

CC-180224

NOTES:

1. STEAM INLET, EXHAUST AND EXTRACTION PIPING MUST BE PROPERLY SUPPORTED SO AS NOT TO EXCEED ALLOWABLE FORCES AND MOMENTS GIVEN.
2. AN ATMOSPHERIC RELIEF VALVE OF SUFFICIENT SIZE TO PASS 34,559 LBS. PER HOUR WITH A MAXIMUM PRESSURE OF 10 PSIG AND SET TO OPEN AT 5 PSIG SHOULD BE PLACED IN THIS LINE. NO SHUT-OFF VALVE SHOULD BE PLACED BETWEEN RELIEF VALVE AND TURBINE.
3. INLET FLANGE BUILT TO ANSI B16.5 "SERRATED FLANGE"
4. ALL FOUNDATION BOLTS SHOULD NOT BE RIGIDLY LOCATED UNTIL UNIT IS IN PLACE ON CUSTOMER'S FOUNDATION AS BOLT HOLES IN BASE-PLATE MAY VARY .25.
5. 16-HOLES 1.12 DIA. THRU FOR 1" DIA. HOLD DOWN BOLTS (SEE NOTE 4). HOLD DOWN BOLTS FURNISHED BY TURBODYNE.
6. TURBINE, GEAR AND GENERATOR TO BE DOWELED TO BASEPLATE AFTER FINAL ALIGNMENT IN FIELD.
7. SHIMS -FURNISHED BY TURBODYNE.
8. THIS DIMENSION INCREASES TO 77.00 WHEN REMOVING UPPER HALF OF TURBINE CASE.
9. COMPRESSED LENGTH OF SPRING TO BE 4.75.
10. CONTOUR OF LAGGING.
11. THIS DIMENSION INCREASES TO 72.00 WHEN REMOVING UPPER HALF OF GEAR CASE.
12. HYDRAULIC TRIP CYLINDER.
13. DISTANCE BETWEEN SHAFT ENDS.
14. 10-HOLES 4.00 DIA. FOR GROUTING. 4-EACH SIDE, 1-EACH END.
15. AUTOMATIC HAND VALVES - 2 REQUIRED.
16. GOVERNOR SETTINGS:  
5802 R.P.M. = TURBINE SPEED MAX.  
5250 R.P.M. = TURBINE SPEED MIN.

17. SENTINEL VALVE SET AT 2 PSIG
18. PROVISION FOR LIFTING GEAR CASE COVER ONLY.
19. BOOSTER OIL PUMP PERMISSIVE START SWITCH.
20. PIPE CONNECTIONS TO EXTEND A MINIMUM OF 3.00" BEYOND LAGGING.
21. 16 - HOLES 1"-8 TAP FOR VERTICAL JACKING SCREWS. SCREWS FURNISHED BY TURBODYNE.
22. ALLOW FOR GROUT.
23. HIGH SPEED COUPLING-AMERIGEAR FE-102 1/2 WITH A 5.00 SPACER.
24. LOW SPEED COUPLING-AMERIGEAR FE-103 1/2 WITH A 5.00 SPACER.
25. HIGH SPEED COUPLING GUARD.
26. LOW SPEED COUPLING GUARD.
27. CUSTOMER TO PROVIDE ADEQUATE SUPPORT ALONG ALL BEAMS OR FOUNDATION TO BE BUILT SO AS TO SUPPORT ALL BEAMS.
28. OIL TANK CAPACITY-APPROX. 125 GALS.
29. 4-OIL TANK CLEAN OUT HOLES (2-EACH SIDE).
30. LIFTING LUGS- 6 PROVIDED.
31. APPROXIMATELY 53 GPM OF FRESH WATER AT 100° F IS REQUIRED FOR COOLING THE LUBRICATING OIL. MAXIMUM ALLOWABLE WATER PRESSURE 150 PSIG. MAXIMUM RECOMMENDED WATER PRESSURE 75 PSIG.
32. A 10"-150# NON-RETURN VALVE OF SUFFICIENT SIZE TO PASS 24,000 LBS. PER HOUR WILL BE FURNISHED FOR THIS LINE BY OTHERS.
33. MAIN OIL PUMP #1 DRIVEN BY GEAR SHAFT.
34. MAIN OIL PUMP SUCTION.
35. DISTANCE REQUIRED TO REMOVE MAIN OIL PUMP.
36. AUXILIARY OIL PUMP #5 GAFTM.
37. BOOSTER OIL PUMP #2 GAFTM.

