

NOTES:

- 1) APPROXIMATE WEIGHT - 19,600 LBS
- 2) FOUNDATION HOLES THROUGH LOWER FLANGE ONLY
- 3) ALL STEAM PIPING MUST BE ARRANGED SO THAT EXCESSIVE STRAINS WILL NOT BE IMPOSED ON THE TURBINE. THE TOTAL RESULTANT FORCE AND TOTAL RESULTANT MOMENT AT ANY CONNECTION SHOULD NOT EXCEED:

INLET: $3F_r + M_r < 3000$
 EXHAUST: $3F_r + M_r < 4333$

THE COMBINED RESULTANTS OF THE FORCES AND MOMENTS OF THE INLET AND EXHAUST CONNECTIONS, RESULTED AT THE CENTERLINE OF THE EXHAUST CONNECTION, SHOULD NOT EXCEED:

$2F_c + M_c < 2472$

THE COMPONENTS OF THESE COMBINED RESULTANTS SHOULD NOT EXCEED:

- $F_{cx} < 494$
- $M_{cx} < 2472$
- $F_{cy} < 1236$
- $M_{cy} < 1236$
- $F_{cz} < 989$
- $M_{cz} < 1236$

4) APPROXIMATE FLANGE THERMAL MOVEMENTS

INLET EXHAUST
 $X = -.160'$ $X = -.030'$
 $Y = +.009'$ $Y = +.004'$
 $Z = +.098'$ $Z = +.060'$

5) X, Y, Z COORDINATE SYSTEM PER NEMA SM24

6) COUPLING GUARDS (NOT SHOWN) WILL BE PROVIDED

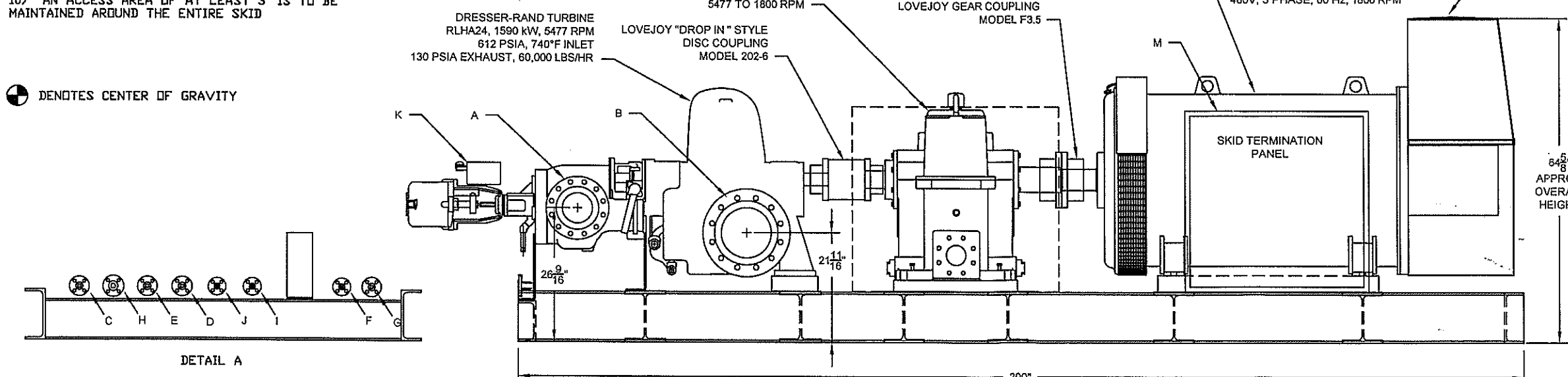
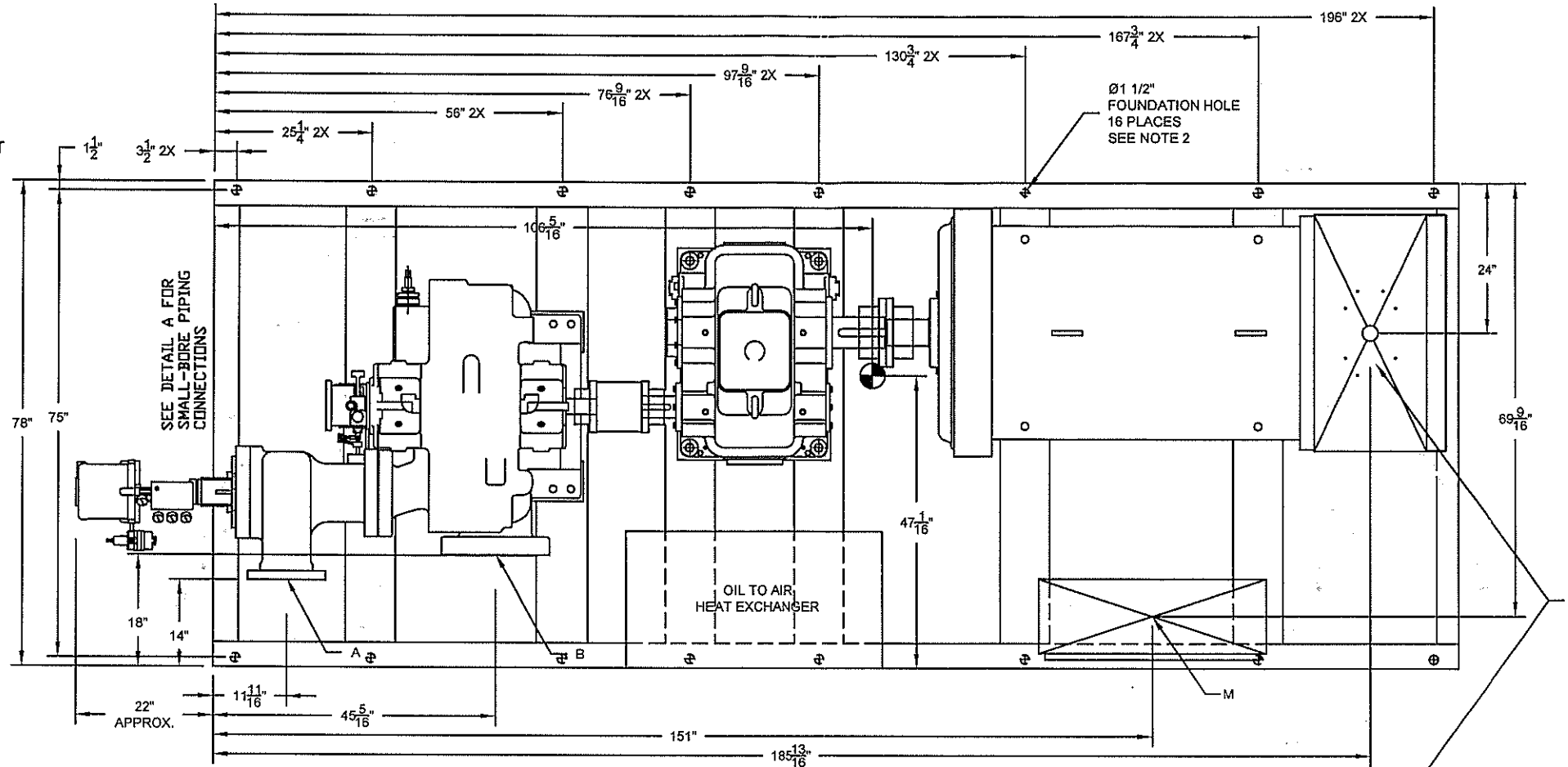
7) SELF CONTAINED AIR COOLED LUBRICATION SYSTEM SERVING TURBINE AND GEAR TO BE INTEGRATED WITH EQUIPMENT

