3rd Edition...

NEW

CAPITOLINE

TRANS-A-PLATE

DESIGN MANUAL

FOR

HEATING, VENTILATION

AND

AIR CONDITIONING

COORDINATED

STANDARD DESIGN DETAILS

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CAPITOLINE TRANS-A-PLATE® DESIGN MANUAL for HEATING, VENTILATION and AIR CONDITIONING with COORDINATED STANDARD DETAILS

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FOREWORD

The tempo of today's economy, the population explosion, higher standards of living and the technological advances in the construction trades all contribute to increasing demands on the engineer to produce more and more in constantly diminishing periods of time. With this situation becoming increasingly apparent through his own personal experiences as a consulting engineer, Lee Kendrick came to the conclusion that "there must be a better way to run a railroad," as the saying goes.

Extensive research into engineering problems, available equipment to do various jobs, specifications, codes, present-day drafting practices, new reproduction materials and advanced reproduction methods, plus many hours of consultations with fellow engineers and related tradesmen, resulted in this first edition of the Heating, Ventilating and Air Conditioning Manual. In conjunction with this unique compilation of engineering data pertinent to these fields, a new concept in the use of Standard Design Details has made possible the reproduction of standard designs printed on translucent pressure-sensitive drafting material which can be applied directly to a tracing, thus eliminating countless hours of repetitious drafting time.

The express purpose of this manual and use of the standard detail system, is to save many valuable man-hours in the preparation of working drawings as well as clearly present the required components of a mechanical system in considerably more detail than would normally be practical by former methods. The author has been using these components for years in his practice with proven savings of valuable time and a more complete and accurate interchange of information between the builder, the design team and the installing contractor.

You will note that the standard detail plates in this manual depict far greater and more minute details than time would permit under former methods, yet they are so drawn to a size that is well within the limits of clear legibility for easy reading no matter what method of reproduction for distribution copies is utilized.

By using this system of standard details, you will readily discover that it provides a ready and constant reference and design method for the selection of equipment to meet specific requirements. Components remain basically constant from project to project, but the standard details contained herein can be very easily altered when necessary to meet a specific situation.

Adequate detailing of components for Heating, Ventilating and Air Conditioning systems is a very necessary step toward obtaining the best end result in the construction of the system, but far too often these details are left until the end of the design stages, thereby resulting in skimpy, if any, details of the components. Frequently, components are not detailed at all, but left to the written word of the specifications. It has been found, when these components are presented in greater detail, system prices are frequently lower and coordination between Architect-Engineer and Contractor goes much smoother since both parties know exactly what is expected. Lack of adequate information results in misunderstanding of exactly what is required and often requires considerable time in verbal explanations or clarification drawings. It is the goal of this book not only to improve the quality of the Heating, Ventilating and Air Conditioning details but to considerably reduce the number of man-hours required to produce these drawings. The tedious task of tracing details and the frequent mistakes in transcribing can now be eliminated by use of the transparencies described herein.

The details that show as plates in this book are all details of standard components of Heating, Ventilation and Air Conditioning systems. These components are used repeatedly from job to job throughout the country, and vary only slightly in the arrangement. This system does not contemplate the standard detailing of systems; since this should be left to the judgment of the designer. The details have been coordinated with the manufacturers of equipment shown and all information needed for the setting and installation of this equipment. In addition, where there is a schedule of capacities required, it has been shown at the lower part of the detail. This was done so that if more than one of these components is on a project, the lines may be extended and more components shown in the schedule. The schedules have been checked to see that all information required by the contractor and the manufacturer is included therein. In this way, it is felt that the often forgotten data will not inadvertently be overlooked.

The concept of this system was based on the premise that, "once a detail has been drawn, it is money out of your pocket every time you pay a man to re-draw it or trace it for each continuing application." This cost figure becomes even greater when you relate it to the loss of a man's time that could have been more profitably spent doing creative system design.

John Everetts Jr

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DESCRIPTION OF CAPITOLINE TRANS-A-PLATE®
STANDARD DETAIL DRAWING TRANSPARENCY SYSTEM

TOGETHER WITH THE DEVELOPMENT OF THE STANDARD DETAIL DRAWING PLATES CONTAINED IN THIS MANUAL, HAS BEEN THE DEVELOPMENT OF PRINTING THE SAME DRAWINGS ON PRESSURE-SENSITIVE ADHESIVE BACKED DRAFTING SURFACE TRANSPARENCY MATERIALS.

DEVELOPED AND AVAILABLE UNDER THE TRADE MARK NAME OF CAPITOLINE TRANS-A-PLATES, THESE STANDARD DETAIL DRAWINGS CAN BE APPLIED QUICKLY AND DIRECTLY ON ALL DRAFTING MATERIALS PRODUCING A PERMANENT ORIGINAL THAT WILL RESULT IN EXCELLENT HIGH QUALITY REPRODUCTIONS. ADDITIONS MAY BE MADE EQUALLY WELL WITH PENCIL OR INK ON THE FINE DRAFTING SURFACE. DELETIONS CAN BE QUICKLY MADE WITH AN ELECTRIC ERASER OR REGULAR RUBY ERASER WITHOUT DAMAGE TO THE DRAFTING SURFACE.

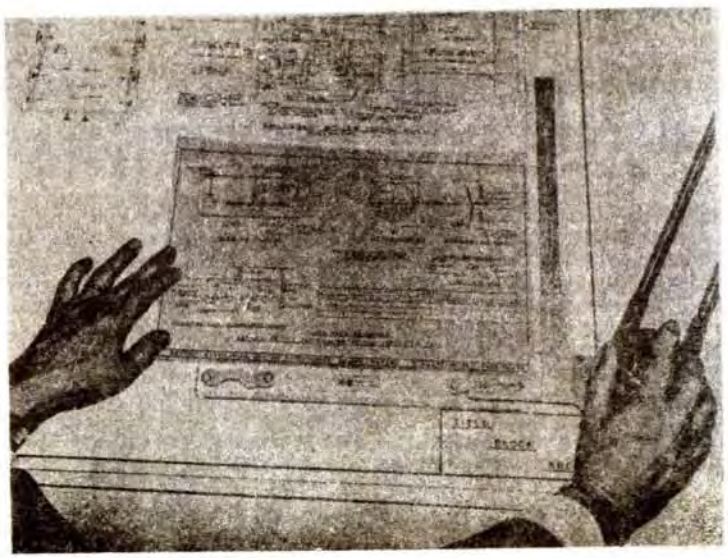
THESE ECONOMICAL, BEAUTIFULLY DETAILED CAPITOLINE TRANS-A-PLATES ARE AVAILABLE IN THE SAME SIZE AS THE DRAWING PLATES APPEARING IN THIS BOOK (10" X 15") AND MAY BE ORDERED BY PLATE NUMBER IN ANY QUANTITY DESIRED.

IF YOUR LOCAL BLUEPRINTER OR ENGINEERING DRAFTING SUPPLY DEALER CANNOT FURNISH THE TRANS-A-PLATES YOU NEED THEY MAY BE ORDERED DIRECT FROM TECHNICAL STANDARDS PUBLICATIONS, INC., 2620 WILSON BLVD., ARLINGTON, VIRGINIA 22210, P.O. BOX 246. YOUR ORDERS WILL BE PROMPTLY PROCESSED AND SENT TO YOU BY RETURN MAIL.

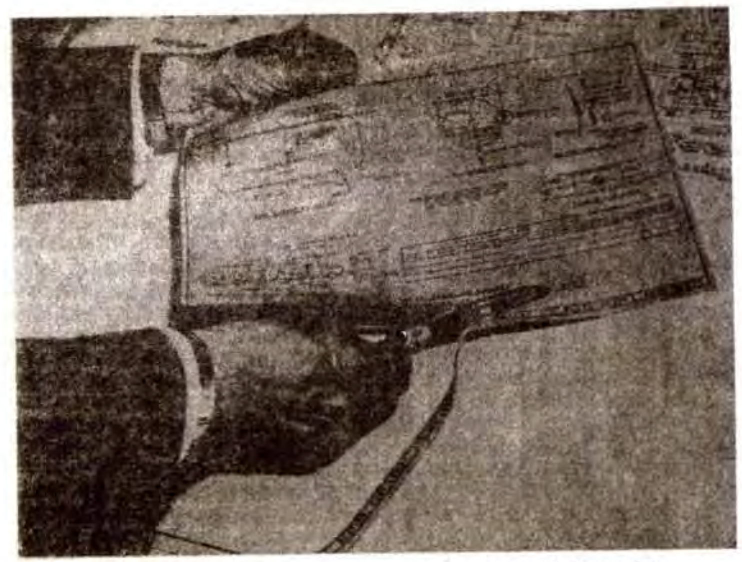
APPLICATION OF THE CAPITOLINE TRANS-A-PLATE TRANSPARENCIES

The pressure-sensitive transparencies may be very easily and quickly applied to your project tracings. Drawings with properly affixed transparencies may be printed repeatedly and handled as frequently as any functional type drawing with no adverse effect. The following procedure should be used in the application of the transparency to the project drawings:

STEP 1 Select appropriate standard detail transparency for project on which you are working.



STEP 2 Orient the transparency on the project drawing.

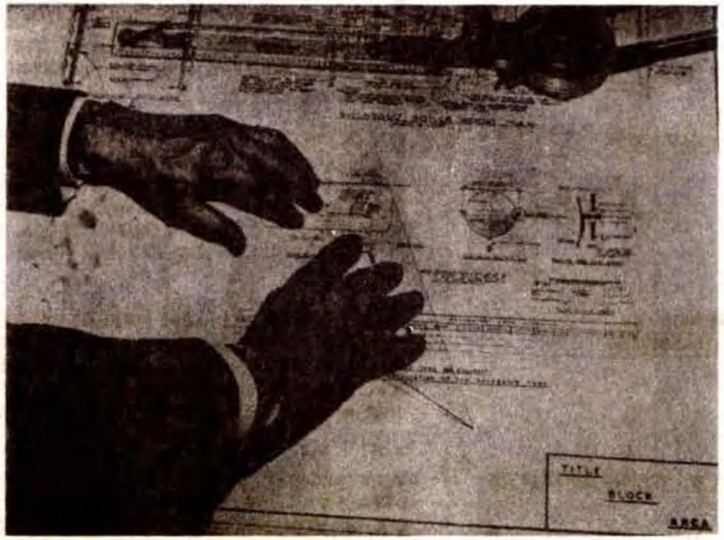


STEP 3 Scissor off the book name, plate number, and page number or any area not applicable to project.

STEP 4 Strip off the backing paper exposing approximately 1" of the pressure-sensitive adhesive along one edge.

STEP 5 Place the exposed adhesive edge of the transparency in its exact location on the drawing in proper alignment.

STEP 6 With a triangular scale rule pressed against the adhered portion, slide the rule, under pressure, over the surface while simultaneously pulling out the backing paper from between the transparency and the tracing.



STEP 7 With a straight edge or triangle, burnish the transparency onto the project tracing, to remove any air pockets between the materials.

STEP 8 Complete the schedules, if any, that are shown on the details. Information on filling in the schedules is shown above each detail in the book on the instruction sheet.

OTHER USES

CHANGES:

IF ANY CHANGE OR DELETION IS, IN THE JUDGMENT OF THE DESIGNER, NECESSARY, IT IS QUITE EASY TO REMOVE ANY LINE OR LETTER FROM THE TRANSPARENCY BY THE USE OF AN ELECTRIC ERASING MACHINE. ADDITIONS MAY BE EQUALLY AS EASILY MADE WITH THE USE OF A DRAFTING PENCIL WITH "H" LEAD. THE TRANSPARENCY, YOU WILL FIND, TAKES PENCIL AS WELL AS THE PROJECT TRACING PAPER.

USE OF THE TRANSPARENCY DURING PRELIMINARY DESIGN STAGES:

IT HAS BEEN FOUND THAT THE TRANSPARENCIES MAY BE USED DURING PRELIMINARY DESIGN STAGES IN THE FOLLOWING MANNER: WHEN THE ARCHITECT OR ENGINEER REQUIRES DESIGN INFORMATION REGARDING THE WEIGHT CHARACTERISTICS, PHYSICAL SIZE, ETC. OF MECHANICAL COMPONENTS, IT IS QUITE EASY TO MAKE A PRINT OF THE TRANSPARENCY, MARK THESE CHARACTERISTICS ON THE PRINT AND SEND IT TO THE ARCHITECT OR STRUCTURAL ENGINEER FOR HIS INFORMATION. INFORMATION USUALLY REQUIRED BY THE ELECTRICAL ENGINEER, SUCH AS HORSEPOWER AND VOLTAGE AND CURRENT CHARACTERISTICS, MAY ALSO BE MARKED ON A PRINT AND SENT TO THE ELECTRICAL ENGINEER FOR HIS USE DURING THE DESIGN STAGES OF THE PROJECT.

USE OF THE TRANSPARENCY DURING THE WORKING DRAWING STAGES:

THE PROJECT DESIGNER WILL FIND THE DETAILS IN THIS BOOK A WELCOME PICTORIAL AID IN EXPLAINING TO A DRAFTSMAN OR CLIENT EXACTLY WHAT PIECE OF EQUIPMENT HE HAS IN MIND AND PRECISELY HOW HE INTENDS TO INSTALL IT. OFTEN A PICTURE OF THE COMPONENT WILL QUICKLY CLEAR UP ANY LACK OF UNDERSTANDING WITHIN THE DESIGN TEAM AS TO THE EXACT INTENT, THEREBY SAVING VALUABLE DESIGN TIME AND ALLOWING DEADLINES TO BE MET. THE DESIGNER CAN, FURTHER, BETTER PRE-PLAN THE WORKING DRAWINGS AND PINPOINT EXACTLY WHAT DETAILS ARE TO BE USED AND ON WHAT SHEETS THEY ARE GOING TO BE PLACED.

REFERENCE SYSTEM:

ON SMALLER PROJECTS WHERE IT IS NOT DESIRED TO PRESENT DRAWINGS IN GREAT DETAIL, THE USE OF THE REFERENCE SYSTEM IS SUGGESTED. IN THE REFERENCE SYSTEM, THE DESIGNER CAN SHOW IN OUTLINE ON THE SMALL SCALE PLANS THE ITEM OF MECHANICAL EQUIPMENT WITH A NOTE THAT STATES, FOR EXAMPLE – "THE PUMP SHALL BE INSTALLED IN ACCORDANCE WITH THE HEATING, VENTILATION AND AIR CONDITIONING MANUAL, PLATE NO. 62". THE USE OF THE REFERENCE SYSTEM IS NOT RECOMMENDED ON LARGE PROJECTS, SINCE IT IS FELT THAT IT IS FAR BETTER TO HAVE THE DETAILS ON DRAWINGS WITH THE REST OF THE PROJECT PLANS SO THAT ALL DETAILS WILL BE IN ONE DOCUMENT.

USE AS A TRAINING AID:

WITH THE GROWTH OF THE CONSTRUCTION INDUSTRY AS A WHOLE, AND THE ARCHITECT-ENGINEER DESIGN PROFESSION SPECIFICALLY, HAS COME A SHORTAGE OF QUALIFIED DESIGNERS. THE RESULT HAS BEEN A NECESSITY TO TRAIN NEW DESIGNERS AS QUICKLY AS POSSIBLE. THE BOOK AND THE TRANSPARENCIES OFFER AN EXCELLENT TRAINING INSTRUMENT FOR YOUNG NEW DESIGNERS NOT THOROUGHLY ACQUAINTED WITH THE VARIOUS COMPONENTS. THE DESIGN NOTES ACCOMPANYING THE DETAILS OFFER A CHECK LIST FOR INFORMATION REQUIRED ON THE SCHEDULES AND DRAWINGS AND A CONCISE METHOD OF DESIGN. SCHOOLS AND VOCATIONAL CLASSES WILL FIND THE BOOK AND DETAILS AN EXCELLENT REFERENCE TEXT IN ATTEMPTING TO TEACH THE DESIGN MAKE-UP, AND USE OF THE VARIOUS PARTS THAT GO TO MAKE UP A COMPLETE SYSTEM.

USE AS A METHOD FOR STANDARDIZING DESIGN:

LARGER FIRMS WITH A LARGE STAFF OF DESIGNERS WILL FIND THE BOOK AND THE TRANSPARENCIES AN EXCELLENT MEANS OF STANDARDIZATION. PRINCIPALS IN THE FIRM CAN, BY GIVING EACH DESIGNER A BOOK AND INSTRUCTIONS TO FOLLOW THE DETAILS, ACHIEVE A FORM OF STANDARDIZATION IN THE DRAWINGS THE FIRM ISSUES. GOVERNMENT, INDUSTRY, SCHOOL BOARDS, INSTITUTIONS, ETC. ABOUT TO EMBARK ON A LARGE SCALE CONSTRUCTION PROGRAM IN WHICH NUMEROUS ARCHITECT-ENGINEER FIRMS ARE TO BE USED, CAN, BY ISSUING THESE DETAILS, ACHIEVE A GOOD MEASURE OF STANDARDIZATION THROUGHOUT THE COURSE OF THE CONSTRUCTION PROGRAM.