38. OIL FILTER TWIN S&S-1200-518-1.5S.
39. TACHOMETER MAGNETIC PICKUPS - (AIRPAX 085-101-0081) MOUNTED IN STEAM END BEARING CASE. 1- INDICATOR MOUNTED IN GAUGEBOARD.
40. AMPLIFIER BOX.
41. LOW GOVERNOR OIL PRESSURE ALARM SWITCH.
42. GOVERNOR SHUT DOWN ON TRIP PRESSURE SWITCH IN TRIP OIL LINE.
43. MICRO SWITCH - TO INDICATE T&T CLOSED.
44. HIGH OIL TEMPERATURE ALARM & TRIP SWITCH.
45. LOW OIL PRESSURE ALARM & TRIP SWITCH.
46. AUXILIARY OIL PUMP PRESSURE SWITCH.
47. OIL COOLER - BASCO "500" 06060.
48. GAUGEBOARD - SEE LIST OF GAUGES.
49. DISTANCE REQUIRED TO REMOVE OIL FILTER ELEMENTS.
50. SOLENOID TRIP - TO TRIP WHEN DE-ENERGIZED IN TRIP OIL LINE.
51. JUNCTION BOXES "A & B".
52. OIL LEVEL INDICATOR.
53. SEE ALSO THE FOLLOWING DRAWINGS:  
TURBINE WIRING SCHEMATIC:CE-181285  
DIAGRAMMATIC- OIL PIPING:LC-180342  
GLAND SEAL & LEAKOFF PIPING:LB-180774
54. INLET & EXHAUST PRESSURE CONTROLLERS & TRANSMITTERS LATER.
55. LOW GOVERNOR OIL PRESSURE TRIP SWITCH.
56. 3-WAY SOLENOID DUMP VALVE FOR AUTOMATIC HAND VALVE #1.
57. 3-WAY SOLENOID DUMP VALVE FOR AUTOMATIC HAND VALVE #2.
58. WOODWARD TM-25LP ACTUATOR.

IMPORTANT :

THIS DRAWING HAS BEEN RELEASED FOR PRODUCTION. ANY CHANGES MAY AFFECT PRICE AND DELIVERY.

THIS PRINT IS CERTIFIED CORRECT FOR

CUSTOMER'S ORDER NO. L.I. 8/19/82  
BRANCH OFFICE NO. 10-21165  
WORK ORDER NO. U-23018  
APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
AP

THE CONSTRUCTION SHOWN IS STANDARD FOR THIS MACHINE. ANY DEVIATION FROM STANDARD MAY INVOLVE ADDITIONAL COST. A CORRESPONDING INCREASE IN SELLING PRICE AND DELAY IN SHIPMENT. IF CHANGES ARE NECESSARY INDICATE THEM CAREFULLY AND IN DETAIL ON THIS PRINT AND RETURN TO TURBODYNE. YOU WILL BE ADVISED PROMPTLY AS TO THE ADDITIONAL PRICE. MEANWHILE THOSE DETAILS INVOLVED WILL BE HELD UP UNTIL YOUR AUTHORIZATION TO PROCEED IS RECEIVED.