8) ALL STEAM LEAK-OFFS AND DRAINS ARE TO BE PIPED TO DRAIN SLOPING AWAY FROM TURBINE

9) SYSTEM TO BE MOUNTED LEVEL ON A CONCRETE PAD AT LEAST THREE TIMES THE MASS OF THE SYSTEM WITH SPACE FOR 1" MINIMUM OF GROUT

10) AN ACCESS AREA OF AT LEAST 3' IS TO BE MAINTAINED AROUND THE ENTIRE SKID

⊙ DENOTES CENTER OF GRAVITY



- SITE CONNECTIONS:**
- A - STEAM INLET - 6" 600# RF
 - B - STEAM EXHAUST - 10" 300# RF
 - C - EXHAUST DRAIN - 3/4" 150# RF
 - D - STEAM CHEST DRAIN - 3/4" 150# RF
 - E - THROTTLE VALVE DRAIN - 3/4" 150# RF
 - F - TRIP VALVE DRAIN - 3/4" 150# RF
 - G - DRIVE END SHAFT LEAK-OFF, 1" 150# RF
 - H - STEAM END LEAK-OFF, 1" 150# RF
 - I - THROTTLE VALVE LEAKOFF - 1/2" 150# RF
 - J - TRIP VALVE LEAKOFF - 1/2" 150# RF
 - K - CONTROL AIR - 1/4" NPT
 - L - GENERATOR MAIN POWER CABLES
 - M - SKID POWER, INSTRUMENTATION AND CONTROL CABLES

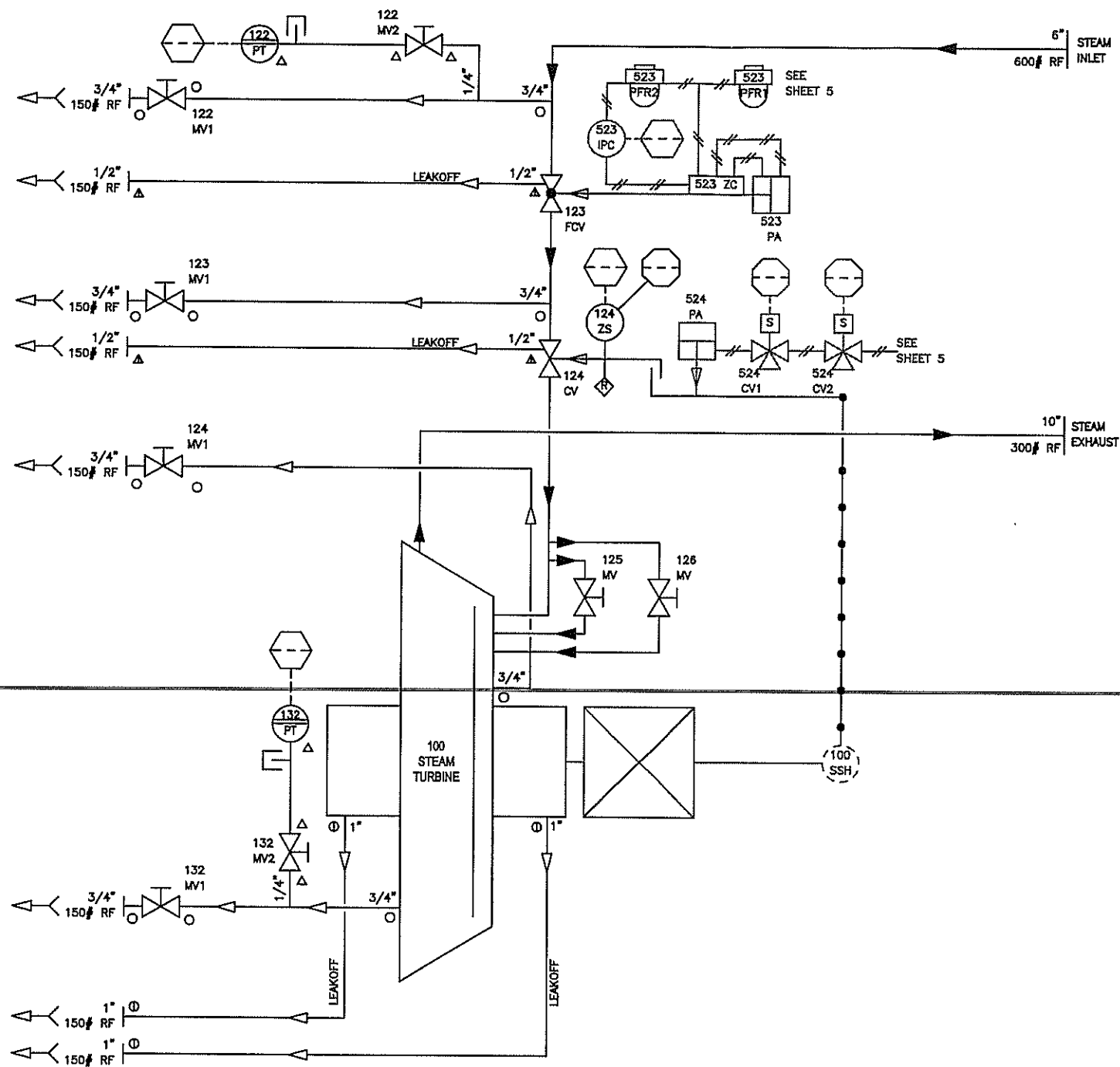
161 INDUSTRIAL BLVD.
 TURNERS FALLS, MA 01376
 413-863-3500 PHONE
 413-863-3157 FAX