USE BY THE INSTALLING CONTRACTOR:

WHERE ADEQUATE DETAILS OF THE COMPONENTS HAVE NOT BEEN GIVEN TO THE INSTALLING CONTRACTOR, THE CONTRACTOR WILL FIND THESE DETAILS WILL ENABLE HIM TO PROVIDE HIS JOB SUPERINTENDENT A DETAILED DRAWING OF THE METHOD OF INSTALLATION OF EQUIPMENT, WITHOUT THE NECESSITY OF SPENDING HOURS SKETCHING OUT THE INSTALLATION DETAILS. THE CONTRACTOR WILL ALSO FIND THAT THE DETAILS ARE QUITE USEFUL WHEN MAKING A DETAILED COST ESTIMATE OF A PROJECT THAT DOES NOT HAVE ADEQUATE DETAILS, THEREBY PROVIDING HIM WITH A VISUAL CHECK OF THE MANY ITEMS REQUIRED FOR COMPLETE INSTALLATION.

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DESIGNERS' CHECK LIST

THE FOLLOWING LIST OF THIRTY-FIVE ITEMS SHOULD BE THOROUGHLY CHECKED BY THE DESIGNER AT THE COMPLETION OF EACH PROJECT. THE LIST SHOULD BE INITIALLED ITEM BY ITEM AND THEN FILED IN THE PROJECT FILE.

1. CHECK TO ASCERTAIN THAT EVERY MECHANICAL COMPONENT ON THE PROJECT HAS BEEN DETAILED ON THE DRAWINGS.
2. CHECK EVERY DETAIL TO SEE IF THE SCHEDULE THEREON HAS BEEN COMPLETED AND IS ACCURATE.
3. CHECK EACH ROOM IN THE BUILDING TO BE SURE THAT IT HAS BEEN ADEQUATELY HEATED, COOLED, AND VENTILATED.
4. CHECK TO BE SURE THAT ADEQUATE SPACE HAS BEEN PROVIDED TO PULL THE TUBES FOR BOILERS, CHILLERS, CONVERTORS, OR HOT WATER GENERATORS.
5. CHECK TO SEE IF VIBRATION ELIMINATORS HAVE BEEN PROPERLY INDICATED FOR EACH PIECE OF ROTATING EQUIPMENT.
6. CHECK TO SEE IF ADEQUATE SPACE HAS BEEN PROVIDED TO SERVICE ALL EQUIPMENT.
7. CHECK TO SEE IF ANY LADDERS OR CATWALKS ARE REQUIRED FOR EACH PIECE OF MAJOR EQUIPMENT
8. CHECK ALL DUCT RUNS TO BE SURE THAT THE DUCT SHOWN WILL FIT INTO THE AVAILABLE SPACE AND DOES NOT INTERFERE WITH PIPES, LIGHTS, OR STRUCTURAL MEMBERS.
9. CHECK ALL PIPE RUNS TO BE SURE THAT THE PIPE WILL FIT INTO THE AVAILABLE SPACE AND DOES NOT INTERFERE WITH DUCTS, LIGHTS, OR STRUCTURAL MEMBERS.
10. CHECK TO SEE IF ADEQUATE COMBUSTION AIR OPENINGS HAVE BEEN PROVIDED FOR THE BOILER ROOM AND INCINERATOR ROOM.
11. CHECK THE FLUE SIZE AND HEIGHT TO SEE IF ADEQUATE DRAFT HAS BEEN PROVIDED.
12. CHECK THE BOILER PRESSURE RATING TO SEE IF IT IS ADEQUATE FOR THE STATIC HEIGHT OF THE BUILDING.
13. CHECK THE EXPANSION TANK CALCULATION TO BE CERTAIN IT IS LARGE ENOUGH AND IS PROPERLY LOCATED IN RELATION TO THE PUMP.
14. CHECK THE PIPING SYSTEM TO SEE IF ADEQUATE EXPANSION LOOPS AND ANCHORS HAVE BEEN PROVIDED AND DETAILED.
15. CHECK RUNOUTS TO ROOM TERMINAL UNITS TO SEE IF PIPES CAN SLEEVE SPANDREL BEAMS OR OTHER OBSTRUCTIONS.
16. CHECK PROJECT PLANS TO SEE IF THE LOCATION OF ALL DUCTS AND PIPES HAS BEEN INDICATED.
17. CHECK THE PROJECT DOOR SCHEDULE TO SEE IF ALL DOORS REQUIRING VENTILATION OPENINGS HAVE BEEN ADEQUATELY UNDERCUT OR LOUVERED.
18. CHECK TO SEE THAT THERE ARE NO EXHAUST FANS OR RETURN AIR OPENINGS IN A ROOM WHERE COMBUSTION IS OCCURING.
19. CHECK TO SEE THAT THE CONTROL AIR COMPRESSOR IS SHOWN ON ALL PNEUMATIC CONTROL PROJECTS.
20. CHECK TO SEE THAT ALL MOTORS AND MOTOR STARTERS ARE SHOWN IN THE MOTOR AND MOTOR CONTROL SCHEDULE.
21. CHECK TO SEE THAT ALL UNDERFLOOR PIPING HAS WELDED JOINTS AND IS SPECIFIED TO BE TESTED TO 150 PSIG.
22. CHECK TO SEE IF TEMPERATURE CONTROL DIAGRAMS HAVE BEEN SHOWN FOR ALL EQUIPMENT REQUIRING AUTOMATIC CONTROL.
23. CHECK ALL CEILINGS TO BE SURE THAT AIR OUTLETS DO NOT INTERFERE WITH LIGHTS.
24. CHECK TO SEE IF THE CONTROL POINTS FOR ALL FANS HAVE BEEN INDICATED ON THE ELECTRICAL DRAWINGS AND IF THESE CONTROL POINTS ARE SATISFACTORY FOR THE OPERATION OF THE SYSTEM.
25. CHECK TO SEE IF SUFFICIENT VALVES HAVE BEEN PLACED IN THE SYSTEM TO ALLOW ISOLATION OF RISERS AND MAINS FOR SERVICE AND DRAIN DOWN.
26. CHECK HEAD ROOM AVAILABLE FOR ALL CEILING HUNG UNITS SUCH AS UNIT HEATERS.
27. CHECK TO BE SURE THAT ALL AIR FLOWS SHOWN BALANCE. CHECK ROOM BY ROOM BALANCE AND CHECK ROOM TOTALS AGAINST FLOW SHOWN FOR AIR HANDLING UNITS AND FANS.
28. CHECK TO SEE IF FIRE DAMPERS HAVE BEEN SHOWN IN ACCORDANCE WITH THE LOCAL CODES AND ORDINANCES.
29. CHECK ACOUSTICAL REQUIREMENTS OF THE PROJECT TO SEE IF ALL REQUIRED DUCT LINING AND SOUND TRAPS HAVE BEEN PROVIDED TO GIVE THE REQUIRED ATTENUATION OF NOISE.
30. CHECK TO SEE THAT ALL PIPES ARE CONTINUED TO POINT OF CONNECTION.
31. CHECK TO SEE IF ALL MOTORS AND OTHER ELECTRICAL INFORMATION HAS BEEN GIVEN TO THE ELECTRICAL DESIGNER.
32. CHECK TO SEE IF FREEZE PROTECTION HAS BEEN PROVIDED FOR WATER PIPES AND COOLING TOWER SUMP WHERE REQUIRED.
33. CHECK THE SPECIFICATIONS FOR COMPLETENESS AND ACCURACY.
34. CHECK THE PROJECT DRAWINGS TO SEE THAT ALL ROOM NAMES AND NUMBERS AND COLUMN NUMBERS HAVE BEEN PROPERLY INCLUDED.
35. CHECK THE PROJECT DRAWINGS FOR COMPLETION OF THE JOB NAME, TITLE BLOCKS AND PROFESSIONAL STAMPS.

HEATING, VENTILATING AND AIR CONDITIONING SYMBOLS

SYMBOL	MEANING	ABBREVIATION
	LOW PRESSURE STEAM PIPE	LPS
	MEDIUM PRESSURE STEAM PIPE	MPS
	HIGH PRESSURE STEAM PIPE	HPS
	LOW PRESSURE CONDENSATE RETURN PIPE	LPR
	MEDIUM PRESSURE CONDENSATE RETURN PIPE	MPR
	HIGH PRESSURE CONDENSATE PIPE	HPR
	HEATING WATER SUPPLY PIPE	HWS
	HEATING WATER RETURN PIPE	HWR
	CHILLED WATER SUPPLY PIPE	CWS
	CHILLED WATER RETURN PIPE	CWR
	COMBINED HEATING OR CHILLED WATER SUPPLY PIPE	HCS
	COMBINED HEATING OR CHILLED WATER RETURN PIPE	HCR
CS	CONDENSER WATER SUPPLY PIPE	C.S.
CR	CONDENSER WATER RETURN PIPE	C.R.
D	DRAIN PIPE FROM COOLING COIL	D
G	NATURAL GAS PIPE	G
LPG	LPG GAS PIPE	LPG
FOS	FUEL OIL SUPPLY PIPE	FOS
FOR	FUEL OIL RETURN PIPE	FOR
FOG	FUEL OIL GAGE PIPE IN CONDUIT	FOG
FOV	FUEL OIL VENT PIPE	FOV
R	REFRIGERANT PIPING	
	PIPE RISING	
	PIPE TURNING DOWN	
	AIR INTO REGISTER	
	AIR OUT OF REGISTER	
A	AIR FLOW THRU UNDERCUT OR LOUVERED DOOR SEE ARCHITECTURAL DRAWINGS FOR SIZE	
200	200 CFM FAN COIL UNIT	
UV 2	UNIT VENTILATOR	
VR 1	VENTILATION RISER	
CW 1	CHILLED WATER RISER	
	HIGH SIDE WALL REGISTER	HSWR
	LOW SIDE WALL REGISTER	LSWR
	CEILING REGISTER	CR
	SPLITTER DAMPER	SD
	THOUSAND BTU PER HOUR	MBH
	POWER ROOF VENTILATOR	PRV
	ROUND	ϕ
	FIRE DAMPER	FD

SYMBOL	MEANING	ABBREVIATION
	UNION	UN
	REDUCER	RED
	STRAINER	ST
	GATE VALVE	GV
	GLOBE VALVE	
	VALVE ON RISER	
	CHECK VALVE	CV
	PRESSURE REDUCING VALVE	PRV
	PRESSURE RELIEF VALVE	RV
	THERMOSTATIC TRAP	TT
	FLOAT AND THERMOSTATIC TRAP	F&T
	BUCKET TRAP	BT
T	THERMOSTAT	T
	SQUARE HEAD BALANCING COCK	
	THERMOMETER	
	PRESSURE GAGE	
	PITCH PIPE DOWN IN DIRECTION OF ARROW	
	ANCHOR	
	3 WAY CONTROL VALVE	
	SUPPLY AIR DUCT SECTION	
	RETURN OR EXHAUST AIR DUCT SECTION	
O A	OUTDOOR AIR DUCT SECTION	
	FIN TUBE RADIATION	
WF 210		
RC-1	RECESSED CONVECTOR	
HW 1	HOT WATER RISER	
OA 1	OUTDOOR AIR RISER	
	OUTDOOR AIR	OA
	RETURN AIR	RA
	SUPPLY AIR	SA
	CUBIC FEET PER MINUTE	CFM
	CEILING DIFFUSER	CD
	GALLON PER MINUTE	GPM
	TURNING VANES	TV
	FUSIBLE LINK	FL

NOTE: THESE ARE STANDARD SYMBOLS AND MAY NOT ALL APPEAR ON THE PROJECT DRAWINGS; HOWEVER, WHEREVER THE SYMBOL ON THE PROJECT DRAWINGS OCCURS, THE ITEM SHALL BE PROVIDED AND INSTALLED.

DESIGNING THE INSTALLATION OF THE GAS-FIRED, CAST-IRON, HOT WATER BOILER

1. DETERMINE THE REQUIRED RATINGS OF THE BOILER BY COMPUTING THE HEAT LOADS ACCORDING TO THE USUAL METHODS AS OUTLINED IN THE ASHRAE GUIDE AND DATA BOOK. NORMALLY, THE RATINGS ARE DEFINED BY THE THREE FOLLOWING VALUES:

   A. NET IBR RATING IN BTU/HR.

   B. AGA OUTPUT RATING IN BTU/HR.

   C. AGA INPUT RATING IN BTU/HR.

   IT SHOULD BE NOTED THAT THE NET IBR RATING INCLUDES A STANDARD ALLOWANCE FOR PIPING LOSS AND PICK-UP AND IS APPROXIMATELY 33 PERCENT HIGHER THAN THE AGA OUTPUT RATING OF THE BOILER.

2. BOILER SELECTION – THE BOILER SELECTED SHOULD HAVE A NET IBR RATING EQUAL TO THE COMPUTED BLOCK HEAT LOAD FOR THE BUILDING. WHERE TWO BOILERS ARE TO BE USED, EACH BOILER SHOULD HAVE A NET IBR RATING EQUAL TO 66-2/3 PERCENT OF THE COMPUTED BLOCK HEAT LOAD. CAREFUL CONSIDERATION SHOULD BE GIVEN TO FUTURE ADDITIONS TO THE BUILDING WHEN COMPUTING THE BLOCK HEAT LOAD FOR THE BUILDING.

3. DETERMINE THE GAS FIRING RATE –

   A. CALCULATE THE REQUIRED INPUT IN BTU/HR BY DIVIDING THE AGA OUTPUT BY .75 (EFFICIENCY).

   B. CALCULATE THE REQUIRED AMOUNT OF GAS TO BE BURNED BY DIVIDING THE INPUT IN BTU/HR BY THE HEATING VALUE OF THE GAS IN BTU/CUBIC FOOT.

   THE HEATING VALUE FOR GAS CAN BE ASCERTAINED FROM THE LOCAL GAS COMPANY; IF NOT AVAILABLE, USE 1,000 BTU/CUBIC FOOT FOR NATURAL GAS.

4. ANNUAL FUEL CONSUMPTION – THE ANNUAL FUEL CONSUMPTION MAY BE ESTIMATED BY THE FOLLOWING FORMULA:

$$\text{ANNUAL GAS CONSUMPTION IN THERMS (100,000 BTU)} = \frac{\text{TOTAL HEAT LOSS (BTU/HR)} \times \text{ANNUAL DEG. DAYS}}{\text{DESIGN TEMPERATURE DIFFERENCE} \times 3500}$$

5. CALCULATE THE AMOUNT OF COMBUSTION AIR REQUIRED – THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR AT 70 DEGREES F.

$$\text{CFM} = 0.265 \times \text{CUBIC FEET PER HOUR}$$

   NOTE: THIS IS THE AMOUNT OF AIR REQUIRED FOR COMBUSTION AND IS NOT THE AMOUNT OF THE FLUE GASES.

6. CALCULATE THE AMOUNT OF FREE AREA REQUIRED IN THE COMBUSTION AIR LOUVERS – THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR ABOVE THAT REQUIRED UNDER NO. 5 ABOVE AND IS THE AMOUNT REQUIRED FOR COMBUSTION AND FOR THE VENTILATION OF THE BOILER ROOM.

$$\text{CFM} \times 1.3 \div 250 \text{ FEET PER MINUTE} = \text{FREE AREA OF COMBUSTION AIR LOUVERS}$$

   IT SHOULD BE NOTED THAT MOST LOUVERS HAVE ONLY ABOUT 50 PERCENT FREE AREA AND THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SIZING THE LOUVER. DOUBLING THE AMOUNT GIVEN BY THE ABOVE FORMULA IS USUALLY ADEQUATE FOR THE GROSS SIZE OF THE COMBUSTION AIR LOUVER. CAUTION – DO NOT USE INSECT SCREEN ON THE LOUVER; USE 1/2-INCH MESH BIRD SCREEN.

7. DETERMINE THE REQUIRED STACK SIZE AND HEIGHT – CONSULT THE MANUFACTURER'S CATALOG FOR THIS DATA. BE CAREFUL NOT TO COMBINE THE BOILER STACK WITH AN INCINERATOR STACK.

8. WATER TRIM – THE BOILER SHOULD BE EQUIPPED WITH THE FOLLOWING MINIMUM WATER TRIM:

   A. HIGH LIMIT AQUASTAT TO SHUT OFF THE GAS BURNER IF THE BOILER WATER TEMPERATURE REACHES A PREDETERMINED HIGH LIMIT SETTING.

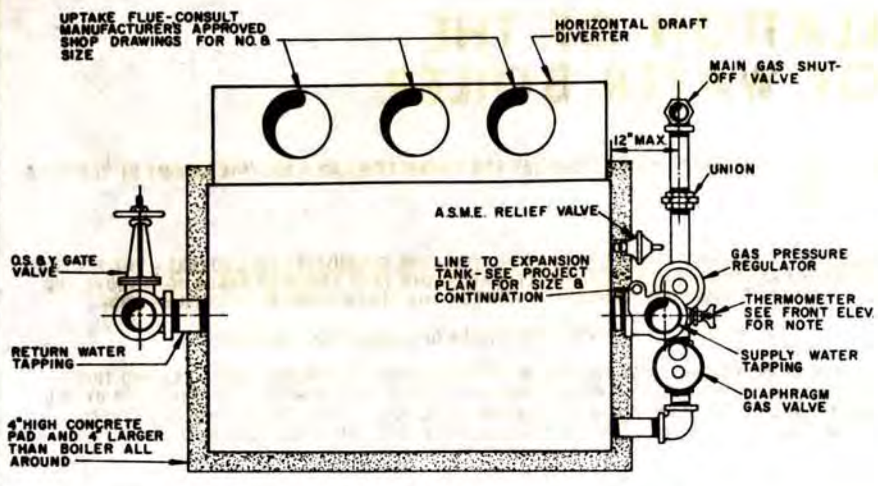
   B. OPERATING AQUASTAT TO START AND STOP THE GAS BURNER TO MAINTAIN A PREDETERMINED SETTING. IT SHOULD BE NOTED HERE THAT THE USE OF LOW (BELOW 170° F) OPERATING TEMPERATURES IS NOT ADVISABLE BECAUSE CONDENSATION MAY OCCUR IN THE FIREBOX. IF OUTDOOR RESET OR LOWER LEAVING TEMPERATURES ARE REQUIRED, THEN THIS SHOULD BE ACCOMPLISHED BY THE USE OF A MODULATING THREE PORT VALVE IN THE PIPING.