STEAM TURBINE DIVISION

OUTLINE NOTES

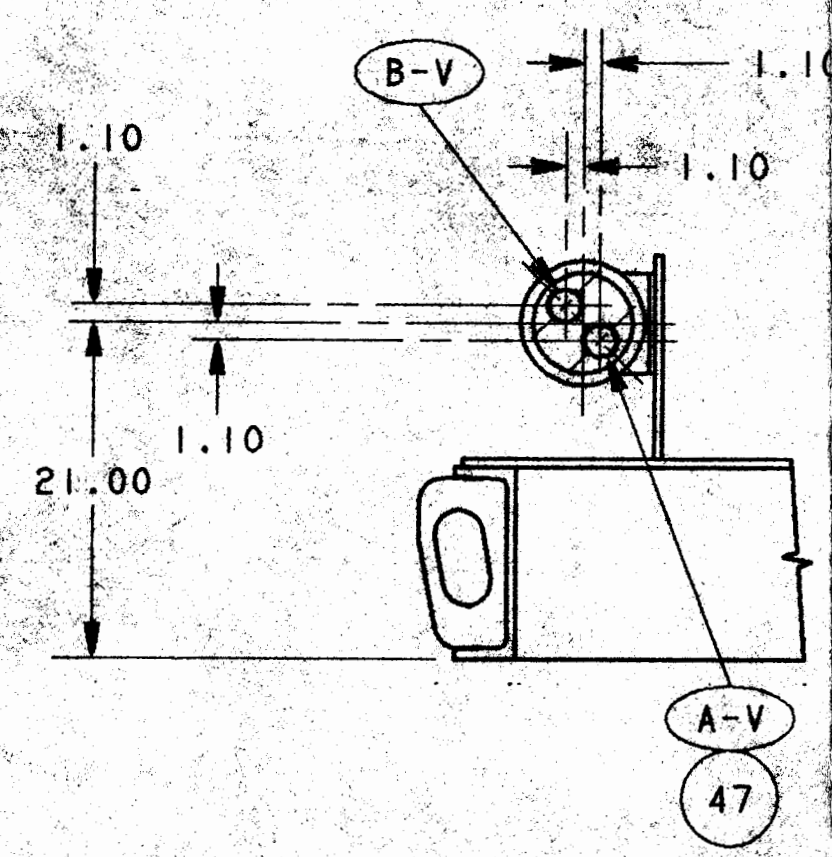
**Turbodyne**  
STEAM TURBINES  
DRAWN BY: R.K. DATE: 11/19/82  
CHECKED: SCALE:  
SUPER: R.A. FRAME:  
APP BY: J.B. SO.: U-23018