**UNIVERSITY OF SOUTH CAROLINA
 EQUIPMENT ASSEMBLY
 DRAWING**

DRAWN BY	SJS	DATE	04/11/06	
CHECKED BY	GHJ	SIZE	A	SHEET 1 OF 1
SCALE	NTS	DWG NO	06177-M2	
REV	DESCRIPTION	DATE	BY	CHECK
A	FOR INTERNAL REVIEW	04/11/06	SJS	GHJ
REVISIONS				



DRAWN BY	SJS	DATE	04/11/06	
CHECKED BY	GHJ	SIZE	A	SHEET 1 OF 1
SCALE	NTS	DWG NO	06177-M2	
REV	DESCRIPTION	DATE	BY	CHECK
A	FOR INTERNAL REVIEW	04/11/06	SJS	GHJ
REVISIONS				



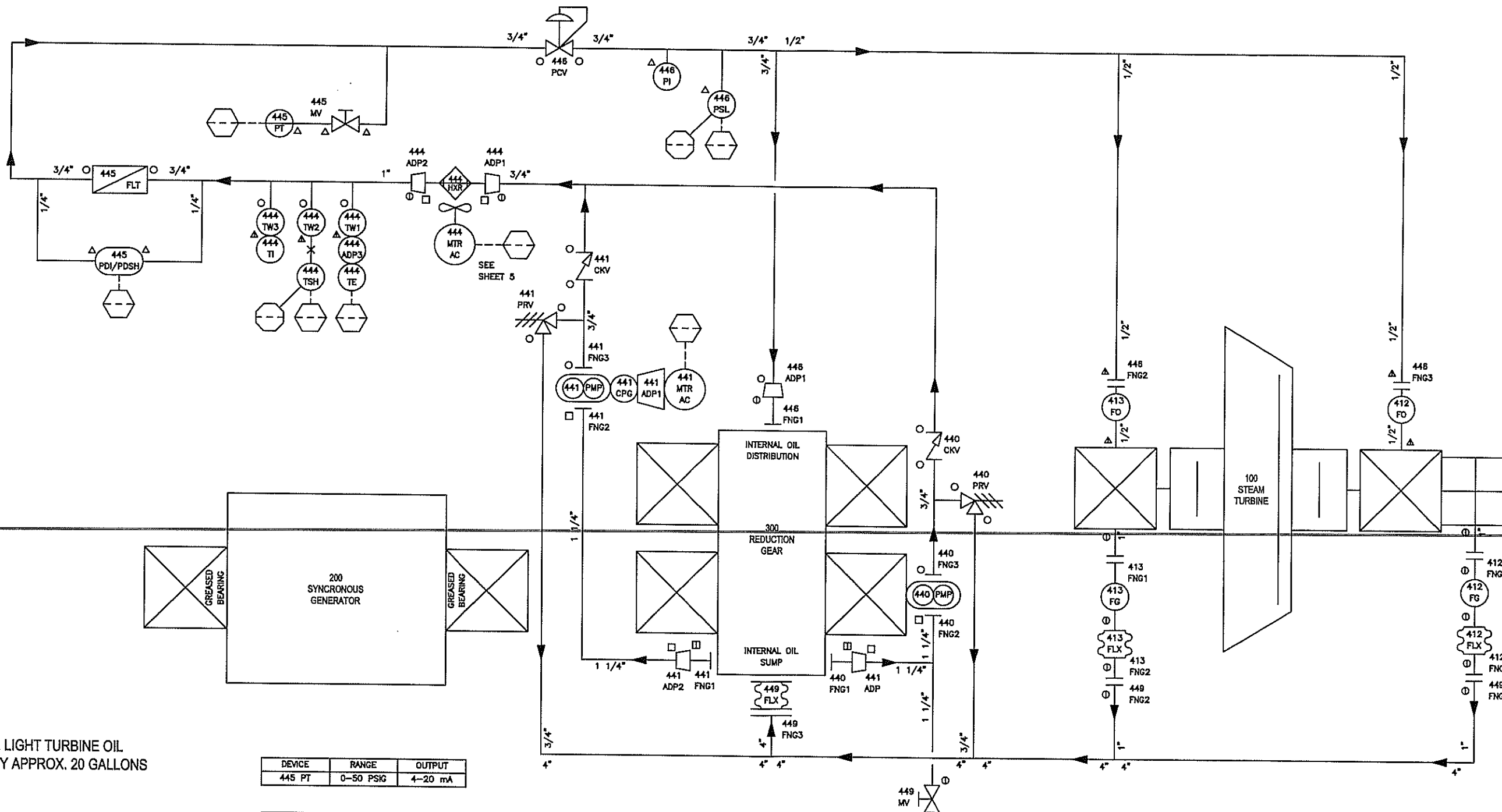
STEAM CONDITIONS:
 INLET: 615 PSIA, 740°F (750°F MAX), 1373.9 BTU/LBM
 EXHAUST: 130 PSIA (165 PSIA MAX)
 FLOW: 60,000 LBS/HR