   C. WATER PRESSURE RELIEF VALVES OF THE NUMBER AND CAPACITY AS REQUIRED BY THE ASME CODE.

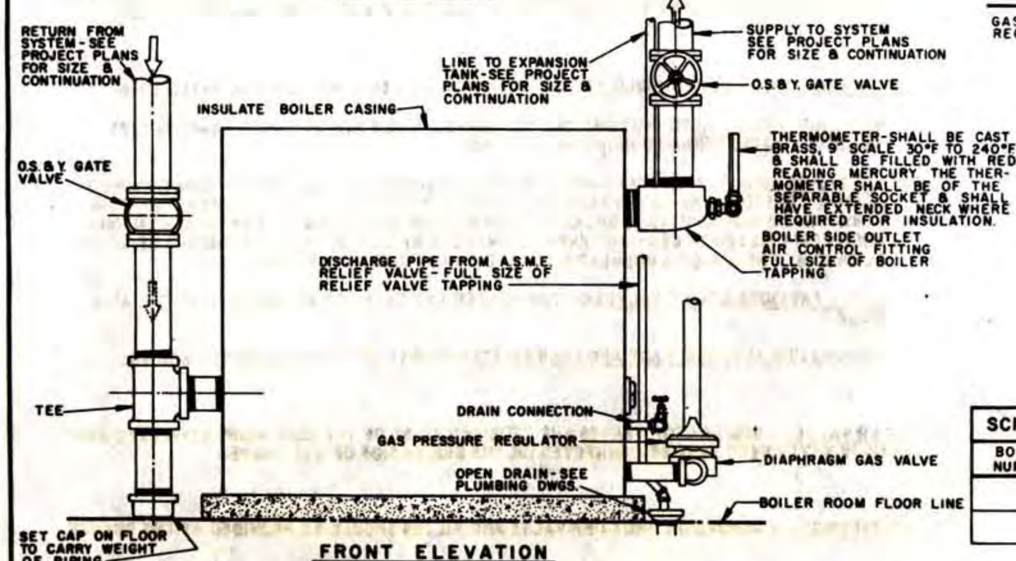
   D. COMBINATION ALTITUDE GAGE AND THERMOMETER SHOULD BE PROVIDED ON THE BOILER.

9. WATER VALVES – BOILER STOP VALVES ARE REQUIRED TO BE OF THE OS&Y RISING STEM TYPE AND MAKE-UP WATER FEED MUST BE CONNECTED ON THE BOILER SIDE OF ALL VALVES.

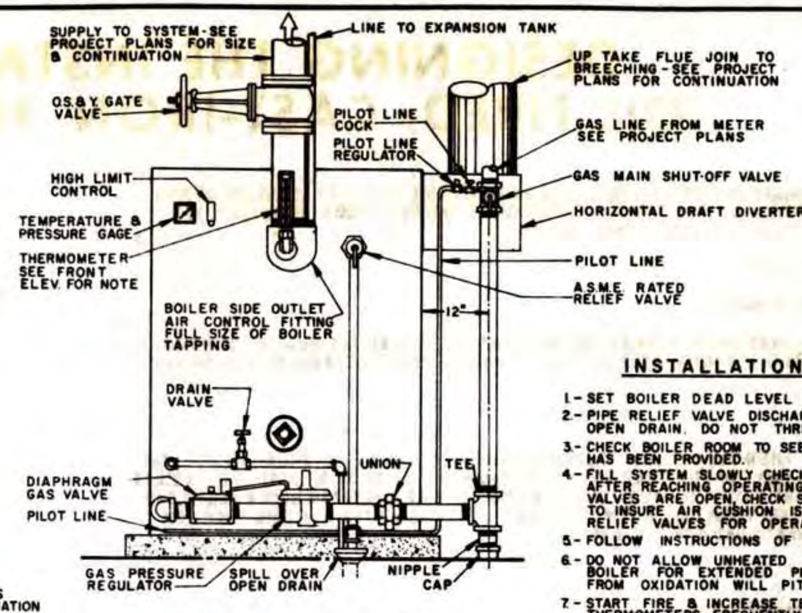
10. GAS TRAIN – A GAS TRAIN WHICH MEETS THE FIA REQUIREMENTS IS CONSIDERED TO BE THE BEST SAFETY PROVISION. A MINIMUM OF THE GAS TRAIN SHOWN IN THE DETAIL SHOULD BE PROVIDED AND SHOULD CONSIST OF A DIAPHRAGM GAS VALVE WITH TRANSFORMER, GAS PRESSURE REGULATOR, MAIN SHUT-OFF VALVE, PILOT LINE COCK, AND 100% SHUT-OFF PILOT SAFETY EQUIPMENT.



PLAN VIEW



FRONT ELEVATION



RIGHT SIDE ELEVATION

INSTALLATION NOTES

1- SET BOILER DEAD LEVEL BOTH DIRECTIONS.
2- PIPE RELIEF VALVE DISCHARGE FULL SIZE OF OUTLET OVER OPEN DRAIN. DO NOT THREAD DISCHARGE END OF PIPE.
3- CHECK BOILER ROOM TO SEE IF ADEQUATE COMBUSTION AIR HAS BEEN PROVIDED.
4- FILL SYSTEM SLOWLY CHECKING FOR LEAKS. AFTER REACHING OPERATING PRESSURE MAKE SURE SYSTEM VALVES ARE OPEN, CHECK SIGHT GLASS OF EXPANSION TANK TO INSURE AIR CUSHION IS AVAILABLE. CHECK SAFETY RELIEF VALVES FOR OPERATION BY PULLING HANDLE.
5- FOLLOW INSTRUCTIONS OF MANUFACTURER TO START FIRE.
6- DO NOT ALLOW UNHEATED FRESH WATER TO STAND IN BOILER FOR EXTENDED PERIODS BECAUSE RAPID CORROSION FROM OXIDATION WILL PIT TUBES.
7- START FIRE & INCREASE TEMPERATURE GRADUALLY. CHECK THERMOMETERS FREQUENTLY. CONDENSATION MAY COLLECT ON SECTIONS UNTIL WATER TEMPERATURE REACHES 160°F. THIS CONDITION SHOULD END WHEN THE OPERATING TEMPERATURE IS REACHED. CONTINUE TO FIRE BOILER UNTIL SYSTEM TEMPERATURE EXCEEDS 190°F. TO DRIVE OFF FREE OXYGEN.
8- DO NOT LEAVE BOILER ROOM UNTIL IT HAS BEEN DETERMINED THAT THE BOILER, AUTOMATIC CONTROLS & SAFETY EQUIPMENT ARE WORKING SATISFACTORILY.
9- CLEAN ENTIRE SYSTEM AS FOLLOWS:
   A.-FILL SYSTEM & BLEED OFF AIR MANUALLY.
   B.-ADD DISSOLVED SODA ASH & CAUSTIC SODA TO SYSTEM IN THE AMOUNT OF 1 LB. PER 1000 LBS. OF SYSTEM WATER.
   C.-BRING SYSTEM UP TO 190°F.
   D.-ALLOW SYSTEM TO CIRCULATE FOR 5 HOURS.
   E.-TURN OFF GAS & SLOWLY DRAIN.
   F.-AFTER SYSTEM HAS DRAINED REMOVE LARGE PLUGS NOT IN USE & WASH OUT BOILER.
   G.-REFILL SYSTEM & PLACE IN OPERATION.

SCHEDULE OF CAPACITIES FOR THE GAS FIRED CAST IRON HOT WATER BOILER

BOILER NUMBER	FUEL	B.T.U. PER CUBIC FOOT	A.G.A. GAS INPUT B.T.U./HR.	GAS C.F.H.	NET I.B.R. RATING B.T.U./HR.	GROSS. OUTPUT B.T.U./HR.	A.G.A. OUTPUT B.T.U./HR.

DETAILS OF THE INSTALLATION OF THE GAS FIRED CAST IRON HOT WATER BOILER

NO SCALE

DESIGNING THE INSTALLATION OF THE OIL-FIRED, CAST-IRON, HOT WATER BOILER

1. DETERMINE THE REQUIRED OUTPUT OF THE BOILER BY COMPUTING THE HEAT LOADS ACCORDING TO THE USUAL METHODS AS OUTLINED IN THE ASHRAE GUIDE AND DATA BOOK. NORMALLY, THE OUTPUT IS DEFINED BY THE TWO FOLLOWING VALUES:

   A. NET IBR RATING IN BTU/HR

   B. GROSS IBR OUTPUT IN BTU/HR

   IT SHOULD BE NOTED THAT THE NET IBR RATING INCLUDES A STANDARD ALLOWANCE FOR PIPING LOSS AND PICK-UP AND IS APPROXIMATELY 33 PERCENT HIGHER THAN THE GROSS OUTPUT OF THE BOILER.

2. BOILER SELECTION – THE BOILER SELECTED SHOULD HAVE A NET IBR RATING EQUAL TO THE COMPUTED BLOCK HEAT LOAD FOR THE BUILDING. WHERE TWO BOILERS ARE TO BE USED, EACH BOILER SHOULD HAVE A NET IBR RATING EQUAL TO 66-2/3 PERCENT OF THE COMPUTED BLOCK HEAT LOAD CAREFUL CONSIDERATION SHOULD BE GIVEN TO FUTURE ADDITIONS TO THE BUILDING WHEN COMPUTING THE BLOCK HEAT LOAD FOR THE BUILDING.

3. DETERMINE THE OIL FIRING RATE –

   A. CALCULATE THE REQUIRED INPUT IN BTU/HR BY DIVIDING THE GROSS OUTPUT BY .75 (EFFICIENCY).

   B. CALCULATE THE REQUIRED AMOUNT OF OIL TO BE BURNED BY DIVIDING THE INPUT IN BTU/HR BY THE HEATING VALUE OF THE OIL IN BTU/GALLON.

   THE HEATING VALUE FOR NO. 2 OIL CAN BE ASCERTAINED FROM THE LOCAL FUEL OIL SUPPLIER; IF NOT AVAILABLE, USE 140,000 BTU/GALLON FOR THE NO. 2 OIL.

4. CHOICE OF THE GRADE OF THE FUEL OIL TO BE BURNED – THE DETAIL SHOWS A GUN TYPE PRESSURE ATOMIZING OIL BURNER AND THIS INSTALLATION SHOULD ALWAYS BE FIRED WITH NO. 1 OR NO. 2 FUEL OIL.

5. ANNUAL FUEL CONSUMPTION – THE ANNUAL FUEL CONSUMPTION MAY BE ESTIMATED BY THE FOLLOWING FORMULA:

$$\text{ANNUAL FUEL IN GALLONS} = \frac{\text{TOTAL HEAT LOSS (BTU/HR)} \times \text{ANNUAL DEGREE DAYS}}{\text{DESIGN TEMPERATURE DIFFERENCE} \times 5000}$$

6. CALCULATE THE AMOUNT OF COMBUSTION AIR REQUIRED – THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR AT 70 DEGREES F.

$$\text{CFM} = 35 \times \text{GPH OF OIL}$$

NOTE: THIS IS THE AMOUNT OF AIR REQUIRED FOR COMBUSTION AND IS NOT THE AMOUNT OF THE FLUE GASES.

7. CALCULATE THE AMOUNT OF FREE AREA REQUIRED IN THE COMBUSTION AIR LOUVERS – THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR ABOVE THAT REQUIRED UNDER NO. 5 ABOVE AND IS THE AMOUNT REQUIRED FOR COMBUSTION AND FOR THE VENTILATION OF THE BOILER ROOM.

$$\text{CFM} \times 1.3 \div 250 \text{ FT. PER MIN.} = \text{FREE AREA OF COMBUSTION AIR LOUVERS.}$$

   IT SHOULD BE NOTED THAT MOST LOUVERS HAVE ONLY ABOUT 50 PERCENT FREE AREA AND THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SIZING THE LOUVER. DOUBLING THE AMOUNT GIVEN BY THE ABOVE FORMULA IS USUALLY ADEQUATE FOR THE GROSS SIZE OF THE COMBUSTION AIR LOUVER. CAUTION – DO NOT USE INSECT SCREEN ON THE LOUVER; USE ½-INCH MESH BIRD SCREEN.

8. DETERMINE THE REQUIRED STAGE SIZE AND HEIGHT – CONSULT THE MANUFACTURER'S CATALOG FOR THIS DATA. BE CAREFUL NOT TO COMBINE THE BOILER STACK WITH AN INCINERATOR STACK.

9. WATER TRIM – THE BOILER SHOULD BE EQUIPPED WITH THE FOLLOWING MINIMUM WATER TRIM:

   A. HIGH LIMIT AQUASTAT TO SHUT OFF THE OIL BURNER IF THE BOILER WATER TEMPERATURE REACHES A PREDETERMINED HIGH LIMIT SETTING.

   B. OPERATING AQUASTAT TO START AND STOP THE OIL BURNER TO MAINTAIN A PREDETERMINED SETTING. IT SHOULD BE NOTED HERE THAT THE USE OF LOW (BELOW 170° F) OPERATING TEMPERATURES IS NOT ADVISABLE BECAUSE CONDENSATION MAY OCCUR IN THE FIREBOX. IF OUTDOOR RESET OR LOWER LEAVING TEMPERATURES ARE REQUIRED, THEN THIS SHOULD BE ACCOMPLISHED BY THE USE OF A MODULATING THREE PORT VALVE IN THE PIPING.

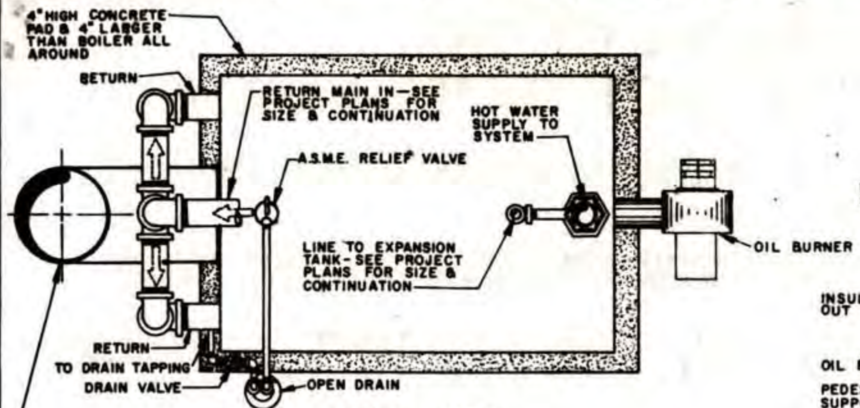
   C. WATER PRESSURE RELIEF VALVES OF THE NUMBER AND CAPACITY AS REQUIRED BY THE ASME CODE.

   D. COMBINATION ALTITUDE GAGE AND THERMOMETER SHOULD BE PROVIDED ON THE BOILER.

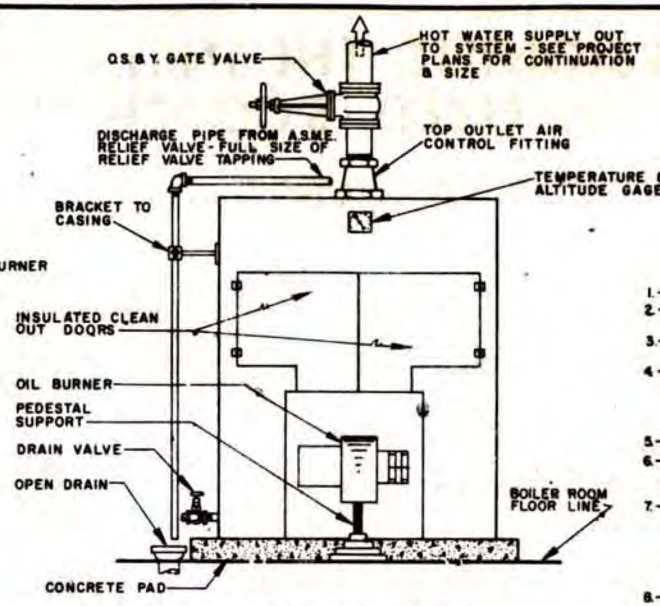
10. WATER VALVES – BOILER STOP VALVES ARE REQUIRED TO BE OF THE OS&Y RISING STEM TYPE AND MAKE-UP WATER FEED MUST BE CONNECTED ON THE BOILER SIDE OF ALL VALVES.

11. OIL FITTINGS – A MANUAL OIL SHUT-OFF VALVE AND FILTER SHOULD BE PROVIDED AT THE BURNER.

12. FLAME SAFETY CONTROL – THE OIL BURNER SHOULD BE EQUIPPED WITH A FLAME SAFEGUARD CONTROL COMPLETE WITH ELECTRONIC PHOTOCELL SCANNER, DELAYED OIL VALVE, AND REQUIRED RELAYS.



