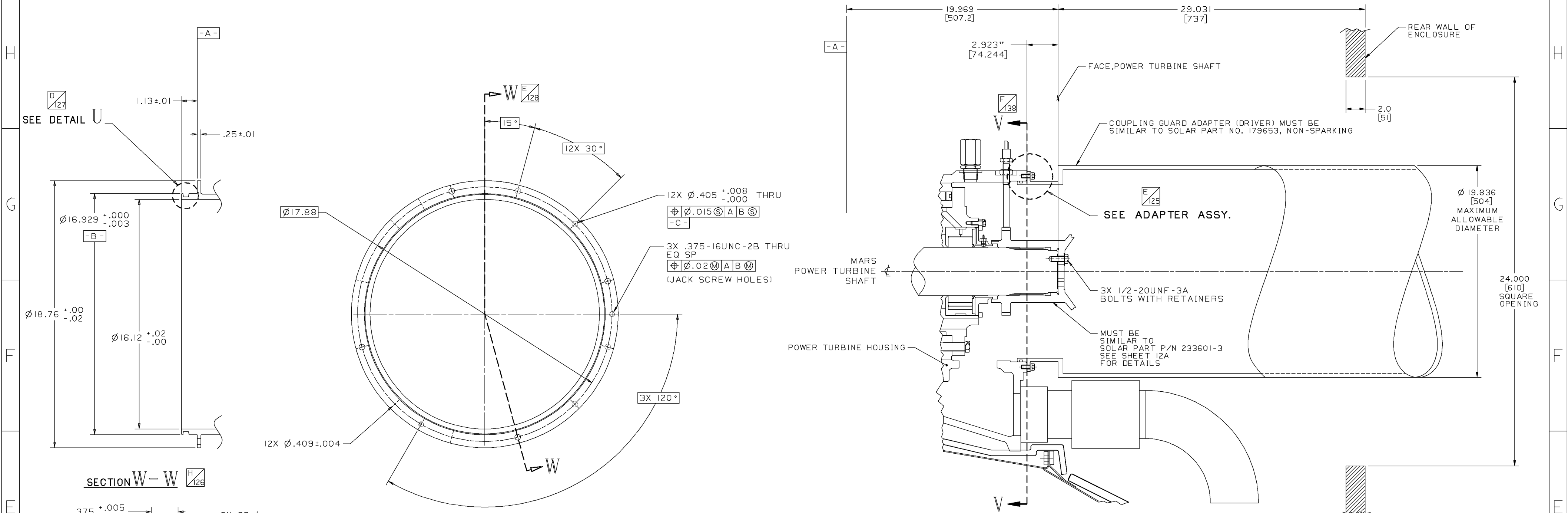
**TARGET/TO MACHINE:**

MACHINE WITHOUT ALIGNMENT TOOL ATTACHED.