DEVICE	RANGE	OUTPUT
122 PT	0-750 PSIG	4-20 mA
132 PT	0-200 PSIG	4-20 mA

TURBO STEAM 161 INDUSTRIAL BLVD.
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 PROCESS AND INSTRUMENTATION
 DIAGRAM
 SKID STEAM & CONDENSATE

REV	DESCRIPTION	DATE	BY	CHECK	DRAWN BY	DATE	CHECKED BY	SIZE	SHEET	OF	REV
A	FOR SUBMITTAL	06-16-06	SJS	TJW	SJS	03/29/06	GHJ	A	3	5	A
REVISIONS					SCALE	DWG NO					
					NTS	06177-M1					



OIL: ISO VG32 LIGHT TURBINE OIL
 QUANTITY APPROX. 20 GALLONS

DEVICE	RANGE	OUTPUT
445 PT	0-50 PSIG	4-20 mA

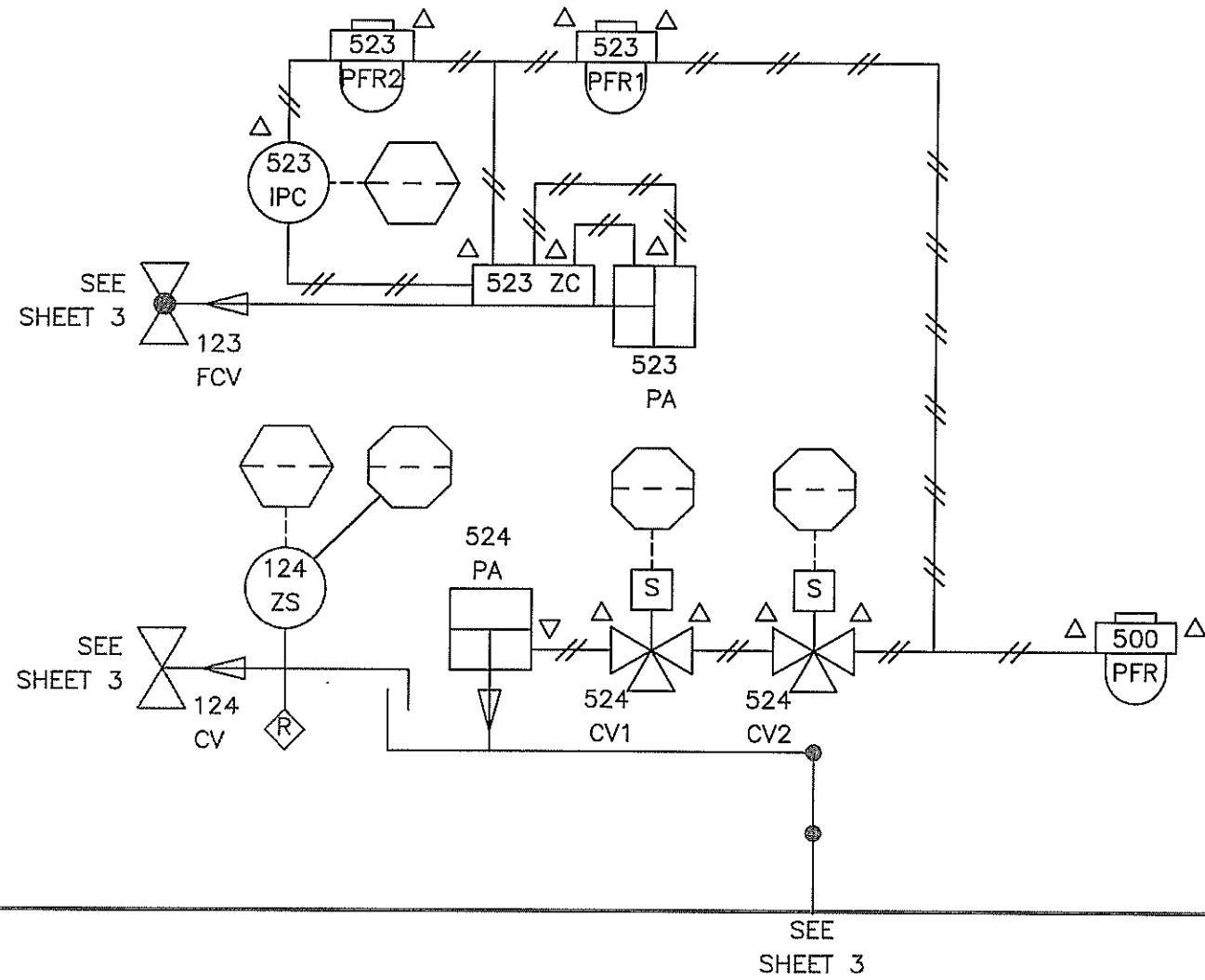
DEVICE	RANGE	SETPOINT
440 PRV	30-100 PSIG	55 PSIG
441 PRV	30-100 PSIG	55 PSIG
444 TE	-58F-500F	130°F
444 TSH	30F-250F	150°F
445 PDI/PDSH	0-15 PSIG	15 PSIG
446 PCV	10-35 PSIG	25 PSIG
448 PSL	1.5-30 PSIG	20 PSIG

REV	DESCRIPTION	DATE	BY	CHECK
A	FOR SUBMITTAL	06-16-06	SJS	TJW

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UNIVERSITY OF SOUTH CAROLINA
PROCESS AND INSTRUMENTATION
DIAGRAM
LUBRICATION