PLAN VIEW



FRONT ELEVATION

INSTALLATION NOTES

1.- SET BOILER DEAD LEVEL BOTH DIRECTIONS.

2.- PIPE RELIEF VALVE DISCHARGE FULL SIZE OF OUTLET OVER OPEN DRAIN. DO NOT THREAD DISCHARGE END OF PIPE.

3.- CHECK BOILER ROOM TO SEE IF ADEQUATE COMBUSTION AIR HAS BEEN PROVIDED.

4.- FILL SYSTEM SLOWLY CHECKING FOR LEAKS. AFTER REACHING OPERATING PRESSURE MAKE SURE SYSTEM VALVES ARE OPEN. CHECK SIGHT GLASS OF EXPANSION TANK TO INSURE AIR CUSHION IS AVAILABLE. CHECK SAFETY RELIEF VALVES FOR OPERATION BY PULLING HANDLE.

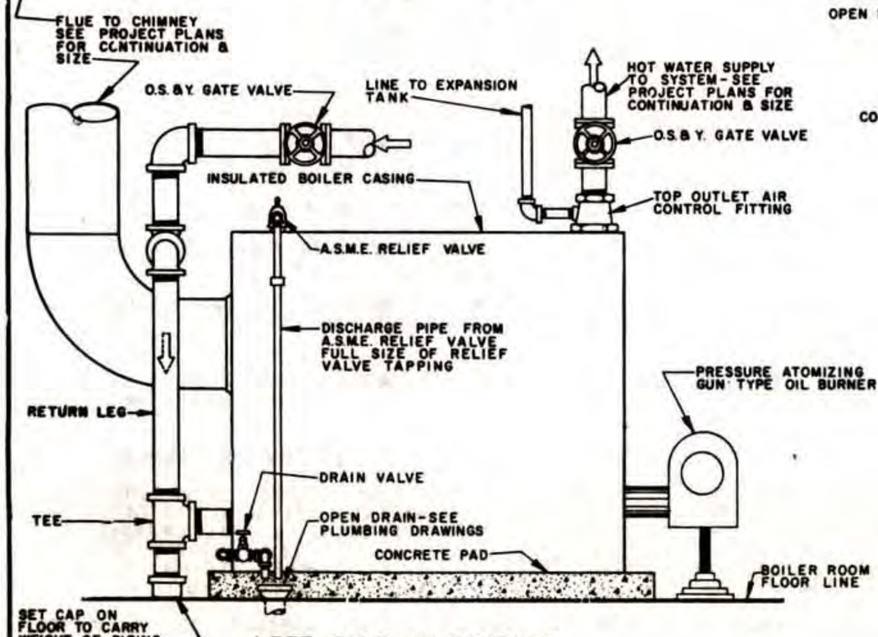
5.- FOLLOW INSTRUCTIONS OF MANUFACTURER TO START FIRE.

6.- DO NOT ALLOW UNHEATED FRESH WATER TO STAND IN BOILER FOR EXTENDED PERIODS BECAUSE RAPID CORROSION FROM OXIDATION WILL PIT TUBES.

7.- START FIRE & INCREASE TEMPERATURE GRADUALLY. CHECK THERMOMETERS FREQUENTLY. CONDENSATION MAY COLLECT ON SECTIONS UNTIL WATER TEMPERATURE REACHES 160°F. THIS CONDITION SHOULD END WHEN THE OPERATING TEMPERATURE IS REACHED. CONTINUE TO FIRE BOILER UNTIL SYSTEM TEMPERATURE EXCEEDS 190°F TO DRIVE OFF FREE OXYGEN.

8.- DO NOT LEAVE BOILER ROOM UNTIL IT HAS BEEN DETERMINED THAT THE BOILER, AUTOMATIC CONTROLS & SAFETY EQUIPMENT ARE WORKING SATISFACTORILY.

9.- CLEAN ENTIRE SYSTEM AS FOLLOWS:
   - A.- FILL SYSTEM & BLEED OFF AIR MANUALLY.
   - B.- ADD DISSOLVED SODA ASH & CAUSTIC SODA TO SYSTEM IN THE AMOUNT OF 1 LB. PER 1000 LBS. OF SYSTEM WATER.
   - C.- BRING SYSTEM UP TO 190°F.
   - D.- ALLOW SYSTEM TO CIRCULATE FOR 5 HOURS.
   - E.- TURN OFF OIL BURNER & SLOWLY DRAIN.
   - F.- AFTER SYSTEM HAS DRAINED REMOVE LARGE PLUGS NOT IN USE & WASH OUT BOILER.
   - G.- REFILL SYSTEM & PLACE IN OPERATION.



LEFT SIDE ELEVATION

SCHEDULE OF CAPACITIES FOR THE OIL FIRED CAST IRON HOT WATER BOILER							
BOILER NUMBER	FUEL	B.T.U. / PER GALLON	B.T.U./HR. INPUT	OIL G.P.H.	NET I.B.R. RATING B.T.U. / HR.	GROSS I.B.R. RATING B.T.U. / HR.	FLUE SIZE

DETAILS OF THE INSTALLATION OF THE OIL FIRED, CAST IRON, HOT WATER BOILER

NO SCALE

DESIGNING THE INSTALLATION OF THE TWO-PASS, OIL-FIRED, SCOTCH TYPE, HOT WATER BOILER

1. DETERMINE THE REQUIRED OUTPUT OF THE BOILER BY THE USUAL METHODS AS OUTLINED IN THE ASHRAE GUIDE AND DATA BOOK. NORMALLY, THE OUTPUT IS DEFINED BY THE TWO FOLLOWING VALUES:

   A. SBI GROSS OUTPUT IN MBH

   B. SBI NET OUTPUT IN MBH

2. DETERMINE THE OIL FIRING RATE –

   A. CALCULATE THE REQUIRED INPUT IN BTU/HR BY DIVIDING THE REQUIRED GROSS OUTPUT BY .80 (EFFICIENCY).

   B. CALCULATE THE REQUIRED AMOUNT OF OIL TO BE BURNED BY DIVIDING THE INPUT IN BTU/HR BY THE HEATING VALUE OF THE OIL IN BTU/GALLON.

   THE HEATING VALUE FOR NO. 5 AND NO. 6 OIL CAN BE ASCERTAINED FROM THE LOCAL FUEL OIL SUPPLIER; IF NOT AVAILABLE, USE 148,800 BTU/GALLON FOR NO. 5 OIL AND 153,400 BTU/GALLON FOR NO. 6 OIL.

3. CHOICE OF THE GRADE OF THE FUEL OIL TO BE BURNED SHOULD BE BASED ON A STUDY OF THE FACTORS INVOLVED AND EACH OF THE FOLLOWING ITEMS SHOULD BE CONSIDERED.

   A. COST OF EACH TYPE OF OIL.

   B. DOES OWNER HAVE OTHER BUILDINGS WHERE HE IS BUYING OIL UNDER ONE CONTRACT?

   C. AVAILABILITY OF EACH TYPE OF OIL, PARTICULARLY DURING PERIODS OF BAD WEATHER.

   D. HOW MUCH OIL STORAGE CAN BE PROVIDED?

   E. CONSIDERATION OF THE OIL HEATING REQUIREMENTS FOR EACH TYPE OF OIL.

   F. STUDY LOCAL CODES AND ORDINANCES REGARDING THE BURNING OF FUEL OIL.

   G. STUDY THE CALIBER OF OPERATING PERSONNEL AND WHETHER OR NOT A LICENSED ENGINEER IS REQUIRED.

   H. CALCULATE THE YEARLY FUEL CONSUMPTION BY THE FOLLOWING FORMULA (FOR HEATING ONLY).

$$\text{ANNUAL FUEL IN GAL.} = \frac{\text{TOTAL HEAT LOSS (BTU/HR)} \times \text{ANNUAL DEGREE DAYS}}{\text{DESIGN TEMPERATURE DIFFERENCE} \times 5000}$$

4. FURNACE VOLUME – SPECIFY THAT THE BOILER DOES NOT HAVE LESS FURNACE VOLUME THAN THE SBI MINIMUM FOR THE BOILER RATING USED.

5. BOILER SELECTION – THE BOILER SELECTED SHOULD HAVE AN SBI NET RATING EQUAL TO THE COMPUTED BLOCK HEAT LOAD FOR THE BUILDING. WHERE TWO BOILERS ARE TO BE USED, EACH BOILER SHOULD HAVE A SBI NET RATING EQUAL TO 66-2/3 PERCENT OF THE COMPUTED BLOCK HEAT LOAD. CAREFUL CONSIDERATION SHOULD BE GIVEN TO FUTURE ADDITIONS TO THE BUILDING WHEN COMPUTING THE BLOCK HEAT LOAD FOR THE BUILDING.

6. CALCULATE THE AMOUNT OF COMBUSTION AIR REQUIRED – THE FOLLOWING FORMULA ALLOWS FOR 30% EXCESS AIR FOR COMBUSTION AT 70 DEGREES F.

$$\text{CFM} = 35 \times \text{GPH OF OIL}$$

   NOTE: THIS IS THE AMOUNT OF AIR REQUIRED FOR COMBUSTION AND IS NOT THE CFM CAPACITY OF THE I.D. FAN SINCE THE I.D. FAN IS HANDLING THE HOT PRODUCTS OF COMBUSTION.

7. CALCULATE THE AMOUNT OF FREE AREA REQUIRED IN THE COMBUSTION AIR LOUVERS – THE FOLLOWING FORMULA ALLOWS FOR 30% EXCESS AIR ABOVE THAT REQUIRED UNDER NO. 6 AND IS THE AMOUNT REQUIRED FOR COMBUSTION AND FOR VENTILATION OF THE BOILER ROOM.

$$\text{CFM} \times 1.3 \div 250 \text{ FT. PER MINUTE} = \text{FREE AREA OF COMBUSTION AIR LOUVERS}$$

   IT SHOULD BE NOTED THAT MOST LOUVERS HAVE ONLY ABOUT 50% FREE AREA AND THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SIZING THE LOUVER. DOUBLING THE AMOUNT GIVEN BY THE ABOVE FORMULA IS USUALLY ADEQUATE FOR THE GROSS SIZE OF THE COMBUSTION LOUVER. CAUTION – DO NOT USE INSECT SCREEN ON THE LOUVER; USE ½-INCH MESH BIRD SCREEN.

8. DETERMINE THE REQUIRED STACK SIZE AND HEIGHT – CONSULT THE MANUFACTURER'S CATALOG FOR THIS DATA. BE CAREFUL NOT TO COMBINE THE BOILER STACK WITH AN INCINERATOR STACK. ALWAYS CHECK THE LOCAL CODES REGARDING STACK SIZE AND HEIGHT.

9. WATER TRIM – THE BOILER SHOULD BE EQUIPPED WITH THE FOLLOWING MINIMUM WATER TRIM:

   A. HIGH LIMIT AQUASTAT TO SHUT OFF THE OIL BURNER IF THE BOILER WATER TEMPERATURE REACHES A PREDETERMINED HIGH LIMIT SETTING.

   B. PROVIDE AN OPERATING AQUASTAT TO START AND STOP THE OIL BURNER TO MAINTAIN THE WATER TEMPERATURE. IF MORE THAN ONE BOILER IS USED, LOCATE A MASTER AQUASTAT IN THE MAIN HEADER TO START AND STOP ALL OIL BURNERS.

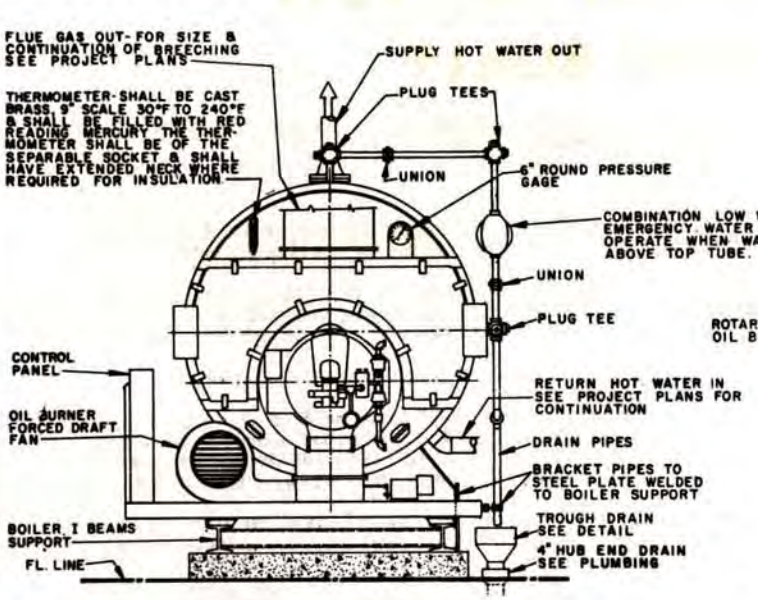
   C. THERMOMETER – A HIGH QUALITY MERCURY FILLED THERMOMETER AT LEAST 8-INCHES LONG SHOULD BE MOUNTED ON THE BOILER IN A CLEARLY VISIBLE LOCATION TO INDICATE THE BOILER WATER TEMPERATURE.

   D. PRESSURE GAGE – PROVIDE A PRESSURE GAGE TO INDICATE THE PRESSURE IN THE BOILER.

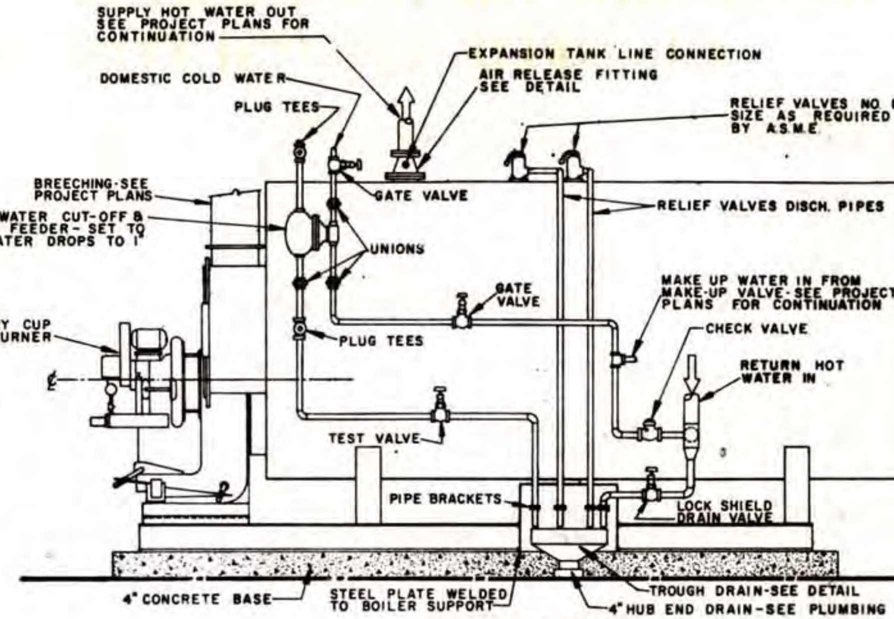
   E. EMERGENCY LOW WATER CUTOFF AND WATER FEEDER – A COMBINATION LOW WATER CUTOFF AND WATER FEEDER SHOULD BE USED TO CUT OFF THE BURNER AND SUPPLY MAKE-UP WATER UNDER FULL DOMESTIC WATER PRESSURE WHEN THE WATER IN THE BOILER FALLS TO 1-INCH ABOVE THE TOP TUBES. THE WATER FEEDING FEATURE OF THIS DEVICE IS NOT TO BE CONSIDERED AS A MAKE-UP WATER FEEDER WHICH NORMALLY COMES IN THROUGH A PRESSURE REDUCING VALVE TO MAINTAIN A PREDETERMINED PRESSURE ON THE SYSTEM, BUT AS AN EMERGENCY FEED.

   F. WATER PRESSURE RELIEF VALVES OF THE NUMBER AND CAPACITY AS REQUIRED BY THE ASME CODE

10. WATER VALVES – BOILER STOP VALVES ARE REQUIRED TO BE OF THE OS&Y RISING STEM TYPE AND MAKE-UP WATER FEED MUST BE CONNECTED ON THE BOILER SIDE OF ALL VALVES.



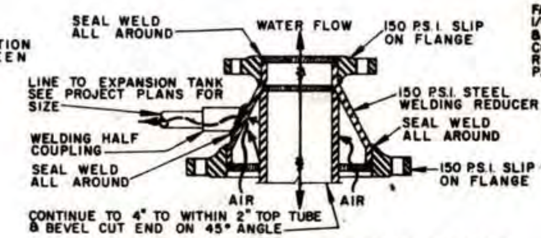
FRONT ELEVATION



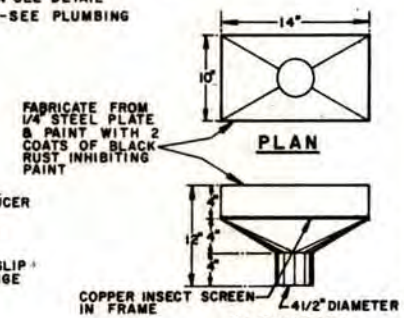
SIDE ELEVATION

INSTALLATION NOTES

1- INSTALL BOILER DEAD LEVEL BOTH DIRECTIONS.
2- FILL SYSTEM SLOWLY AND CHECK FOR LEAKS.
3- CHECK EXPANSION TANK TO BE SURE AIR CUSHION IS AVAILABLE.
4- CONTACT OIL BURNER CONTRACTOR FOR BURNER START-UP
5- DO NOT ALLOW UNHEATED FRESH WATER TO STAND IN BOILER FOR EXTENDED PERIODS AS RAPID CORROSION FROM OXIDATION MAY PIT TUBES.
6- INCREASE TEMPERATURE.
7- DO NOT OPERATE BOILER UNDER 160°F. BECAUSE CONDENSATION MAY FORM IN TUBES.
8- FIRE BOILER TO 190°F. BOILER WATER TEMPERATURE TO DRIVE OFF FREE OXYGEN
9- CHECK TO SEE IF ADEQUATE COMBUSTION AIR (200% OF STACK SIZE) HAS BEEN PROVIDED INTO THE BOILER ROOM.
10- CHECK SAFETY RELIEF VALVES BY PULLING HANDLE.