CC-180224

FIGURE 2.11

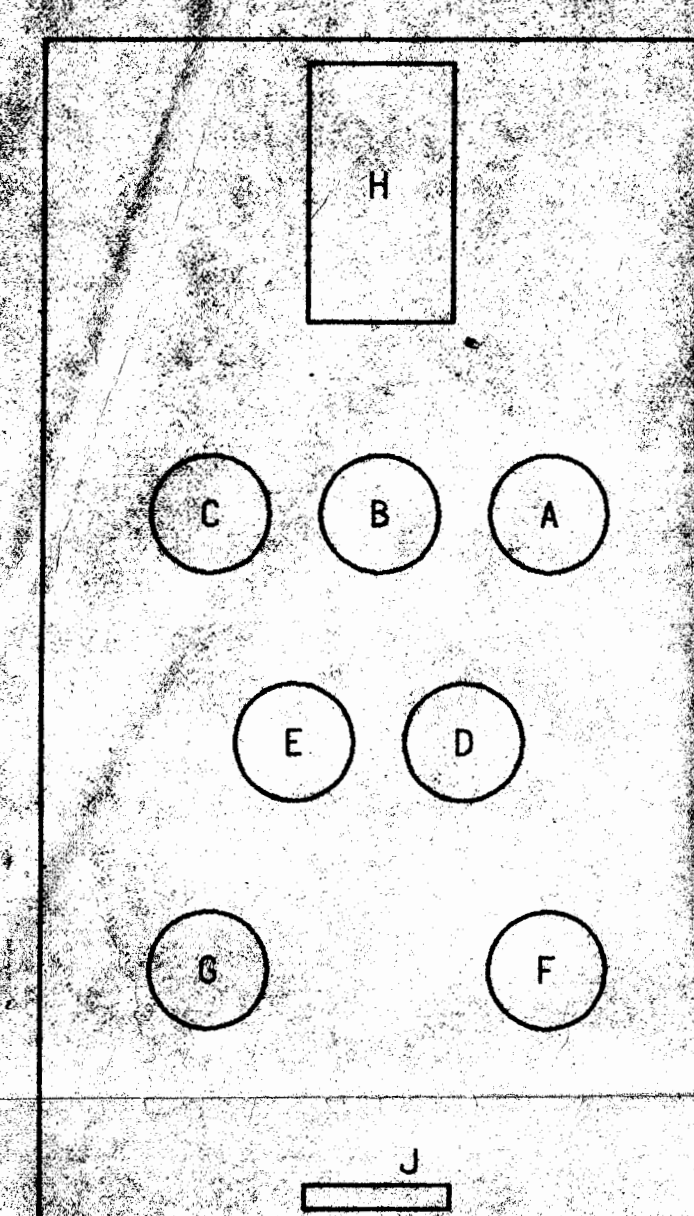
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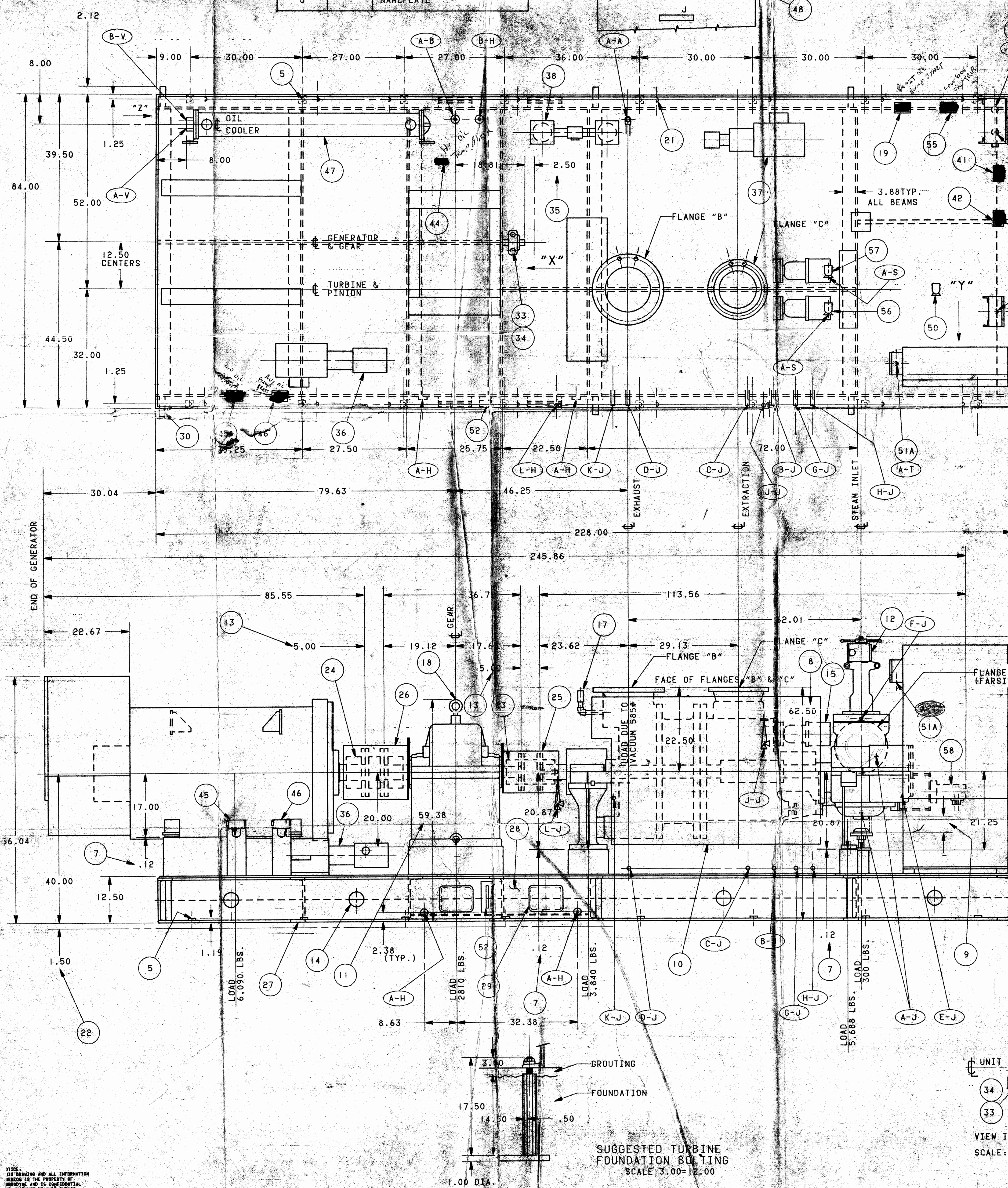


VIEW IN DIRECTION OF ARROW "7"

| LIST OF GAUGES |           |                                |
|----------------|-----------|--------------------------------|
| GAUGE          | DIAL SIZE | DESCRIPTION                    |
| A              | 4-1/2     | INITIAL PRESSURE               |
| B              | 4-1/2     | GLAND SEAL PRESSURE            |
| C              | 4-1/2     | BEARING OIL PRESSURE           |
| D              | 4-1/2     | CONTROLLED EXTRACTION PRESSURE |
| E              | 4-1/2     | EXHAUST END PRESSURE           |
| F              | 4-1/2     | STEAM INLET THERMOMETER        |
| G              | 4-1/2     | EXHAUST END THERMOMETER        |
| H              |           | TACHOMETER                     |
| J              |           | NAMEPLATE                      |