DRAWN BY	SJS	DATE	03/29/06
CHECKED BY	GHJ	SIZE	A
		SHEET	4
		OF	5
SCALE	NTS	DWG NO	06177-M1
		REV	A



80-150 PSIG
 30 SCFM MAX
 (SHORT DURATION)
 CLEAN AND DRY
 FILTERED TO 5 MICRON

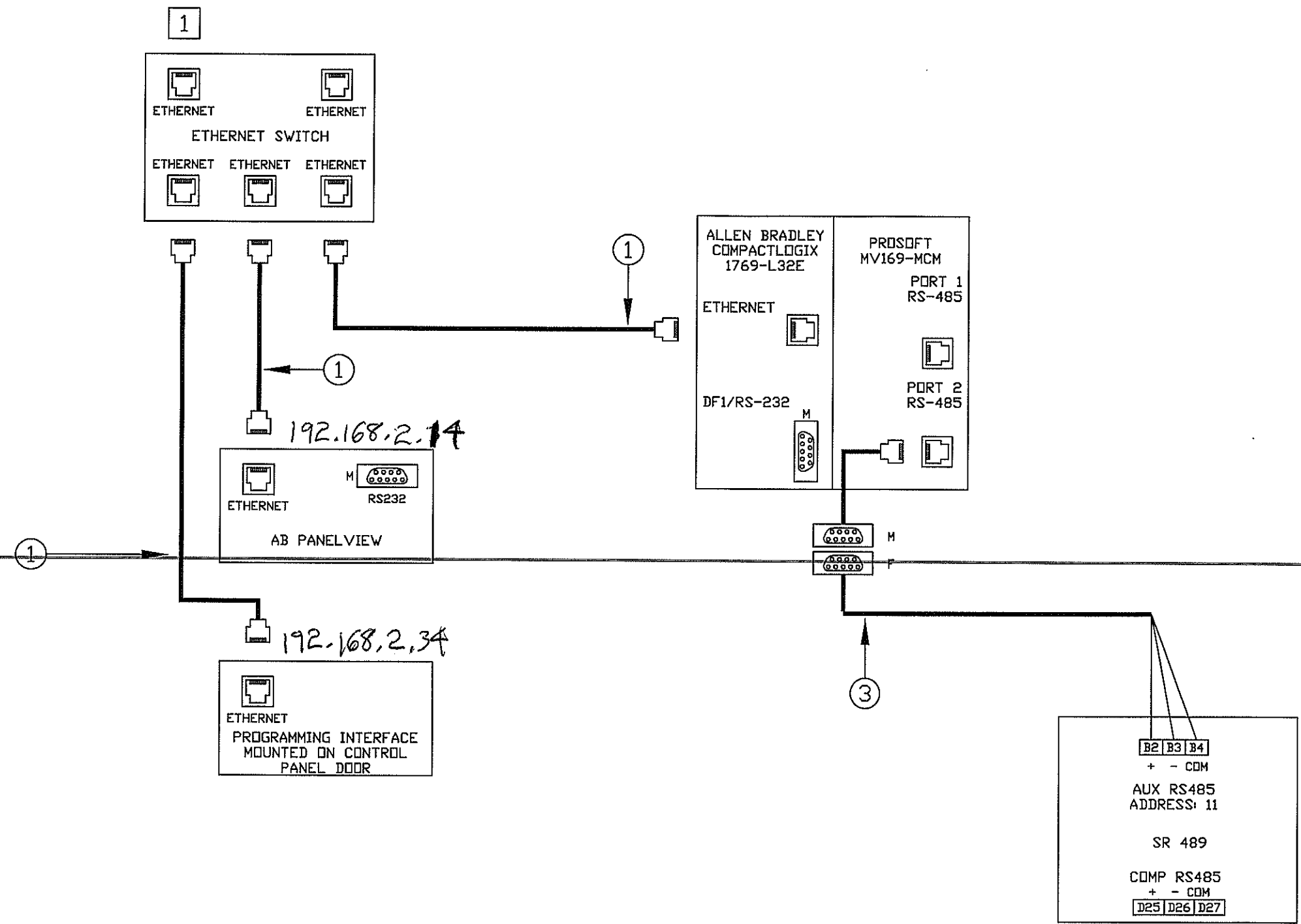
DEVICE	RANGE	SETPOINT
200 PDI/PDSH	0-5 IN WG	3 IN WG
500 PFR	0-160 PSIG	80 PSIG
523 PFR1	0-160 PSIG	20 PSIG
523 PFR2	0-30 PSIG	20 PSIG

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UNIVERSITY OF SOUTH CAROLINA
PROCESS AND INSTRUMENTATION
DIAGRAM
AIR & PNEUMATIC

DRAWN BY	SJS	DATE	03/29/06
CHECKED BY	GHJ	SIZE	A SHEET 5 OF 5
SCALE	NTS	DWG NO	06177-M1
			REV A

REV	DESCRIPTION	DATE	BY	CHECK
A	FOR SUBMITTAL	08-16-06	SJS	TJW
	REVISIONS			



CABLE / ADAPTER LEGEND

- ① RJ45 CAT5 ETHERNET CABLE
- ② BELDEN 9463 OR ALLEN BRADLEY P/N 1770-CD WITH DB9 FEMALE ONE END
- ③ BELDEN 9463 OR ALLEN BRADLEY P/N 1770-CD WITH DB9 FEMALE ONE END
- ④ Belden 9463 OR ALLEN BRADLEY P/N 1770-CD WITH DB9 FEMALE ONE END
- ⑤ Belden 9463 OR ALLEN BRADLEY P/N 1770-CD WITH DB9 FEMALE ONE END
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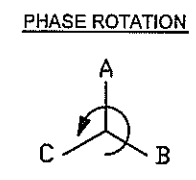
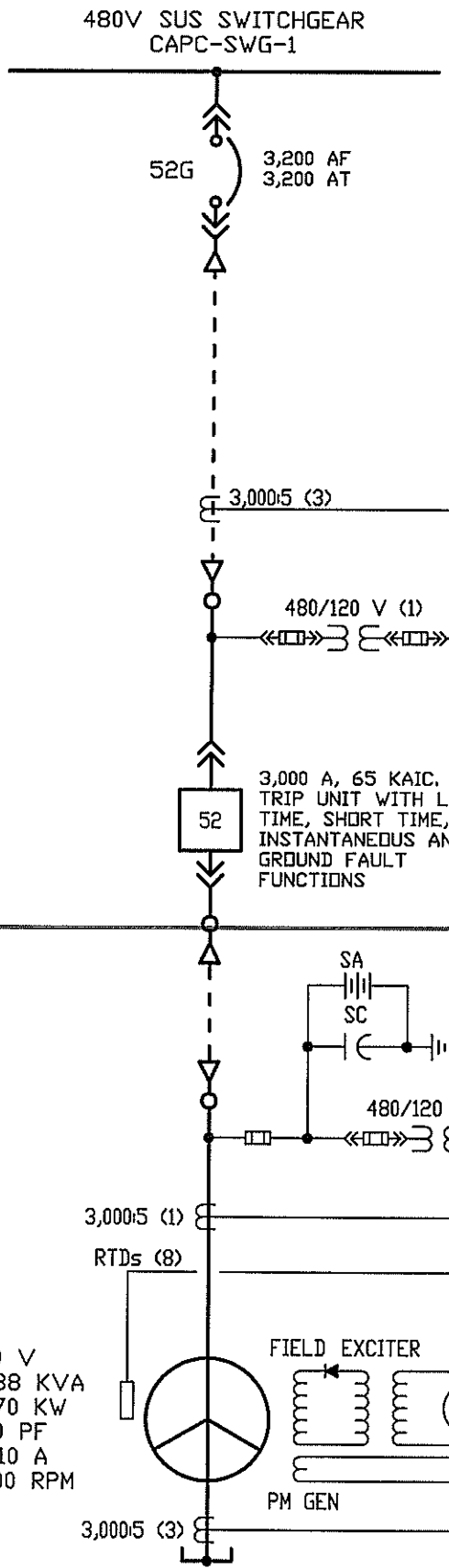