DETAIL OF AIR RELEASE FITTING



DETAILS OF TROUGH DRAIN

DETAILS OF THE INSTALLATION OF THE TWO PASS, OIL FIRED, SCOTCH TYPE, HOT WATER BOILER

NO SCALE

SCHEDULE OF CAPACITIES OF THE TWO PASS, OIL FIRED, SCOTCH TYPE, HOT WATER BOILER

BOILER NO	S.B.I. GROSS OUTPUT	S.B.I. NET OUTPUT	OPERATING PRESSURE	WORKING PRESSURE RATING OF BOILER	TYPE OF FUEL OIL	OIL FIRING RATE	HEATING SURFACE WATERSIDE	HEATING SURFACE FIRESIDE	FURNACE VOLUME MINIMUM	MAXIMUM HEAT RELEASE	ELECTRIC OIL HEATER			FORCED DRAFT FAN MOTOR				
											KW	VOLTS	PHASE	C.F.M.	S.P.	H.P.	VOLTS	PHASE

DESIGNING THE INSTALLATION OF THE TWO-PASS, OIL-FIRED, SCOTCH TYPE, STEAM BOILER

1. **DETERMINE THE REQUIRED OUTPUT OF THE BOILER** BY THE USUAL METHODS AS OUTLINED IN THE ASHRAE GUIDE AND DATA BOOK. NORMALLY, THE OUTPUT IS DEFINED BY THE TWO FOLLOWING VALUES:

   A. SBI GROSS OUTPUT IN MBH
   B. SBI NET OUTPUT IN MBH

2. **DETERMINE THE OIL FIRING RATE** –

   A. CALCULATE THE REQUIRED INPUT IN BTU/HR BY DIVIDING THE REQUIRED GROSS OUTPUT BY .80 (EFFICIENCY).

   B. CALCULATE THE REQUIRED AMOUNT OF OIL TO BE BURNED BY DIVIDING THE INPUT IN BTU/HR BY THE HEATING VALUE OF THE OIL IN BTU/GALLON.

   THE HEATING VALUE FOR NO. 5 AND NO. 6 OIL CAN BE ASCERTAINED FROM THE LOCAL FUEL OIL SUPPLIER; IF NOT AVAILABLE, USE 148,800 BTU/GALLON FOR NO. 5 OIL AND 153,400 BTU/GALLON FOR NO. 6 OIL.

3. **CHOICE OF THE GRADE OF THE FUEL OIL TO BE BURNED** SHOULD BE BASED ON A STUDY OF THE FACTORS INVOLVED AND EACH OF THE FOLLOWING ITEMS SHOULD BE CONSIDERED

   A. COST OF EACH TYPE OF OIL.

   B. DOES OWNER HAVE OTHER BUILDINGS WHERE HE IS BUYING OIL UNDER ONE CONTRACT?

   C. AVAILABILITY OF EACH TYPE OF OIL, PARTICULARLY DURING PERIODS OF BAD WEATHER.

   D. HOW MUCH OIL STORAGE CAN BE PROVIDED?

   E. CONSIDERATION OF THE OIL HEATING REQUIREMENTS FOR EACH TYPE OF OIL

   F. STUDY LOCAL CODES AND ORDINANCES REGARDING THE BURNING OF FUEL OIL

   G. STUDY THE CALIBER OF OPERATING PERSONNEL AND WHETHER OR NOT A LICENSED ENGINEER IS REQUIRED.

   H. CALCULATE THE YEARLY FUEL CONSUMPTION BY THE FOLLOWING FORMULA (FOR HEATING ONLY).

$$\text{ANNUAL FUEL IN GAL.} = \frac{\text{TOTAL HEAT LOSS (BTU/HR)} \times \text{ANNUAL DEGREE DAYS}}{\text{DESIGN TEMPERATURE DIFFERENCE} \times 5000}$$

4. **FURNACE VOLUME** – SPECIFY THAT THE BOILER DOES NOT HAVE LESS FURNACE VOLUME THAN THE SBI MINIMUM FOR THE BOILER RATING USED.

5. **BOILER SELECTION** – THE BOILER SELECTED SHOULD HAVE AN SBI NET RATING EQUAL TO THE COMPUTED BLOCK HEAT LOAD FOR THE BUILDING. WHERE TWO BOILERS ARE TO BE USED, EACH BOILER SHOULD HAVE A NET IBR RATING EQUAL TO 66-2/3 PERCENT OF THE COMPUTED BLOCK HEAT LOAD. CAREFUL CONSIDERATION SHOULD BE GIVEN TO FUTURE ADDITIONS TO THE BUILDING WHEN COMPUTING THE BLOCK HEAT LOAD FOR THE BUILDING.

6. **CALCULATE THE AMOUNT OF COMBUSTION AIR REQUIRED** – THE FOLLOWING FORMULA ALLOWS FOR 30% EXCESS AIR FOR COMBUSTION AT 70 DEGREES F.

$$\text{CFM} = 35 \times \text{GPH OF OIL}$$

   NOTE: THIS IS THE AMOUNT OF AIR REQUIRED FOR COMBUSTION AND IS NOT THE CFM CAPACITY OF THE I.D. FAN SINCE THE I.D. FAN IS HANDLING THE HOT PRODUCTS OF COMBUSTION.

7. **CALCULATE THE AMOUNT OF FREE AREA REQUIRED IN THE COMBUSTION AIR LOUVERS** – THE FOLLOWING FORMULA ALLOWS FOR 30% EXCESS AIR ABOVE THAT REQUIRED UNDER NO. 6 AND IS THE AMOUNT REQUIRED FOR COMBUSTION AND FOR VENTILATION OF THE BOILER ROOM.

$$\text{CFM} \times 1.3 \quad \text{250 FT. PER MIN.} = \text{FREE AREA OF COMBUSTION AIR LOUVERS}$$

   IT SHOULD BE NOTED THAT MOST LOUVERS HAVE ONLY ABOUT 50% FREE AREA AND THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SIZING THE LOUVER. DOUBLING THE AMOUNT GIVEN BY THE ABOVE FORMULA IS USUALLY ADEQUATE FOR THE GROSS SIZE OF THE COMBUSTION LOUVER. **CAUTION** – DO NOT USE INSECT SCREEN ON THE LOUVER; USE ½ INCH MESH BIRD SCREEN.

8. **DETERMINE THE REQUIRED STACK SIZE AND HEIGHT** – CONSULT THE MANUFACTURER'S CATALOG FOR THIS DATA. BE CAREFUL NOT TO COMBINE THE BOILER STACK WITH AN INCINERATOR STACK. ALWAYS CHECK THE LOCAL CODES REGARDING STACK SIZE AND HEIGHT.

9. **STEAM TRIM** – THE BOILER SHOULD BE EQUIPPED WITH THE FOLLOWING MINIMUM STEAM TRIM.

   A. **HIGH LIMIT PRESSURESTAT** TO SHUT OFF THE OIL BURNER IF THE BOILER ROOM PRESSURE REACHES A PREDETERMINED HIGH LIMIT SETTING.

   B. **PROVIDE AN OPERATING PRESSURESTAT** TO START AND STOP THE OIL BURNER TO MAINTAIN THE STEAM PRESSURE. IF MORE THAN ONE BOILER IS USED, LOCATE A MASTER PRESSURESTAT IN THE MAIN HEADER TO START AND STOP ALL OIL BURNERS.

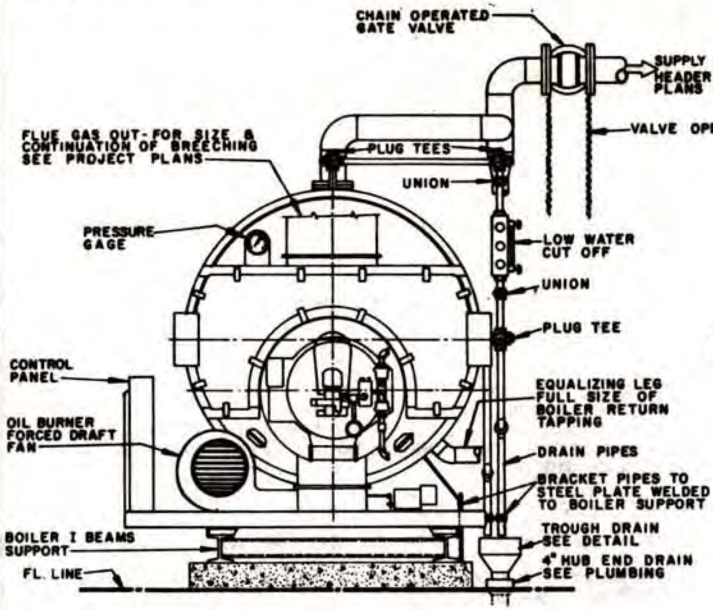
   C. **PRESSURE GAGE** – PROVIDE A PRESSURE GAGE TO INDICATE THE STEAM PRESSURE IN THE BOILER.

   D. **PUMP STARTER, LOW WATER CUT-OFF AND ALARM** – PROVIDE A COMBINATION FLOAT AND MERCURY SWITCH TYPE PUMP STARTER, LOW WATER CUT-OFF AND ALARM. THE PUMP STARTER SHALL START AND STOP THE CONDENSATE RETURN PUMP TO MAINTAIN THE WATER LEVEL IN THE BOILER AT THE DESIRED HEIGHT. THE LOW WATER CUT-OFF AND ALARM SHALL SHUT OFF THE OIL BURNER AND SOUND AN ALARM IF THE LEVEL IN THE BOILER FALLS TO A PREDETERMINED LOW LEVEL.

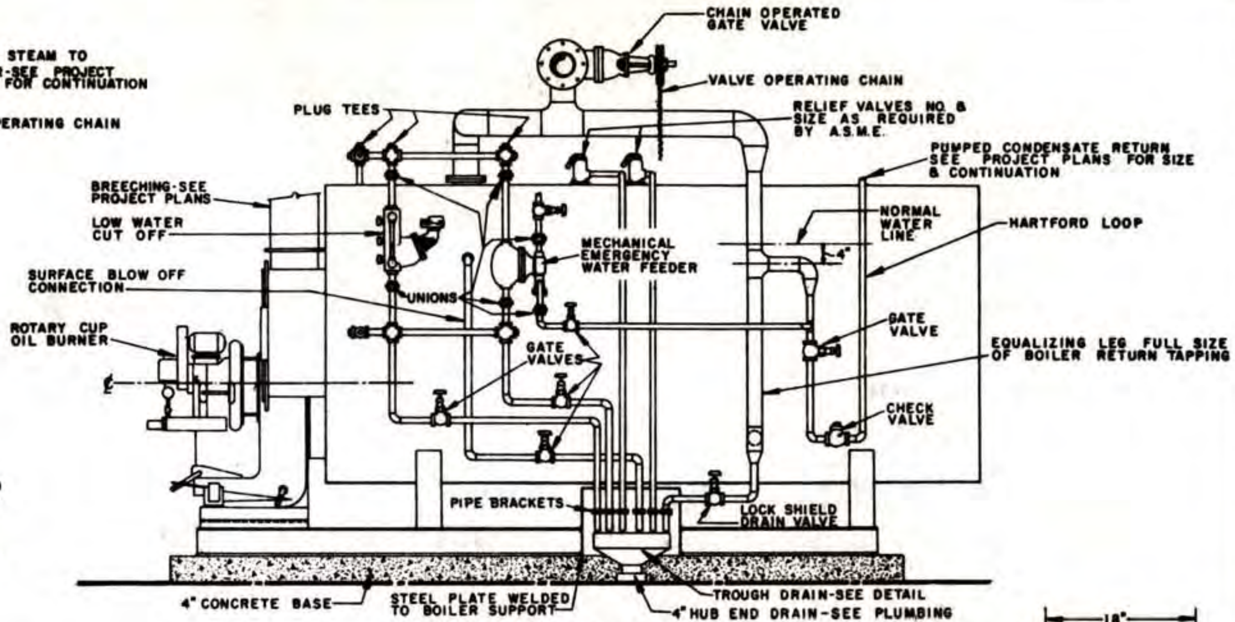
   E. **EMERGENCY WATER FEEDER** – THE EMERGENCY WATER FEEDER SHALL OPEN CITY WATER PRESSURE INTO THE BOILER IN THE EVENT THAT THE WATER LEVEL IN THE BOILER FALLS TO A PREDETERMINED LOW LEVEL.

   F. **STEAM PRESSURE RELIEF VALVES** OF THE NUMBER AND CAPACITY AS REQUIRED BY THE ASME CODE.

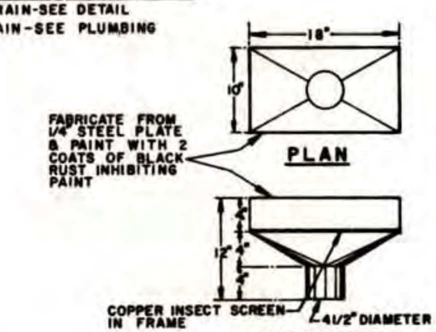
10. **STEAM AND BOILER FEED VALVES** – BOILER STOP VALVES ARE REQUIRED TO BE OF THE OS&Y RISING STEM TYPE AND MAKE-UP WATER FEED MUST BE CONNECTED ON THE BOILER SIDE OF ALL VALVES.



FRONT ELEVATION



SIDE ELEVATION



DETAILS OF TROUGH DRAIN

INSTALLATION NOTES

1– INSTALL BOILER DEAD LEVEL BOTH DIRECTIONS.
2– FILL SYSTEM SLOWLY AND CHECK FOR LEAKS.
3– OBSERVE RISE OF WATER IN SIGHT GLASS AND TEST TRY COCKS.
4– CONTACT OIL BURNER CONTRACTOR FOR BURNER START-UP.
5– DO NOT ALLOW UNHEATED FRESH WATER TO STAND IN BOILER FOR EXTENDED PERIODS AS RAPID CORROSION FROM OXIDATION MAY PIT TUBES.
6– INCREASE TEMPERATURE GRADUALLY.
7– DO NOT OPERATE BOILER UNDER 160°F. BECAUSE CONDENSATION MAY FORM IN TUBES.
8– FIRE BOILER TO 190°F. BOILER WATER TEMPERATURE TO DRIVE OFF FREE OXYGEN.
9– CHECK TO SEE IF ADEQUATE COMBUSTION AIR (200% OF STACK SIZE) HAS BEEN PROVIDED INTO THE BOILER ROOM.
10– CHECK SAFETY RELIEF VALVES BY PULLING HANDLE.

DETAILS OF THE INSTALLATION OF THE TWO PASS, OIL FIRED, SCOTCH TYPE, STEAM BOILER

NO SCALE

SCHEDULE OF CAPACITIES OF THE TWO PASS, OIL FIRED, SCOTCH TYPE, STEAM BOILER

BOILER NO.	S.B.I. GROSS OUTPUT	S.B.I. NET OUTPUT	OPERATING PRESSURE	WORKING PRESSURE RATING OF BOILER	TYPE OF FUEL OIL	OIL FIRING RATE	HEATING SURFACE WATERSIDE	HEATING SURFACE FIRESIDE	FURNACE VOLUME MINIMUM	MAXIMUM HEAT RELEASE	ELECTRIC OIL HEATER			FORCED DRAFT FAN MOTOR				
											KW	VOLTS	PHASE	C.F.M.	S.P.	H.P.	VOLTS	PHASE

DESIGNING THE INSTALLATION OF THE TWO-PASS, GAS-FIRED, SCOTCH TYPE, HOT WATER BOILER

1. DETERMINE THE REQUIRED OUTPUT OF THE BOILER BY THE USUAL METHODS AS OUTLINED IN THE ASHRAE GUIDE AND DATA BOOK. NORMALLY, THE OUTPUT IS DEFINED BY THE TWO FOLLOWING VALUES:

   A. SBI GROSS OUTPUT IN MBH

   B. SBI NET OUTPUT IN MBH

2. DETERMINE THE GAS FIRING RATE.

   A. CALCULATE THE REQUIRED INPUT IN BTU/HR BY DIVIDING THE SBI GROSS OUTPUT BY .80 (EFFICIENCY).

   B. CALCULATE THE REQUIRED AMOUNT OF GAS TO BE BURNED BY DIVIDING THE INPUT IN BTU/HR BY THE HEATING VALUE OF THE GAS IN BTU/CUBIC FOOT.

   THE HEATING VALUE FOR GAS CAN BE ASCERTAINED FROM THE LOCAL GAS COMPANY; IF NOT AVAILABLE, USE 1,000 BTU/CUBIC FOOT FOR NATURAL GAS.