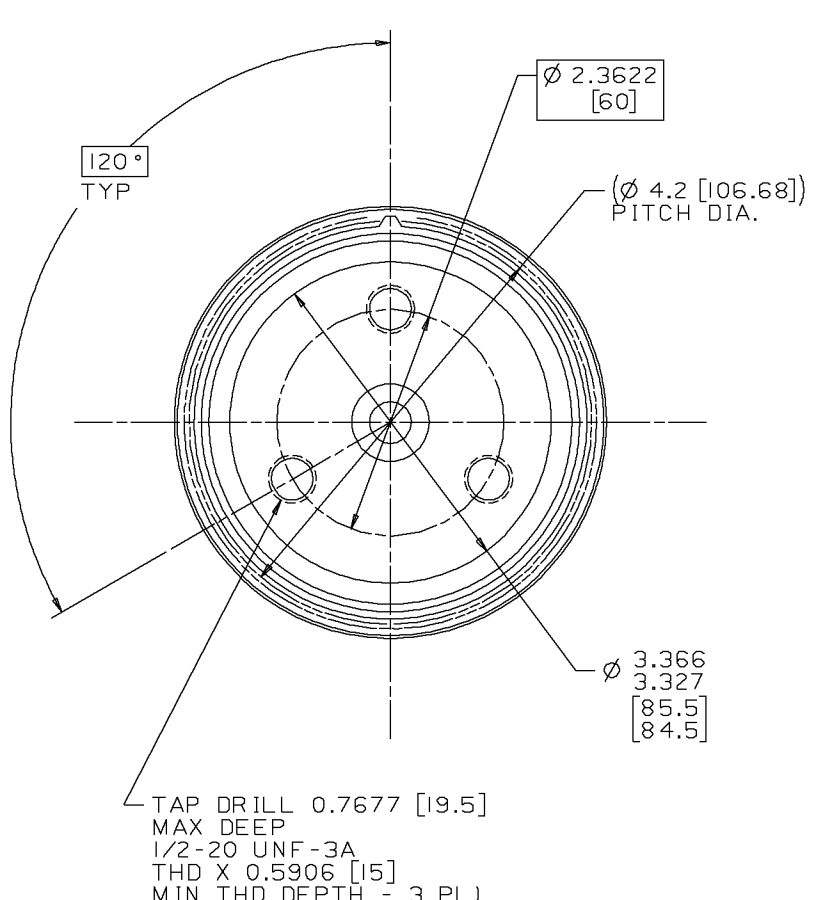
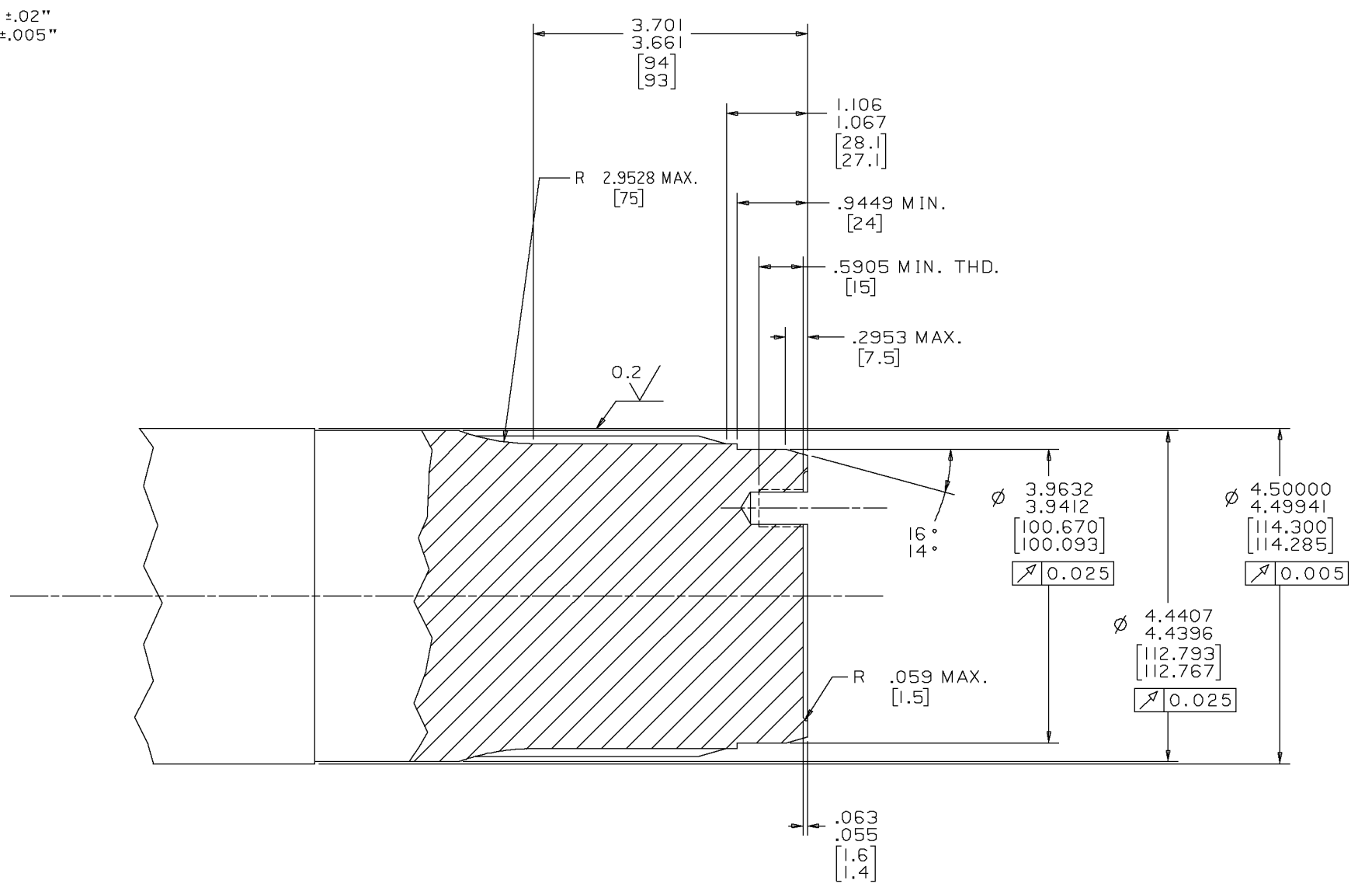
DRAWING NO. 52121-149746	REV B SHEET 11
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128 127 126 125 124 123 122 121



**ADAPTER ASSY. DETAILS (TYPICAL)**  
 POWER TURBINE HOUSING OMITTED FOR CLARITY  
 TOLERANCES UNLESS OTHERWISE GIVEN  
 2 PLACE DECIMALS ±.02"  
 3 PLACE DECIMALS ±.005"

EXTERNAL INVOLUTE SPLINE DATA	
TYPE	FILLET ROOT SIDE FIT
PRESSURE ANGLE	30°
PITCH	10/20 (2.54/1.27 SPLINE MODULES)
NUMBER OF TEETH	42
PITCH DIAMETER (REF)	106.68 [106.05]
BASE DIAMETER (REF)	92.38759
MAJOR DIAMETER	109.09-109.22
FORM DIAMETER, (MAXIMUM)	103.91
MINOR DIAMETER, (MINIMUM)	101.52
CIRCULAR TOOTH THICKNESS:	
MAXIMUM EFFECTIVE	3.990
MINIMUM ACTUAL	3.898
MAXIMUM ACTUAL (REF)	3.936
FILLET RADIUS, (MINIMUM)	0.84
MAJOR DIA CONCENTRICITY WITH EFFECTIVE SPLINE	---
MEASUREMENT OVER PINS, (MINIMUM) (REF)	114.152
PIN DIAMETER (REF)	4.8768
SPLINE REQUIREMENTS PER SOLAR SPEC 9-21	CLASS-4
ANSI B92.1-1970 AUG.1973	



**POWER TURBINE SHAFT**

**Solar Turbines**  
 A Caterpillar Company  
 DRAWING NO. 52121-149746  
 REV B  
 SHEET 12