TURBOSTEAM CORPORATION
 161 INDUSTRIAL BOULEVARD
 TURNERS FALLS, MA 01376
 1-888-913-9464
 WWW.TURBOSTEAM.COM

UNIVERSITY OF SOUTH CAROLINA
 DIAGRAM
 COMMUNICATIONS/NETWORK
 DWG NO: 06177 - E4 REV: A SCALE: NTS

SHEET: 1
 OF: 1

REV	DESCRIPTION	DATE	DRN	AP'VD
A	FOR SUBMITTAL	5/15/06	AFF	



DEVICE LIST

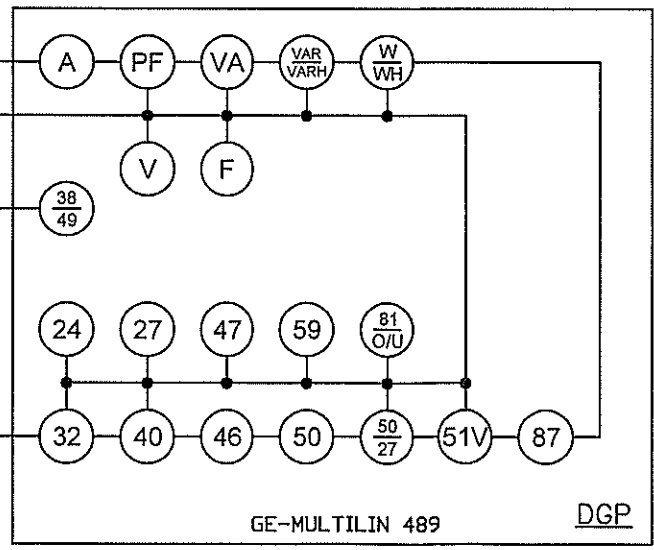
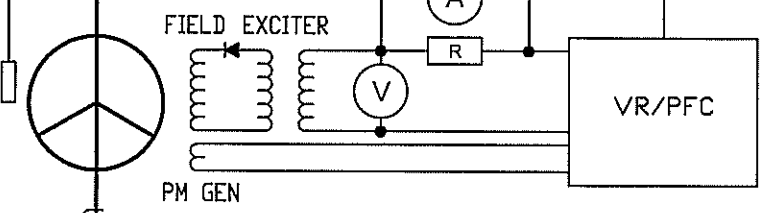
- 24 OVEREXCITATION VOLTS/HERTZ RELAY
- 25A AUTOMATIC SYNCHRONIZING RELAY
- 25C SYNCHRONISM CHECK RELAY
- 27 UNDERVOLTAGE RELAY
- 32 REVERSE POWER RELAY
- 38 BEARING OVERTEMPERATURE
- 40 LOSS OF FIELD RELAY
- 46 NEGATIVE SEQUENCE OVERCURRENT RELAY
- 47 VOLTAGE PHASE REVERSAL RELAY
- 49 STATOR OVERTEMPERATURE
- 50 INSTANTANEOUS OVERCURRENT RELAY
- 50/27 INADVERTENT GENERATOR ENERGIZATION RELAY
- 51V VOLTAGE RESTRAINED TIME OVERCURRENT RELAY
- 52 POWER CIRCUIT BREAKER
- 59 OVERVOLTAGE RELAY
- 81 O/U OVER/UNDER FREQUENCY RELAY
- 87 PERCENTAGE DIFFERENTIAL RELAY
- A AMMETER
- DGP DIGITAL GENERATOR PROTECTION RELAY
- F FREQUENCY METER
- FX FREQUENCY TRANSMITTER
- PF POWER FACTOR METER
- R RESISTOR
- SA SURGE ARRESTOR
- SC SURGE CAPACITOR
- SS SYNCHROSCOPE
- V VOLTMETER
- VA APPARENT POWER METER
- VAR REACTIVE POWER METER
- VARH INTEGRATED REACTIVE POWER METER
- VR/PFC AUTOMATIC VOLTAGE REGULATOR WITH VAR/PF CONTROL
- VX VOLTAGE TRANSMITTER
- W REAL POWER METER
- WH ENERGY METER