3. ANNUAL FUEL CONSUMPTION. THE ANNUAL FUEL CONSUMPTION MAY BE ESTIMATED BY THE FOLLOWING FORMULA:

$$\text{ANNUAL GAS CONSUMPTION IN THERMS (100,000 BTU)} = \frac{\text{TOTAL HEAT LOSS(BTU/HR)} \times \text{ANNUAL DEGREE DAYS}}{\text{DESIGN TEMPERATURE DIFFERENCE} \times 3500}$$

4. CALCULATE THE AMOUNT OF COMBUSTION AIR REQUIRED. THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR AT 70 DEGREES F.

   CFM 0.265 x CUBIC FEET PER HOUR

   NOTE: THIS IS THE AMOUNT OF AIR REQUIRED FOR COMBUSTION AND IS NOT THE AMOUNT OF THE FLUE GASES.

5. CALCULATE THE AMOUNT OF FREE AREA REQUIRED IN THE COMBUSTION AIR LOUVERS. THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR ABOVE THAT REQUIRED UNDER NO. 4 ABOVE AND IS THE AMOUNT REQUIRED FOR COMBUSTION AND FOR THE VENTILATION OF THE BOILER ROOM.

   CFM x 1.3 - 250 FT. PER MINUTE – FREE AREA OF COMBUSTION AIR LOUVERS

   IT SHOULD BE NOTED THAT MOST LOUVERS HAVE ONLY ABOUT 50 PERCENT FREE AREA AND THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SIZING THE LOUVER. DOUBLING THE AMOUNT GIVEN BY THE ABOVE FORMULA IS USUALLY ADEQUATE FOR THE GROSS SIZE OF THE COMBUSTION AIR LOUVER. CAUTION – DO NOT USE INSECT SCREEN ON THE LOUVER; USE 1/2-INCH MESH BIRD SCREEN.

6. DETERMINE THE REQUIRED STACK SIZE AND HEIGHT. CONSULT THE MANUFACTURER'S CATALOG FOR THIS DATA. BE CAREFUL NOT TO COMBINE THE BOILER STACK WITH AN INCINERATOR STACK.

7. FURNACE VOLUME. SPECIFY THAT THE BOILER DOES NOT HAVE LESS FURNACE VOLUME THAN THE SBI MINIMUM FOR THE BOILER RATING USED.

8. BOILER SELECTION. THE BOILER SELECTED SHOULD HAVE AN SBI NET RATING EQUAL TO THE COMPUTED BLOCK HEAT LOAD FOR THE BUILDING. WHERE TWO BOILERS ARE TO BE USED, EACH BOILER SHOULD HAVE AN SBI NET RATING EQUAL TO 66-2/3 PERCENT OF THE COMPUTED BLOCK HEAT LOAD. CAREFUL CONSIDERATION SHOULD BE GIVEN TO FUTURE ADDITIONS TO THE BUILDING WHEN COMPUTING THE BLOCK HEAT LOAD FOR THE BUILDING.

9. WATER TRIM. THE BOILER SHOULD BE EQUIPPED WITH THE FOLLOWING MINIMUM WATER TRIM:

   A. HIGH LIMIT AQUASTAT TO SHUT OFF THE GAS BURNER IF THE BOILER WATER TEMPERATURE REACHES A PREDETERMINED HIGH LIMIT SETTING.

   B. PROVIDE AN OPERATING AQUASTAT TO START AND STOP THE GAS BURNER TO MAINTAIN THE THE WATER TEMPERATURE. IF MORE THAN ONE BOILER IS USED, LOCATE A MASTER AQUASTAT IN THE MAIN HEADER TO START AND STOP ALL GAS BURNERS.

   C. THERMOMETER. A HIGH QUALITY MERCURY FILLED THERMOMETER AT LEAST 8-INCHES LONG SHOULD BE MOUNTED ON THE BOILER IN A CLEARLY VISIBLE LOCATION TO INDICATE THE BOILER WATER TEMPERATURE.

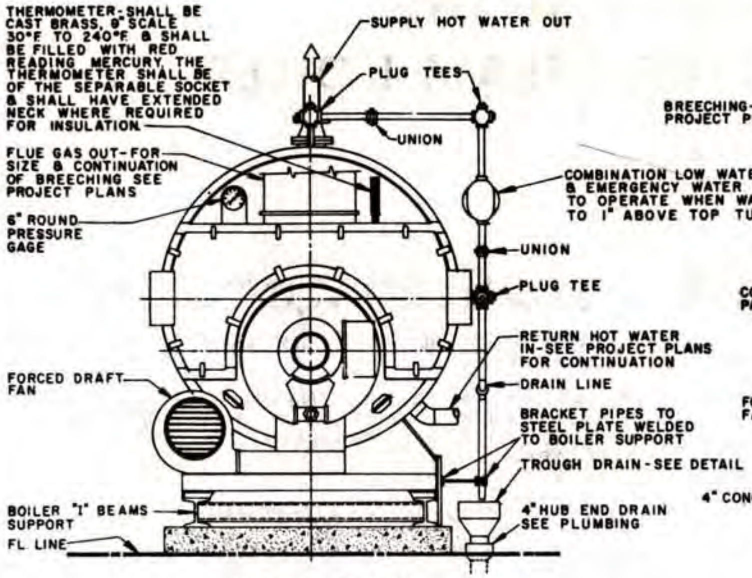
   D. PRESSURE GAGE. PROVIDE A PRESSURE GAGE TO INDICATE THE PRESSURE IN THE BOILER.

   E. EMERGENCY LOW WATER CUTOFF AND WATER FEEDER. A COMBINATION LOW WATER CUTOFF AND WATER FEEDER SHOULD BE USED TO CUT OFF THE GAS BURNER AND SUPPLY MAKE-UP WATER UNDER FULL DOMESTIC WATER PRESSURE WHEN THE WATER IN THE BOILER FALLS TO ONE-INCH ABOVE THE TOP TUBES. THE WATER FEEDING FEATURE OF THIS DEVICE IS NOT TO BE CONSIDERED AS A MAKE-UP WATER FEEDER WHICH NORMALLY COMES IN THROUGH A PRESSURE REDUCING VALVE TO MAINTAIN A PREDETERMINED PRESSURE ON THE SYSTEM, BUT AS AN EMERGENCY FEED.

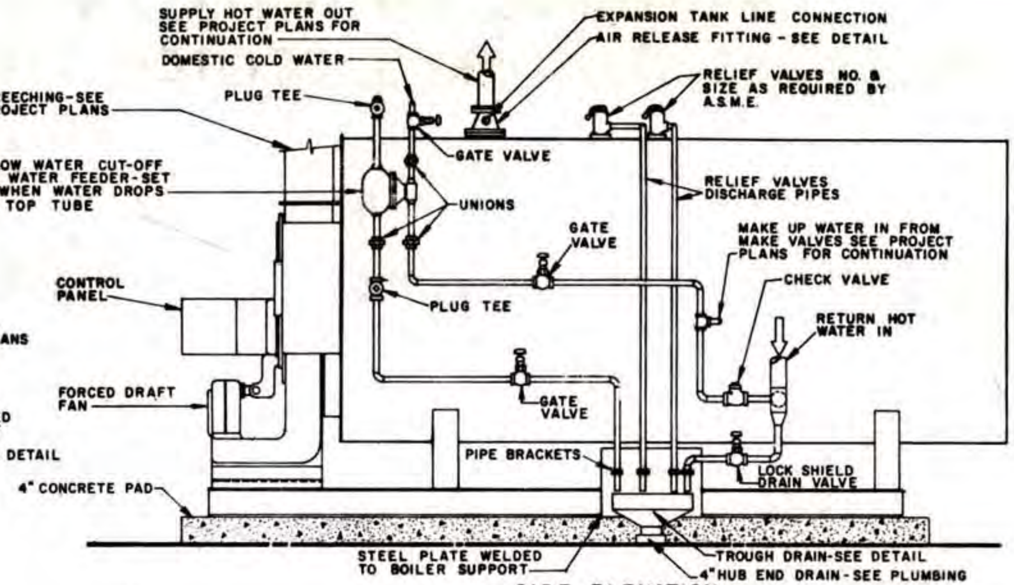
   F. WATER PRESSURE RELIEF VALVES OF THE NUMBER AND CAPACITY AS REQUIRED BY THE ASME CODE.

10. WATER VALVES. BOILER STOP VALVES ARE REQUIRED TO BE OF THE OS&Y RISING STEM TYPE AND MAKE-UP WATER FEED MUST BE CONNECTED ON THE BOILER SIDE OF ALL VALVES.

11. GAS TRAIN. A GAS TRAIN WHICH MEETS THE FIA REQUIREMENTS SHOULD BE PROVIDED.



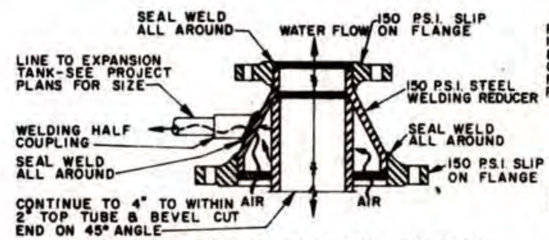
FRONT ELEVATION



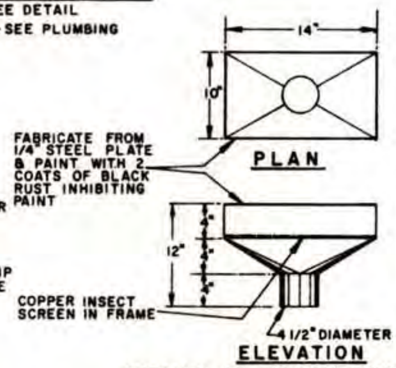
SIDE ELEVATION

INSTALLATION NOTES

1-INSTALL BOILER DEAD LEVEL BOTH DIRECTIONS.
2-FILL SYSTEM SLOWLY AND CHECK FOR LEAKS.
3-OBSERVE RISE OF WATER IN SIGHT GLASS AND TEST TRY COCKS.
4-CONTACT GAS BURNER CONTRACTOR FOR BURNER START-UP.
5-DO NOT ALLOW UNHEATED FRESH WATER TO STAND IN BOILER FOR EXTENDED PERIODS AS RAPID CORROSION FROM OXIDATION MAY PIT TUBES.
6-INCREASE TEMPERATURE.
7-DO NOT OPERATE BOILER UNDER 160°F BECAUSE CONDENSATION MAY FORM IN TUBES.
8-FIRE BOILER TO 190°F BOILER WATER TEMPERATURE TO DRIVE OFF FREE OXYGEN.
9-CHECK TO SEE IF ADEQUATE COMBUSTION AIR (200% OF STACK SIZE) HAS BEEN PROVIDE INTO THE BOILER ROOM.
10-CHECK SAFETY RELIEF VALVES BY PULLING HANDLE.



DETAILS OF AIR RELEASE FITTING



DETAILS OF TROUGH DRAIN

DETAILS OF THE INSTALLATION OF THE TWO PASS, GAS FIRED, SCOTCH TYPE, HOT WATER BOILER

NO SCALE

SCHEDULE OF CAPACITIES OF THE TWO PASS, GAS FIRED, SCOTCH TYPE, HOT WATER BOILER

BOILER NO	S.B.I GROSS OUTPUT	S.B.I. NET OUTPUT	OPERATING PRESSURE	WORKING PRESSURE RATING OF BOILER	TYPE OF GAS	GAS INPUT	HEATING SURFACE WATERSIDE	HEATING SURFACE FIRESIDE	FURNACE VOLUME MINIMUM	MAXIMUM HEAT RELEASE	GAS			FORCED DRAFT FAN MOTOR				
											BTU./HR.	CU. FT.	FIRING RATE	C.F.M.	S.P.	H.P.	VOLT	PHASE

DESIGNING THE INSTALLATION OF THE TWO-PASS, GAS-FIRED, SCOTCH TYPE, STEAM BOILER

1. DETERMINE THE REQUIRED OUTPUT OF THE BOILER BY THE USUAL METHODS AS OUTLINED IN THE ASHRAE GUIDE AND DATA BOOK. NORMALLY, THE OUTPUT IS DEFINED BY THE TWO FOLLOWING VALUES:

   A. SBI GROSS OUTPUT IN MBH

   B. SBI NET OUTPUT IN MBH

2. DETERMINE THE GAS FIRING RATE.

   A. CALCULATE THE REQUIRED INPUT IN BTU/HR BY DIVIDING THE SBI GROSS OUTPUT BY .80 (EFFICIENCY).

   B. CALCULATE THE REQUIRED AMOUNT OF GAS TO BE BURNED BY DIVIDING THE INPUT IN BTU HR BY THE HEATING VALUE OF THE GAS IN BTU/CUBIC FOOT.

   THE HEATING VALUE FOR GAS CAN BE ASCERTAINED FROM THE LOCAL GAS COMPANY; IF NOT AVAILABLE, USE 1,000 BTU/CU. FT. FOR NATURAL GAS.

3. ANNUAL FUEL CONSUMPTION. THE ANNUAL FUEL CONSUMPTION MAY BE ESTIMATED BY THE FOLLOWING FORMULA:

$$\text{ANNUAL GAS CONSUMPTION IN THERMS (100,000 BTU)} = \frac{\text{TOTAL HEAT LOSS (BTU/HR)} \times \text{ANNUAL DEGREE DAYS}}{\text{DESIGN TEMPERATURE DIFFERENCE} \times 3500}$$

4. CALCULATE THE AMOUNT OF COMBUSTION AIR REQUIRED. THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR AT 70 DEGREES F.

$$\text{CFM} = 0.265 \times \text{CUBIC FEET PER HOUR}$$

   NOTE: THIS IS THE AMOUNT OF AIR REQUIRED FOR COMBUSTION AND IS NOT THE AMOUNT OF THE FLUE GASES.

5. CALCULATE THE AMOUNT OF FREE AREA REQUIRED IN THE COMBUSTION AIR LOUVERS. THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR ABOVE THAT REQUIRED UNDER NO. 4 ABOVE AND IS THE AMOUNT REQUIRED FOR COMBUSTION AND FOR THE VENTILATION OF THE BOILER ROOM.

$$\text{CFM} \times 1.3 \div 250 \text{ FT. PER MINUTE} = \text{FREE AREA OF COMBUSTION AIR LOUVERS}$$

   IT SHOULD BE NOTED THAT MOST LOUVERS HAVE ONLY ABOUT 50 PERCENT FREE AREA AND THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SIZING THE LOUVER. DOUBLING THE AMOUNT GIVEN BY THE ABOVE FORMULA IS USUALLY ADEQUATE FOR THE GROSS SIZE OF THE COMBUSTION AIR LOUVER. CAUTION. DO NOT USE INSECT SCREEN ON THE LOUVER; USE 1/2-INCH MESH BIRD SCREEN.

6. DETERMINE THE REQUIRED STACK SIZE AND HEIGHT. CONSULT THE MANUFACTURER'S CATALOG FOR THIS DATA. BE CAREFUL NOT TO COMBINE THE BOILER STACK WITH AN INCINERATOR STACK.

7. FURNACE VOLUME. SPECIFY THAT THE BOILER DOES NOT HAVE LESS FURNACE VOLUME THAN THE SBI MINIMUM FOR THE BOILER RATING USED.

8. BOILER SELECTION. THE BOILER SELECTED SHOULD HAVE AN SBI RATING EQUAL TO THE COMPUTED BLOCK HEAT LOAD FOR THE BUILDING. WHERE TWO BOILERS ARE TO BE USED, EACH BOILER SHOULD HAVE AN SBI NET RATING EQUAL TO 66-2/3 PERCENT OF THE COMPUTED BLOCK HEAT LOAD. CAREFUL CONSIDERATION SHOULD BE GIVEN TO FUTURE ADDITIONS TO THE BUILDING WHEN COMPUTING THE BLOCK HEAT LOAD FOR THE BUILDING.

9. STEAM TRIM. THE BOILER SHOULD BE EQUIPPED WITH THE FOLLOWING MINIMUM STEAM TRIM:

   A. HIGH LIMIT PRESSURESTAT TO SHUT OFF THE GAS BURNER IF THE BOILER ROOM PRESSURE REACHES A PREDETERMINED HIGH LIMIT SETTING.

   B. OPERATING PRESSURESTAT TO START AND STOP THE GAS BURNER TO MAINTAIN THE STEAM PRESSURE. IF MORE THAN ONE BOILER IS USED, LOCATE A MASTER PRESSURESTAT IN THE MAIN HEADER TO START AND STOP ALL GAS BURNERS.