VIEW IN DIRECTION OF ARROW "Y"  
SCALE 3.00=12.00



SUGGESTED TURBINE  
FOUNDATION BOLTING  
SCALE 3.00=12.00

## PIPING CALCULATIONS

1. THE TOTAL RESULTANT FORCE AND TOTAL RESULTANT MOMENT IMPOSED ON THE TURBINE AT ANY CONNECTION MUST NOT EXCEED THE FOLLOWING:

|            |     |
|------------|-----|
| FLANGE     | A   |
| INLET      | 300 |
| EXTRACTION | 434 |
| EXHAUST    | 467 |

**F** = RESULTANT FORCE (POUNDS) INCLUDING PRESSURE FORCES WHERE UNRESTRAINED EXPANSION JOINTS ARE USED AT THE CONNECTION EXCEPT ON VERTICAL EXHAUSTS. FULL VACUUM LOAD IS ALLOWED ON VERTICAL DOWN EXHAUST FLANGES. IT IS NOT INCLUDED AS PART OF THE PIPING LOAD.

M= RESULTANT MOMENT, POUND FEET

2. THE COMBINED RESULTANTS OF THE FORCES AND MOMENTS OF THE INLET, EXTRACTION AND EXHAUST CONNECTIONS, RESOLVED AT THE CENTERLINES OF THE EXHAUST CONNECTION MUST NOT EXCEED THE FOLLOWING TWO CONDITIONS:

A. THE RESULTANTS MUST NOT EXCEED:  $F_c = \frac{20,000 - MC}{\lambda}$

$F_C$  = COMBINED RESULTANT OF INLET, EXTRACTION AND EXHAUST FORCES. POUNDS.

M C = COMBINED RESULTANT OF INLET, EXTRACTION AND EXHAUST MOMENTS AND MOMENTS RESULTING FROM FORCES. POUND FEET.