SYNCHRONIZING ENABLE SWITCH SW-SE

CONTACTS	OFF	ON
A11 B11		X
A12 B12	X	
A1 B1		X
A5 B5		X
A6 B6	X	
A7 B7		X



480 V
1,838 KVA
1,470 KW
0.80 PF
2,210 A
1,800 RPM



TURBO STEAM

161 INDUSTRIAL BOULEVARD, TURNERS FALLS, MA, 01376

UNIVERSITY OF SOUTH CAROLINA

ELECTRICAL DIAGRAM

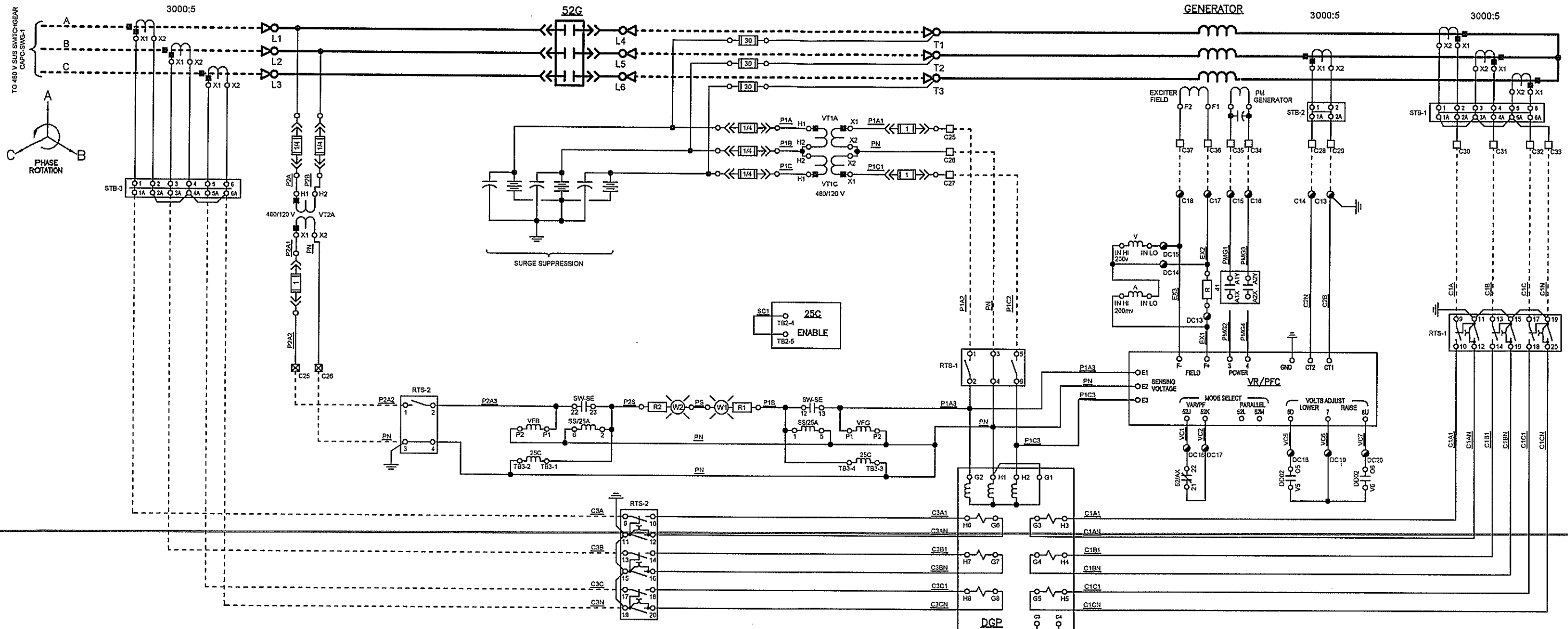
SINGLE LINE

DRAWN BY: TJW DATE: 02/01/06

CHECKED BY: GFJ SHEET: 1 OF: 1

SCALE: NTS DWG NO: 06177-E1 REV A


REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
A	FOR SUBMITTAL	05-15-08	TJW	
	REVISIONS			



SYNCHRONIZING ENABLE SWITCH
SW-SE

DECK	CONTACTS	OFF	ON
1	1-1	X	X
	1-2	X	X
	1-3	X	X
2	2-1	X	X
	2-2	X	X
	2-3	X	X
3	3-1	X	X
	3-2	X	X
	3-3	X	X

- TERMINAL LEGEND:**
- DEVICE TERMINAL
 - CONTROL PANEL TERMINAL
 - SKID PANEL TERMINAL
 - ⊠ GENERATOR CIRCUIT BREAKER TERMINAL
 - ⊞ TERMINAL IN CUSTOMER'S EQUIPMENT