   C. PRESSURE GAGE. PROVIDE A PRESSURE GAGE TO INDICATE THE STEAM PRESSURE IN THE BOILER.

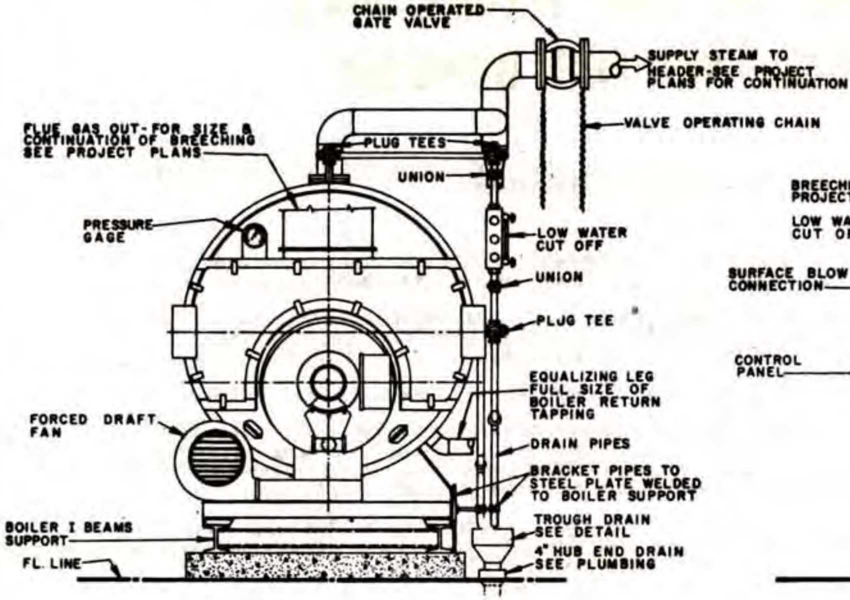
   D. PUMP STARTER, LOW WATER CUT-OFF AND ALARM. PROVIDE A COMBINATION FLOAT AND MERCURY SWITCH TYPE PUMP STARTER, LOW WATER CUT-OFF AND ALARM. THE PUMP STARTER SHALL START AND STOP THE CONDENSATE RETURN PUMP TO MAINTAIN THE WATER LEVEL IN THE BOILER AT THE DESIRED HEIGHT. THE LOW WATER CUT-OFF AND ALARM SHALL SHUT OFF THE GAS BURNER AND SOUND AN ALARM IF THE LEVEL IN THE BOILER FALLS TO A PREDETERMINED LOW LEVEL.

   E. EMERGENCY WATER FEEDER. THE EMERGENCY WATER FEEDER SHALL OPEN CITY WATER PRESSURE INTO THE BOILER IN THE EVENT THAT THE WATER LEVEL IN THE BOILER FALLS TO A PREDETERMINED LOW LEVEL.

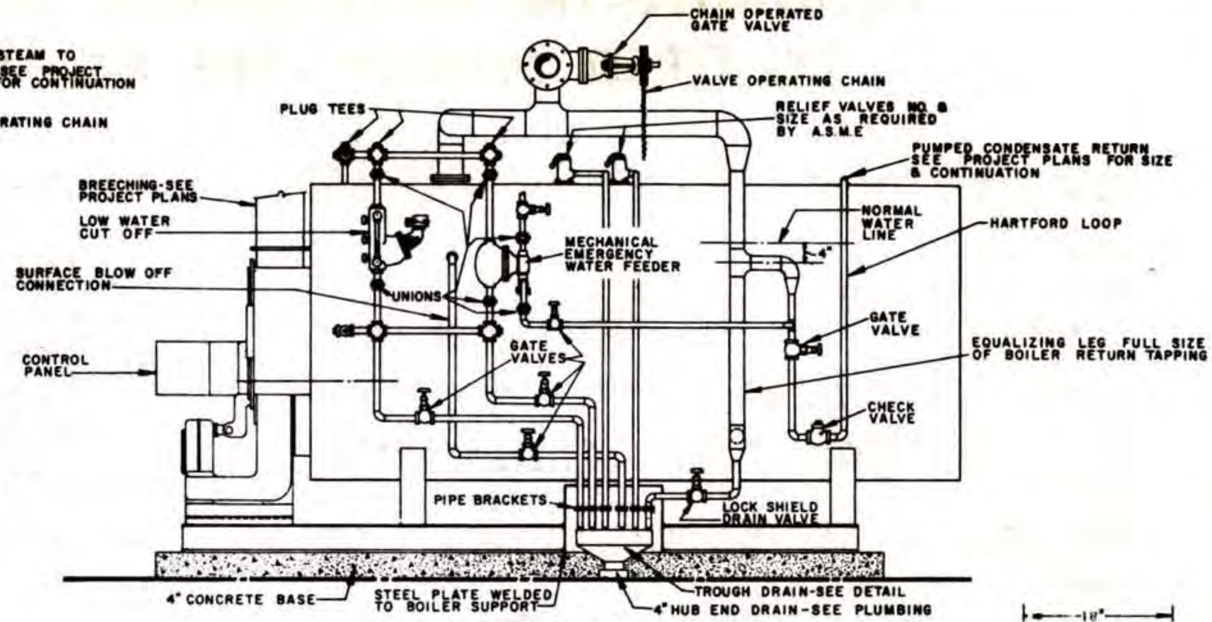
   F. STEAM PRESSURE RELIEF VALVES OF THE NUMBER AND CAPACITY AS REQUIRED BY THE ASME CODE.

10. STEAM AND BOILER FEED VALVES. BOILER STOP VALVES ARE REQUIRED TO BE OF THE OS&Y RISING STEM TYPE AND MAKE-UP WATER FEED MUST BE CONNECTED ON THE BOILER SIDE OF ALL VALVES.

11. GAS TRAIN. A GAS TRAIN WHICH MEETS THE FIA REQUIREMENTS SHOULD BE PROVIDED.



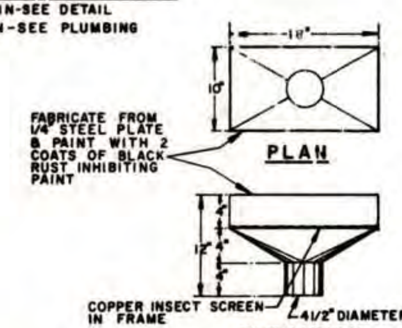
FRONT ELEVATION



SIDE ELEVATION

INSTALLATION NOTES

1- INSTALL BOILER DEAD LEVEL BOTH DIRECTIONS.
2- FILL SYSTEM SLOWLY AND CHECK FOR LEAKS.
3- OBSERVE RISE OF WATER IN SIGHT GLASS AND TEST TRY COCKS.
4- CONTACT GAS BURNER CONTRACTOR FOR BURNER START-UP
5- DO NOT ALLOW UNHEATED FRESH WATER TO STAND IN BOILER FOR EXTENDED PERIODS AS RAPID CORROSION FROM OXIDATION MAY PIT TUBES.
6- INCREASE TEMPERATURE
7- DO NOT OPERATE BOILER UNDER 160°F. BECAUSE CONDENSATION MAY FORM IN TUBES.
8- FIRE BOILER TO 190°F. BOILER WATER TEMPERATURE TO DRIVE OFF FREE OXYGEN.
9- CHECK TO SEE IF ADEQUATE COMBUSTION AIR (200% OF STACK SIZE) HAS BEEN PROVIDED INTO THE BOILER ROOM.
10- CHECK SAFETY RELIEF VALVES BY PULLING HANDLE.



DETAILS OF TROUGH DRAIN

DETAILS OF THE INSTALLATION OF THE TWO PASS, GAS FIRED, SCOTCH TYPE, STEAM BOILER

NO SCALE

SCHEDULE OF CAPACITIES OF THE TWO PASS, GAS FIRED, SCOTCH TYPE, STEAM BOILER

BOILER NO.	S.B.I. GROSS OUTPUT	S.B.I. NET OUTPUT	OPERATING PRESSURE	WORKING PRESSURE RATING OF BOILER	TYPE OF GAS	GAS INPUT	HEATING SURFACE WATERSIDE	HEATING SURFACE FIRESIDE	FURNACE VOLUME MINIMUM	MAXIMUM HEAT RELEASE	GAS			FORCED DRAFT FAN MOTOR				
											BTU/HR	CU. FT.	FIRING RATE	C.F.M.	S.P.	H.P.	VOLTS	PHASE

DESIGNING THE INSTALLATION OF THE THREE-PASS, OIL-FIRED, SCOTCH TYPE, HOT WATER BOILER

1. DETERMINE THE REQUIRED OUTPUT OF THE BOILER BY THE USUAL METHODS AS OUTLINED IN THE ASHRAE GUIDE AND DATA BOOK. NORMALLY, THE OUTPUT IS DEFINED BY THE TWO FOLLOWING VALUES:

   A. GROSS OUTPUT IN MBH
   B. NET OUTPUT IN MBH

2. DETERMINE THE OIL FIRING RATE –

   A. CALCULATE THE REQUIRED INPUT IN BTU/HR BY DIVIDING THE REQUIRED GROSS OUTPUT BY .80 (EFFICIENCY).

   B. CALCULATE THE REQUIRED AMOUNT OF OIL TO BE BURNED BY DIVIDING THE INPUT IN BTU/HR BY THE HEATING VALUE OF THE OIL IN BTU/GALLON.

   THE HEATING VALUE FOR NO. 5 AND NO. 6 OIL CAN BE ASCERTAINED FROM THE LOCAL FUEL OIL SUPPLIER; IF NOT AVAILABLE, USE 148,800 BTU/GALLON FOR NO. 5 OIL AND 153,400 BTU/GALLON FOR NO. 6 OIL.

3. CHOICE OF THE GRADE OF THE FUEL OIL TO BE BURNED SHOULD BE BASED ON A STUDY OF THE FACTORS INVOLVED AND EACH OF THE FOLLOWING ITEMS SHOULD BE CONSIDERED.

   A. COST OF EACH TYPE OF OIL.

   B. DOES OWNER HAVE OTHER BUILDING WHERE HE IS BUYING OIL UNDER ONE CONTRACT?

   C. AVAILABILITY OF EACH TYPE OF OIL, PARTICULARLY DURING PERIODS OF BAD WEATHER

   D. HOW MUCH OIL STORAGE CAN BE PROVIDED?

   E. CONSIDERATION OF THE OIL HEATING REQUIREMENTS FOR EACH TYPE OF OIL.

   F. STUDY LOCAL CODES AND ORDINANCES REGARDING THE BURNING OF FUEL OIL.

   G. STUDY THE CALIBER OF OPERATING PERSONNEL AND WHETHER OR NOT A LICENSED ENGINEER IS REQUIRED.

   H. CALCULATE THE YEARLY FUEL CONSUMPTION BY THE FOLLOWING FORMULA (FOR HEATING ONLY)

$$\text{ANNUAL FUEL IN GAL.} = \frac{\text{TOTAL HEAT LOSS (BTU/HR)} \times \text{ANNUAL DEGREE DAYS}}{\text{DESIGN TEMPERATURE DIFFERENCE} \times 5000}$$

4. OIL BURNER – THE OIL BURNER WILL NORMALLY BE OF THE AIR ATOMIZING TYPE AND WILL REQUIRE AN AIR COMPRESSOR – CONSULT MANUFACTURER'S DATA FOR COMPRESSOR SIZE.

5. BOILER SELECTION – THE BOILER SELECTED SHOULD HAVE A NET RATING EQUAL TO THE COMPUTED BLOCK HEAT LOAD FOR THE BUILDING. WHERE TWO BOILERS ARE TO BE USED, EACH BOILER SHOULD HAVE A NET IBR RATING EQUAL TO 66-2/3 PERCENT OF THE COMPUTED BLOCK HEAT LOAD. CAREFUL CONSIDERATION SHOULD BE GIVEN TO FUTURE ADDITIONS TO THE BUILDING WHEN COMPUTING THE BLOCK HEAT LOAD FOR THE BUILDING.

6. CALCULATE THE AMOUNT OF COMBUSTION AIR REQUIRED – THE FOLLOWING FORMULA ALLOWS FOR 30% EXCESS AIR FOR COMBUSTION AT 70 DEGREES F.

$$\text{CFM} = 35 \times \text{GPH OF OIL}$$

   NOTE: THIS IS THE AMOUNT OF AIR REQUIRED FOR COMBUSTION AND IS NOT THE CFM CAPACITY OF THE I.D. FAN SINCE THE I.D. FAN IS HANDLING THE HOT PRODUCTS OF COMBUSTION.

7. CALCULATE THE AMOUNT OF FREE AREA REQUIRED IN THE COMBUSTION AIR LOUVERS – THE FOLLOWING FORMULA ALLOWS FOR 30% EXCESS AIR ABOVE THAT REQUIRED UNDER NO. 6 AND IS THE AMOUNT REQUIRED FOR COMBUSTION AND FOR VENTILATION OF THE BOILER ROOM.

$$\text{CFM} \times 1.3 \div 250 \text{ FT. PER MINUTE} = \text{FREE AREA OF COMBUSTION AIR LOUVERS}$$

   IT SHOULD BE NOTED THAT MOST LOUVERS HAVE ONLY ABOUT 50% FREE AREA AND THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SIZING THE LOUVER. DOUBLING THE AMOUNT GIVEN BY THE ABOVE FORMULA IS USUALLY ADEQUATE FOR THE GROSS SIZE OF THE COMBUSTION LOUVER. CAUTION – DO NOT USE INSECT SCREEN ON THE LOUVER; USE ½ INCH MESH BIRD SCREEN.

8. DETERMINE THE REQUIRED STACK SIZE AND HEIGHT – CONSULT THE MANUFACTURER'S CATALOG FOR THIS DATA. BE CAREFUL NOT TO COMBINE THE BOILER STACK WITH AN INCINERATOR STACK. ALWAYS CHECK THE LOCAL CODES REGARDING STACK SIZE AND HEIGHT.

9. WATER TRIM – THE BOILER SHOULD BE EQUIPPED WITH THE FOLLOWING MINIMUM WATER TRIM:

   A HIGH LIMIT AQUASTAT TO SHUT OFF THE OIL BURNER IF THE BOILER WATER TEMPERATURE REACHES A PREDETERMINED HIGH LIMIT SETTING.

   B PROVIDE AN OPERATING AQUASTAT TO START AND STOP THE OIL BURNER TO MAINTAIN THE WATER TEMPERATURE. IF MORE THAN ONE BOILER IS USED, LOCATE A MASTER AQUASTAT IN THE MAIN HEADER TO START AND STOP ALL OIL BURNERS.

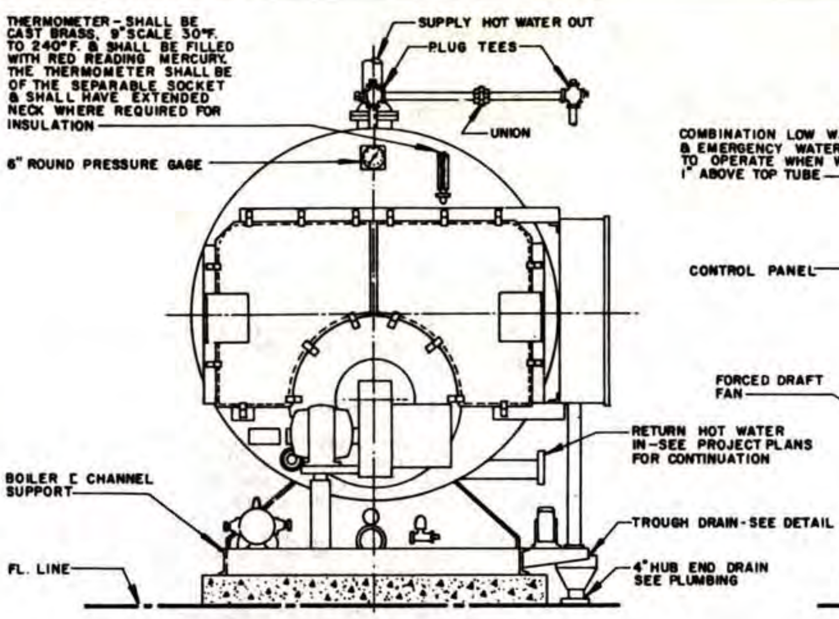
   C THERMOMETER – A HIGH QUALITY MERCURY FILLED THERMOMETER AT LEAST 8-INCHES LONG SHOULD BE MOUNTED ON THE BOILER IN A CLEARLY VISIBLE LOCATION TO INDICATE THE BOILER WATER TEMPERATURE.