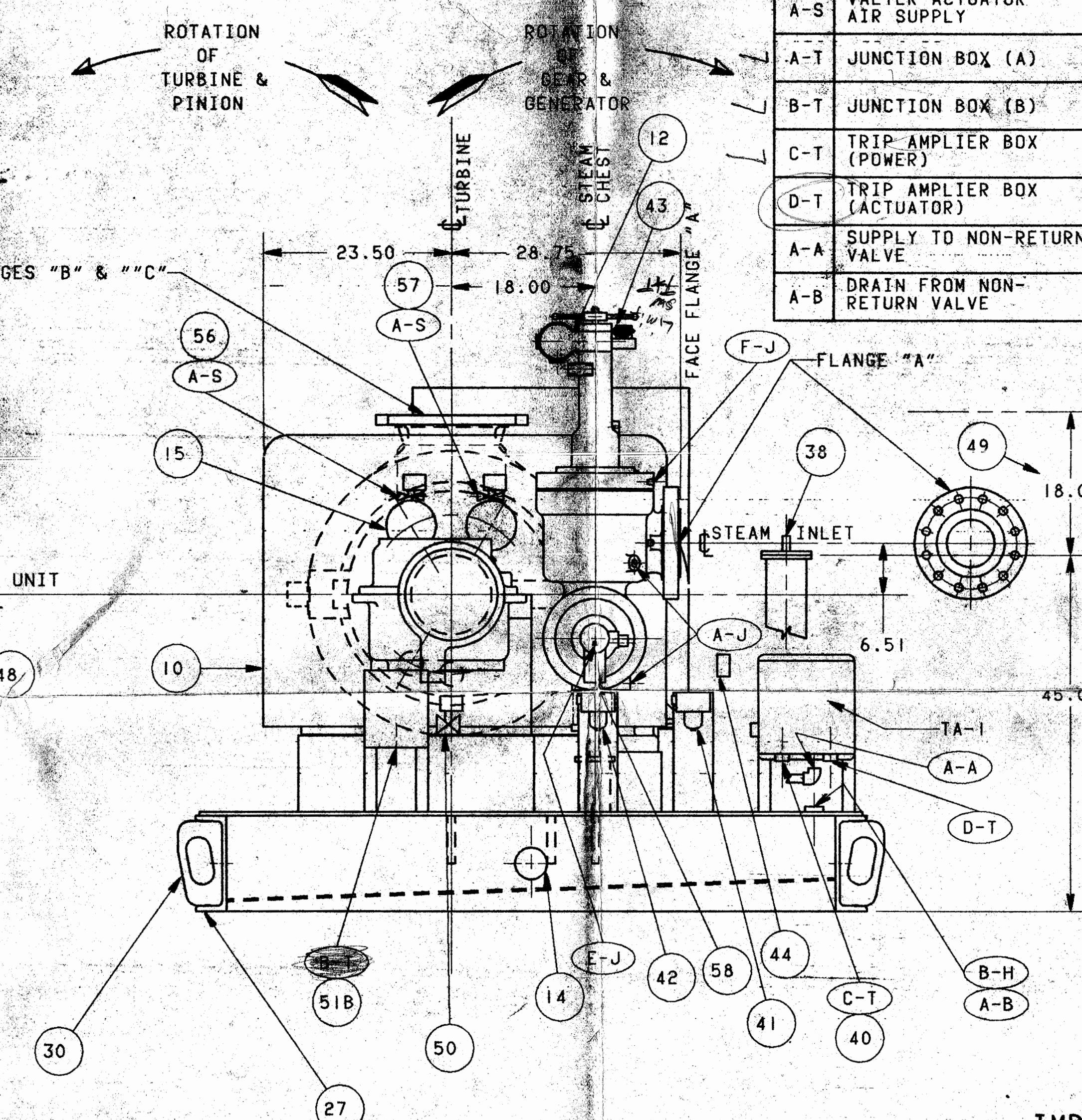
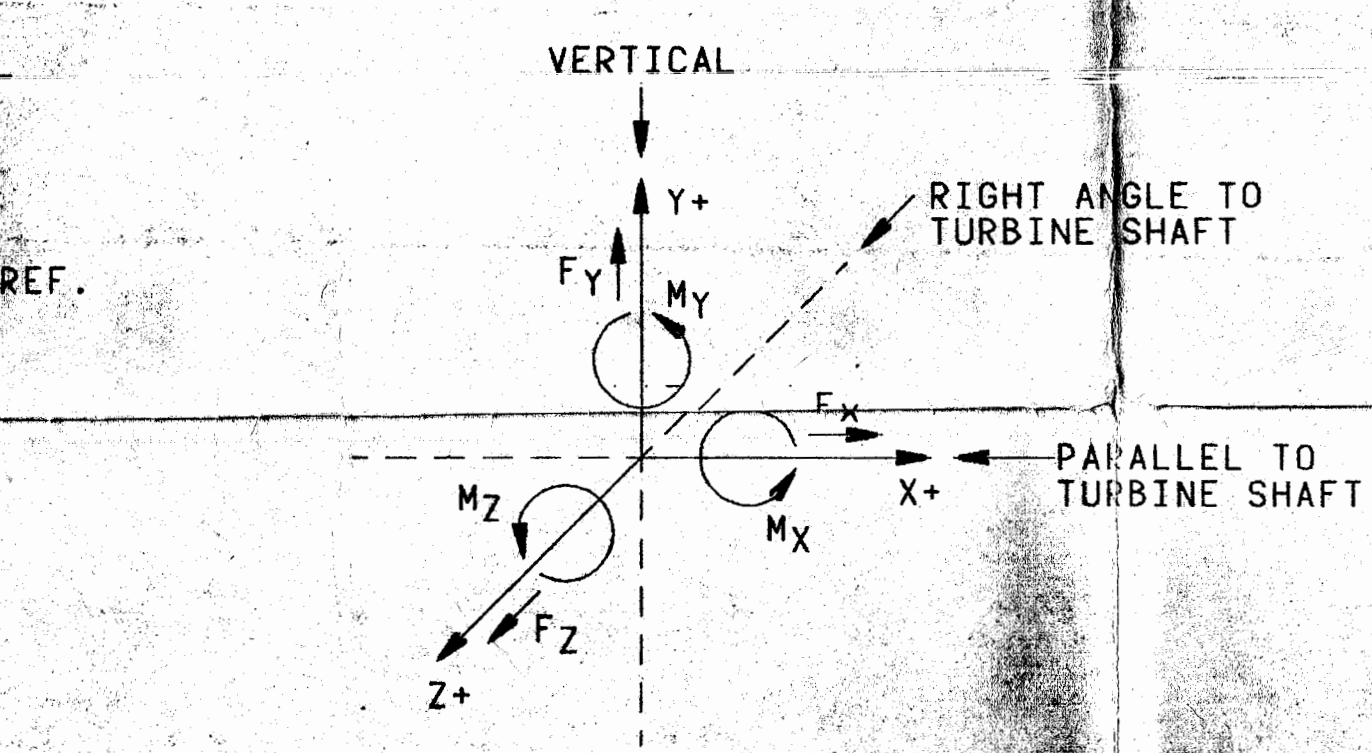
B. THE COMPONENTS OF THESE RESULTANTS SHALL NOT EXCEED:

THE COMPONENTS OF THESE RESULTANTS SHALL NOT BE

|                              |                                  |
|------------------------------|----------------------------------|
| F <sub>X</sub> = 579 POUNDS  | M <sub>X</sub> = 2894 POUND FEET |
| F <sub>Y</sub> = 1447 POUNDS | M <sub>Y</sub> = 1447 POUND FEET |
| F <sub>Z</sub> = 1158 POUNDS | M <sub>Z</sub> = 1447 POUND FEET |

3. FOR TURBINES WITH A VERTICAL EXHAUST AND AN UNRESTRAINED EXPANSION JOINT AT THE EXHAUST, CALCULATE THE VERTICAL FORCE COMPONENT ON THE EXHAUST CONNECTION EXCLUDING PRESSURE LOADING. COMPARE THIS WITH 1/6 OF THE PRESSURE LOADING ON THE EXHAUST. USE THE LARGER OF THE TWO VALUES FOR VERTICAL FORCE COMPONENT ON THE EXHAUST CONNECTION.

4. THESE VALUES OF ALLOWABLE FORCE AND MOMENT PERTAIN TO THE TURBINE STRUCTURE ONLY. THEY DO NOT PERTAIN TO THE FORCES AND MOMENTS IN THE CONNECTING PIPING, FLANGE AND FLANGE BOLTING SHOULD NOT EXCEED THE ALLOWABLE STRESS AS DEFINED BY APPLICABLE CODES AND REGULATORY BODIES.



FORM "SHB" MULTISTAGE STEAM TURBINE  
WITH  
WOODWARD 2301 ELECTRONIC GOVERNOR  
DRIVING  
1538 KVA, 480 VOLTS, 3 PHASE, 60 HZ  
GENERATOR WITH BRUSHLESS EXCITOR  
THRU  
FORM "E" REDUCTION GEAR 5526/1800 R.

### APPROXIMATE WEIGHTS

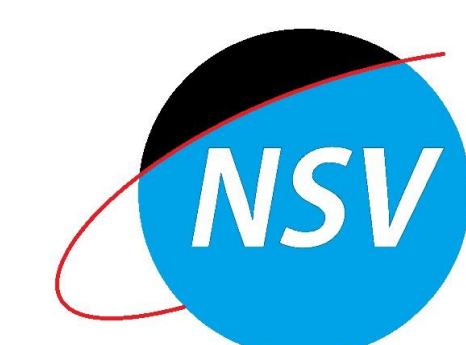
|                                 |        |
|---------------------------------|--------|
| TURBINE-----                    | 9,828  |
| GEAR-----                       | 2,810  |
| GENERATOR-----                  | 6,090  |
| BASEPLATE-----                  | 11,100 |
| ACCESSORIES-----                | 772    |
| TOTAL-----                      | 30,600 |
| GENERATOR ROTOR-----            | 2,731  |
| UPPER HALF OF TURBINE CASE----- | 2,462  |
| TURBINE ROTOR-----              | 1,158  |

CUSTOMERS MAJOR FLANGED CONNECTIONS

|   | FLANGE                  | SIZE | ANSI | O.D.  | B.C.  | NO. HOLES | DIA. HOLES | MIN. FLANGE THICKNESS | RAISED FACE    | REMARKS    |
|---|-------------------------|------|------|-------|-------|-----------|------------|-----------------------|----------------|------------|
| A | TURBINE INLET           | 6    | 600  | 14.00 | 11.50 | 12        | 1.00       | 1.88                  | .25 X 8.50 DIA | NOTES #1,3 |
| B | TURBINE EXHAUST         | 12   | 150  | 19.00 | 17.00 | 12        | 1.00       | 1.25                  | NONE           | NOTES #1,2 |
| C | UNCONTROLLED EXTRACTION | 10   | 150  | 16.00 | 14.25 | 12        | 1.00       | 1.19                  | .06 X 12.75DIA | NOTES#1,32 |