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ELECTRICAL

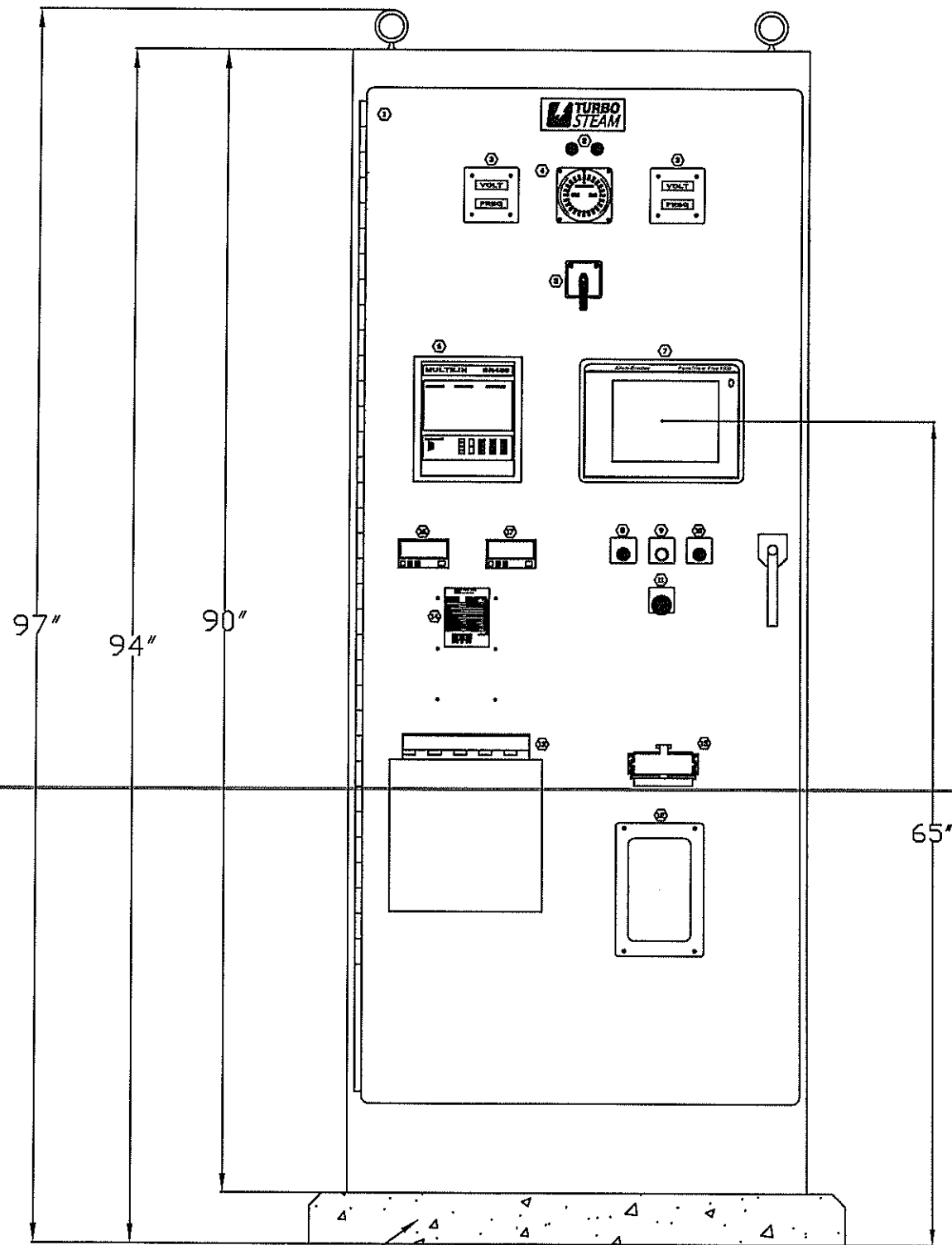
THREE LINE DIAGRAM

DRAWN BY:	TJW	DATE:	02/01/06
CHECKED BY:	GFJ	SHEET:	1 OF 1
SCALE:	NTS	DWG NO:	06177-E2
REV	DESCRIPTION	DATE	DRAWN BY / CHECKED BY
	REVISIONS		

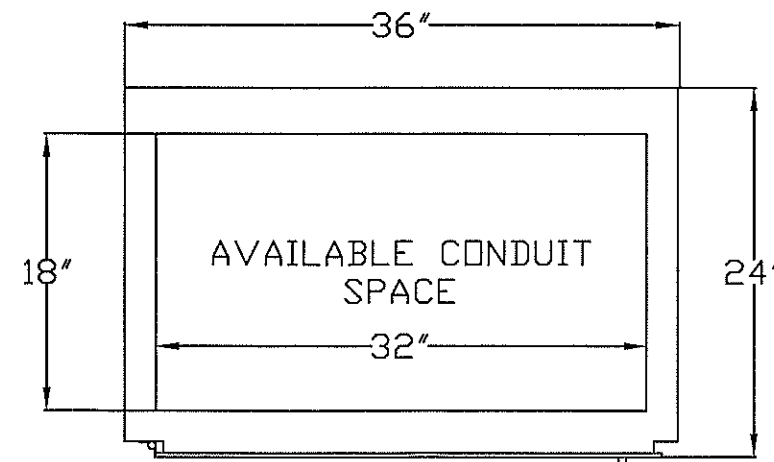
D	AS BUILT	10/11/06	DCA	
C	CHANGED TERMINAL NUMBERS	8/24/06	BK	TJW
B	CHANGED TERMINAL NUMBERS	6.28.06	BK	TJW
A	FOR SUBMITTAL	06-16-06	TJW	BK
REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
	REVISIONS			

BILL OF MATERIAL

MARK	QTY	DESCRIPTION	MANUFACTURER	PART NUMBER
1	1	CONTROL PANEL	HOFFMAN	A903624FS
2	2	WHITE SYNCHRONIZING LIGHT	GENERAL ELECTRIC	116B6708G5W
3	2	DIGITAL AC VOLT/FREQUENCY METER	YOKOGAWA	249222-AHD-0-1
4	1	LED SYNCHROSCOPE	CROMPTON	077-14LU-PQYY-FQ
5	1	SYNCHRONIZATION ENABLE SWITCH	ELECTROSWITCH	24203B
6	1	GENERATOR MANAGEMENT RELAY	GE MULTILIN	SR 489-P5-HI-A20
7	1	OPERATOR INTERFACE	ALLEN BRADLEY	PANELVIEW +1000
8	1	CONTROL POWER SWITCH	GENERAL ELECTRIC	P9SCDOA95
9	1	POWER AVAILABLE LIGHT	GENERAL ELECTRIC	P9CLBD
10	1	MECHANICAL OVERSPEED TEST PUSHBUTTON	GENERAL ELECTRIC	P9CPNNG
11	1	EMERGENCY STOP PUSHBUTTON	GENERAL ELECTRIC	P9CET4RN1
12	1	SYNCHRONISM CHECK RELAY	BECKWITH	M-0388-D2E2
13	1	FOLD DOWN SHELF	HAMMOND	FDS1212
14	1	DIGITAL VOLTAGE REGULATOR	MARATHON	DVR2000E
15	1	PROGRAMMING PORTS	PHOENIX	5604805
16	1	FIELD VOLTAGE METER	SIMPSON	H335114100
17	1	FIELD CURRENT METER	SIMPSON	H335111100



FRONT VIEW



PLAN VIEW

4" high house-keeping pad



161 INDUSTRIAL BOULEVARD, TURNERS FALLS, MA, 01376

UNIVERSITY OF S. CAROLINA

ENCLOSURE
TURBINE GENERATOR CONTROL PANEL

DRAWN BY: AFF DATE: 5/15/06

CHECKED BY: TJW SHEET: 1 OF: 2

SCALE: NTS DWG NO: 06177-ENCL REV B

REV	DESCRIPTION	DATE	DRAWN BY	CHECKED BY
B	CHANGED TO AS BUILT	10.09.06	BK	DCA
A	FOR SUBMITTAL	5/19/06	AFF	TJW
	REVISIONS			