CUSTOMERS AUXILIARY CONNECTIONS

|     | CONNECTION                                 | NO. | SIZE & TYPE    | VALVE REQ'D | VALVE SUPPLIED BY | PIPE TO            | REMARKS  |
|-----|--------------------------------------------|-----|----------------|-------------|-------------------|--------------------|----------|
| A-J | STEAM CHEST DRAINS                         | 2   | 3/4" PIPE TAP  | YES         | CUSTOMER          | OPEN DRAIN         |          |
| B-J | NOZZLE BOWL DRAIN                          | 1   | 3/4" PIPE THD. | YES         | CUSTOMER          | OPEN DRAIN         | NOTE #20 |
| C-J | FIRST STAGE DRAIN                          | 1   | 3/4" PIPE THD. | YES         | CUSTOMER          | OPEN DRAIN         | NOTE #20 |
| D-J | TURBINE CASE DRAIN                         | 1   | 3/4" PIPE THD. | YES         | CUSTOMER          | OPEN DRAIN         | NOTE #20 |
| E-J | STEAM CHEST COVER DRAIN                    | 1   | 1/2" PIPE TAP  | NO          |                   | OPEN DRAIN         |          |
| G-J | STEAM END PACKING CASE ATMOS. LEAKOFF      | 1   | 3/4" PIPE THD. |             |                   | OPEN DRAIN         | NOTE #20 |
| H-J | STEAM END PACKING CASE DRIP DRAIN          | 1   | 3/4" PIPE THD. | NO          |                   | OPEN DRAIN         | NOTE #20 |
| J-J | STEAM END PACK. CASE SEAL, STM. SUPPLY     | 1   | 3/8" PIPE TAP  | YES         | TURBODYNE         | STEAM SUPPLY       |          |
| K-J | EXHAUST END PACKING CASE DRIP DRAIN        | 1   | 1" PIPE THD.   | NO          |                   | OPEN DRAIN         | NOTE #20 |
| L-J | EXHAUST END PACKING CASE SEAL, STM. SUPPLY | 1   | 3/8" PIPE TAP  | YES         | TURBODYNE         | STEAM SUPPLY       |          |
| A-H | OIL TANK DRAIN & OIL PURIFIER SUPPLY       | 2   | 3/4" PIPE TAP  |             | CUSTOMER          |                    | PLUGGED  |
| B-H | OIL PURIFIER RETURN                        | 1   | 3/4" PIPE TAP  |             |                   | LUST. OIL PURIFIER |          |
| A-V | OIL COOLER WATER INLET                     | 1   | 2" PIPE TAP    | YES         | CUSTOMER          | WATER SUPPLY       | NOTE #31 |
| B-V | OIL COOLER WATER OUTLET                    | 1   | 2" PIPE TAP    |             |                   |                    |          |
| F-J | TRIP VALVE STEM LEAKOFF                    | 1   | 3/4" PIPE TAP  | NO          |                   | OPEN DRAIN         |          |
| A-S | VALTEK ACTUATOR AIR SUPPLY                 | 2   | 1/2" PIPE TAP  |             |                   | 40 PSIG AIR SUPPLY | NOTE #15 |
| A-T | JUNCTION BOX (A)                           | 1   | 3/4" PIPE TAP  |             |                   |                    | NOTE #51 |
| B-T | JUNCTION BOX (B)                           | 1   | 1" PIPE TAP    |             |                   |                    | NOTE #51 |
| C-T | TRIP AMPLIFIER BOX (POWER)                 | 1   | 1/2" PIPE TAP  |             |                   |                    | NOTE #40 |
| D-T | TRIP AMPLIFIER BOX (ACTUATOR)              | 1   | 1/2" PIPE TAP  |             |                   |                    | NOTE #40 |
| A-A | SUPPLY TO NON-RETURN VALVE                 | 1   | 3/4" PIPE TAP  | NO          |                   |                    |          |
| A-B | DRAIN FROM NON-RETURN VALVE                | 1   | 3/4" PIPE TAP  | NO          |                   |                    |          |



FOR NOTES SEE CC-180224

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APPROVED BY: J. R. Burger DATE: 5-...

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STEAM TURBINE DIVISION

## OUTLINE

**Turbodyne** WORTHINGTON DIV.  
MC GRAM EDISON CO.

|                 |                      |
|-----------------|----------------------|
| STEAM TURBINES  | WELLSVILLE, NY 14895 |
| DRAWN BY: B. H. | DATE: 9/27/82        |

|              |               |
|--------------|---------------|
| CHECKED R.K. | SCALE: 1.0=12 |
|--------------|---------------|

|               |                  |
|---------------|------------------|
| SUPER: R. A.  | FRAME: SHB7/E-57 |
| ADD BY: J. R. | CD: 11 23018     |

APR 21 1964

**FIGURE**