   D. PRESSURE GAGE – PROVIDE A PRESSURE GAGE TO INDICATE THE PRESSURE IN THE BOILER.

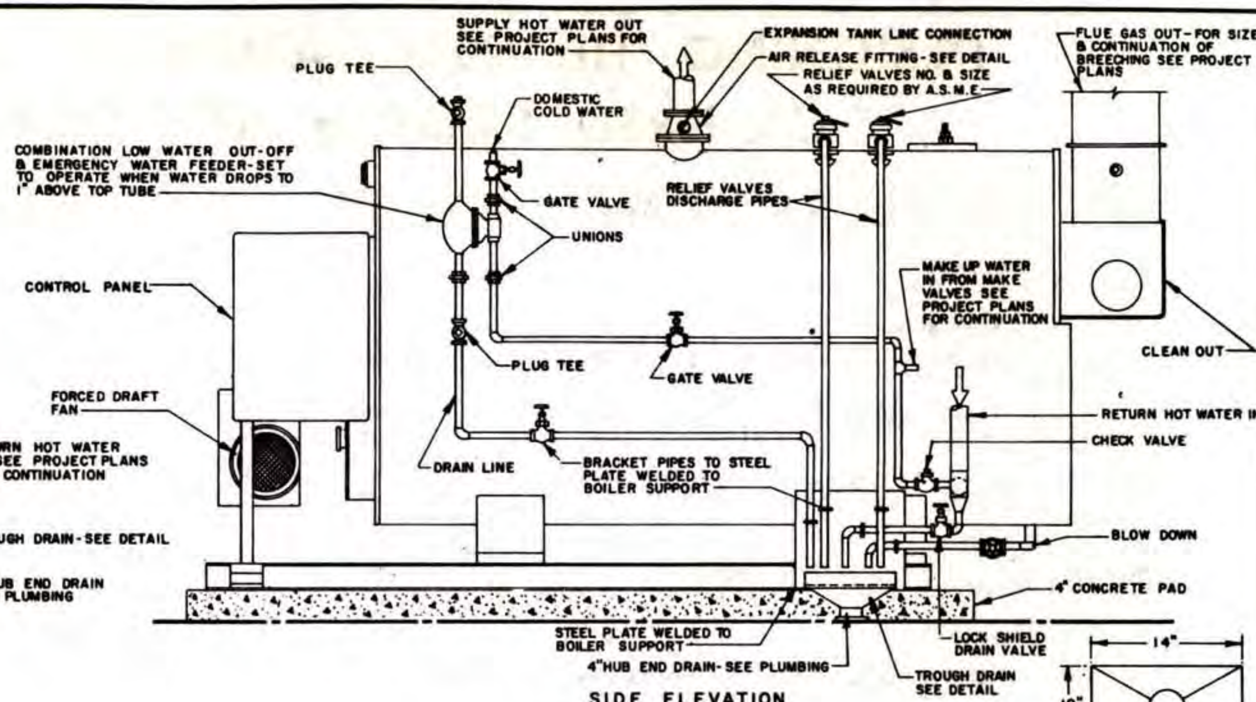
   E. EMERGENCY LOW WATER CUT-OFF AND WATER FEEDER – A COMBINATION LOW WATER CUT-OFF AND WATER FEEDER SHOULD BE USED TO CUT OFF THE BURNER AND SUPPLY MAKE-UP WATER UNDER FULL DOMESTIC WATER PRESSURE WHEN THE WATER IN THE BOILER FALLS TO 1-INCH ABOVE THE TOP TUBES. THE WATER FEEDING FEATURE OF THIS DEVICE IS NOT TO BE CONSIDERED AS A MAKE-UP WATER LEEDER WHICH NORMALLY COMES IN THROUGH A PRESSURE REDUCING VALVE TO MAINTAIN A PREDETERMINED PRESSURE ON THE SYSTEM, BUT AS AN EMERGENCY FEED.

   F WATER PRESSURE RELIEF VALVES OF THE NUMBER AND CAPACITY AS REQUIRED BY THE ASME CODE.

10. WATER VALVES – BOILER STOP VALVES ARE REQUIRED TO BE OF THE OS&Y RISING STEM TYPE AND MAKE-UP WATER FEED MUST BE CONNECTED ON THE BOILER SIDE OF ALL VALVES.



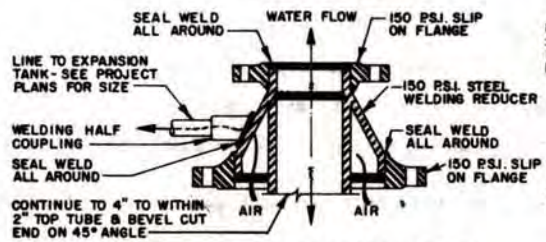
FRONT ELEVATION



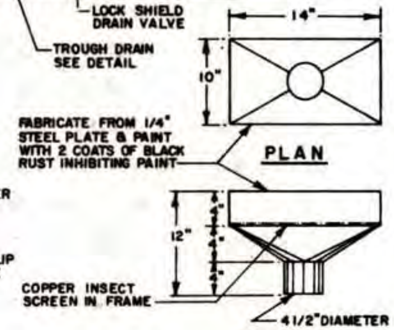
SIDE ELEVATION

INSTALLATION NOTES

1. INSTALL BOILER DEAD LEVEL BOTH DIRECTIONS.
2. FILL SYSTEM SLOWLY AND CHECK FOR LEAKS.
3. CHECK EXPANSION TANK TO BE SURE AIR CUSHION IS AVAILABLE.
4. CONTACT OIL BURNER CONTRACTOR FOR BURNER START-UP.
5. DO NOT ALLOW UNHEATED FRESH WATER TO STAND IN BOILER FOR EXTENDED PERIODS AS RAPID CORROSION FROM OXIDATION MAY PIT TUBES.
6. INCREASE TEMPERATURE.
7. DO NOT OPERATE BOILER UNDER 160°F. BECAUSE CONDENSATION MAY FORM IN TUBES.
8. FIRE BOILER TO 190°F. BOILER WATER TEMPERATURE TO DRIVE OFF FREE OXYGEN.
9. CHECK TO SEE IF ADEQUATE COMBUSTION AIR (200% OF STACK SIZE) HAS BEEN PROVIDED INTO THE BOILER ROOM.
10. CHECK SAFETY RELIEF VALVES BY PULLING HANDLE.



DETAILS OF AIR RELEASE FITTING



DETAILS OF TROUGH DRAIN

DETAILS OF THE INSTALLATION OF THE THREE PASS, OIL FIRED, SCOTCH TYPE, HOT WATER BOILER

SCHEDULE OF CAPACITIES OF THE THREE PASS, OIL FIRED, SCOTCH TYPE, HOT WATER BOILER

BOILER NO.	S.B.I. GROSS OUTPUT	S.B.I. NET OUTPUT	OPERATING PRESSURE	WORKING PRESSURE RATING OF BOILER	TYPE OF FUEL OIL	OIL FIRING RATE	HEATING SURFACE WATERSIDE	HEATING SURFACE FIRESIDE	FURNACE VOLUME MINIMUM	MAXIMUM HEAT RELEASE	ELECTRIC OIL HEATER			FORCED DRAFT FAN MOTOR				
											KW	VOLTS	PHASE	C.F.M.	S.P.	H.P.	VOLTS	PHASE

DESIGNING THE INSTALLATION OF THE THREE-PASS, OIL-FIRED, SCOTCH TYPE, STEAM BOILER

1. DETERMINE THE REQUIRED OUTPUT OF THE BOILER BY THE USUAL METHODS AS OUTLINED IN THE ASHRAE GUIDE AND DATA BOOK. NORMALLY, THE OUTPUT IS DEFINED BY THE TWO FOLLOWING VALUES:

   A. GROSS OUTPUT IN MBH
   B. NET OUTPUT IN MBH

2. DETERMINE THE OIL FIRING RATE –

   A. CALCULATE THE REQUIRED INPUT IN BTU/HR BY DIVIDING THE REQUIRED GROSS OUTPUT BY .80 (EFFICIENCY)

   B. CALCULATE THE REQUIRED AMOUNT OF OIL TO BE BURNED BY DIVIDING THE INPUT IN BTU/HR BY THE HEATING VALUE OF THE OIL IN BTU/GALLON.

   THE HEATING VALUE FOR NO. 5 AND NO. 6 OIL CAN BE ASCERTAINED FROM THE LOCAL FUEL OIL SUPPLIER; IF NOT AVAILABLE, USE 148,800 BTU/GALLON FOR NO. 5 OIL AND 153,400 BTU/GALLON FOR NO. 6 OIL.

3. CHOICE OF THE GRADE OF THE FUEL OIL TO BE BURNED SHOULD BE BASED ON A STUDY OF THE FACTORS INVOLVED AND EACH OF THE FOLLOWING ITEMS SHOULD BE CONSIDERED

   A. COST OF EACH TYPE OF OIL

   B. DOES OWNER HAVE OTHER BUILDINGS WHERE HE IS BUYING OIL UNDER ONE CONTRACT?

   C. AVAILABILITY OF EACH TYPE OF OIL, PARTICULARLY DURING PERIODS OF BAD WEATHER

   D. HOW MUCH OIL STORAGE CAN BE PROVIDED?

   E. CONSIDERATION OF THE OIL HEATING REQUIREMENTS FOR EACH TYPE OF OIL.

   F. STUDY LOCAL CODES AND ORDINANCES REGARDING THE BURNING OF FUEL OIL.

   G. STUDY THE CALIBER OF OPERATING PERSONNEL AND WHETHER OR NOT A LICENSED ENGINEER IS REQUIRED

   H. CALCULATE THE YEARLY FUEL CONSUMPTION BY THE FOLLOWING FORMULA (FOR HEATING ONLY).

$$\text{ANNUAL FUEL IN GAL.} = \frac{\text{TOTAL HEAT LOSS (BTU/HR)} \times \text{ANNUAL DEGREE DAYS}}{\text{DESIGN TEMPERATURE DIFFERENCE} \times 5000}$$

4. OIL BURNER – THE OIL BURNER WILL NORMALLY BE OF THE AIR ATOMIZING TYPE AND WILL REQUIRE AN AIR COMPRESSOR – CONSULT MANUFACTURERS DATA FOR SIZE.

5. BOILER SELECTION – THE BOILER SELECTED SHOULD HAVE A NET RATING EQUAL TO THE COMPUTED BLOCK HEAT LOAD FOR THE BUILDING. WHERE TWO BOILERS ARE TO BE USED, EACH BOILER SHOULD HAVE A NET RATING EQUAL TO 66-2/3-PERCENT OF THE COMPUTED BLOCK HEAT LOAD. CAREFUL CONSIDERATION SHOULD BE GIVEN TO FUTURE ADDITIONS TO THE BUILDING WHEN COMPUTING THE BLOCK HEAT LOAD FOR THE BUILDING.

6. CALCULATE THE AMOUNT OF COMBUSTION AIR REQUIRED – THE FOLLOWING FORMULA ALLOWS FOR 30% EXCESS AIR FOR COMBUSTION AT 70 DEGREES F.

$$\text{CFM} = 35 \times \text{GPH OF OIL}$$

   NOTE: THIS IS THE AMOUNT OF AIR REQUIRED FOR COMBUSTION AND IS NOT THE CFM CAPACITY OF THE I.D. FAN SINCE THE I.D. FAN IS HANDLING THE HOT PRODUCTS OF COMBUSTION.

7. CALCULATE THE AMOUNT OF FREE AREA REQUIRED IN THE COMBUSTION AIR LOUVERS – THE FOLLOWING FORMULA ALLOWS FOR 30% EXCESS AIR ABOVE THAT REQUIRED UNDER NO. 6 AND IS THE AMOUNT REQUIRED FOR COMBUSTION AND FOR VENTILATION OF THE BOILER ROOM.

$$\text{CFM} \times 1.3 \div 250 \text{ FT. PER MIN.} = \text{FREE AREA OF COMBUSTION AIR LOUVERS}$$

   IT SHOULD BE NOTED THAT MOST LOUVERS HAVE ONLY ABOUT 50% FREE AREA AND THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SIZING THE LOUVER. DOUBLING THE AMOUNT GIVEN BY THE ABOVE FORMULA IS USUALLY ADEQUATE FOR THE GROSS SIZE OF THE COMBUSTION LOUVER. CAUTION – DO NOT USE INSECT SCREEN ON THE LOUVER; USE ½ INCH MESH BIRD SCREEN.

8. DETERMINE THE REQUIRED STACK SIZE AND HEIGHT – CONSULT THE MANUFACTURER'S CATALOG FOR THIS DATA. BE CAREFUL NOT TO COMBINE THE BOILER STACK WITH AN INCINERATOR STACK. ALWAYS CHECK THE LOCAL CODES REGARDING STACK SIZE AND HEIGHT.

9. STEAM TRIM – THE BOILER SHOULD BE EQUIPPED WITH THE FOLLOWING MINIMUM STEAM TRIM.

   A. HIGH LIMIT PRESSURESTAT TO SHUT OFF THE OIL BURNER IF THE BOILER ROOM PRESSURE REACHES A PREDETERMINED HIGH LIMIT SETTING.

   B. PROVIDE AN OPERATING PRESSURESTAT TO START AND STOP THE OIL BURNER TO MAINTAIN THE STEAM PRESSURE. IF MORE THAN ONE BOILER IS USED, LOCATE A MASTER PRESSURESTAT IN THE MAIN HEADER TO START AND STOP ALL OIL BURNERS.

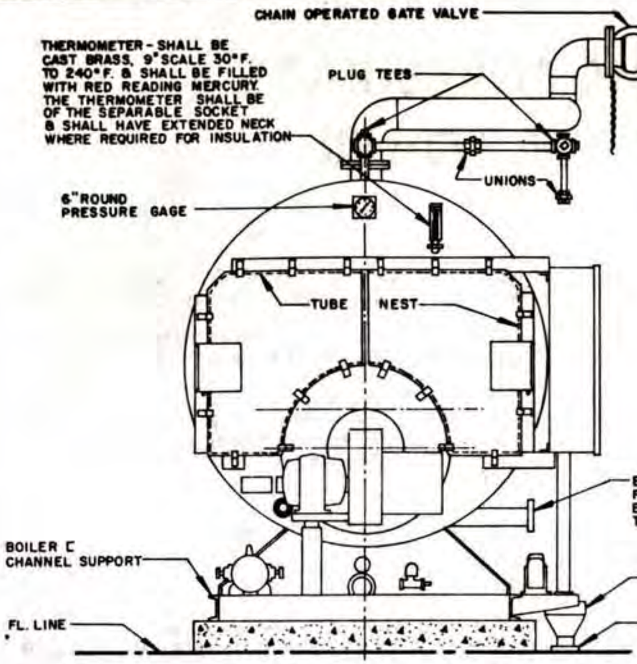
   C. PRESSURE GAGE – PROVIDE A PRESSURE GAGE TO INDICATE THE STEAM PRESSURE IN THE BOILER.

   D. PUMP STARTER, LOW WATER CUT-OFF AND ALARM – PROVIDE A COMBINATION FLOAT AND MERCURY SWITCH TYPE PUMP STARTER, LOW WATER CUT-OFF AND ALARM. THE PUMP STARTER SHALL START AND STOP THE CONDENSATE RETURN PUMP TO MAINTAIN THE WATER LEVEL IN THE BOILER AT THE DESIRED HEIGHT. THE LOW WATER CUT-OFF AND ALARM SHALL SHUT OFF THE OIL BURNER AND SOUND AN ALARM IF THE LEVEL IN THE BOILER FALLS TO A PREDETERMINED LOW LEVEL.

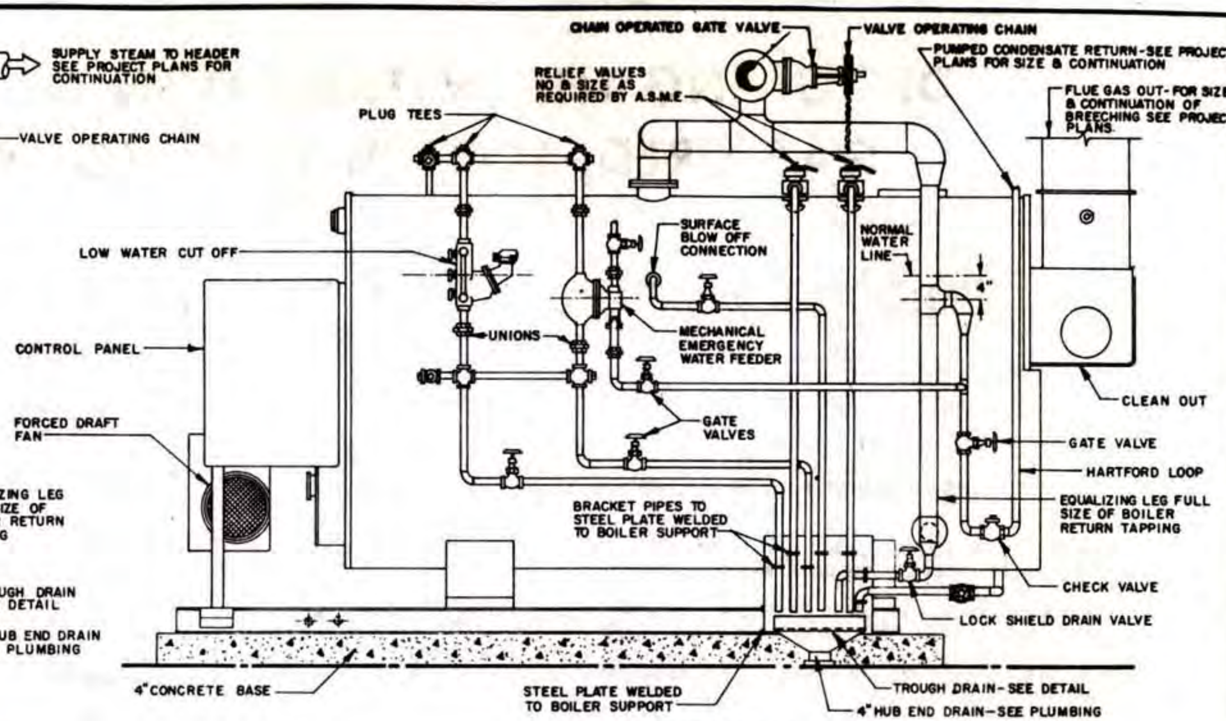
   E. EMERGENCY WATER FEEDER – THE EMERGENCY WATER FEEDER SHALL OPEN CITY WATER PRESSURE INTO THE BOILER IN THE EVENT THAT THE WATER LEVEL IN THE BOILER FALLS TO A PREDETERMINED LOW LEVEL.

   F. STEAM PRESSURE RELIEF VALVES OF THE NUMBER AND CAPACITY AS REQUIRED BY THE ASME CODE.

10. STEAM AND BOILER FEED VALVES – BOILER STOP VALVES ARE REQUIRED TO BE OF THE OS&Y RISING STEM TYPE AND MAKE-UP WATER FEED MUST BE CONNECTED ON THE BOILER SIDE OF ALL VALVES.



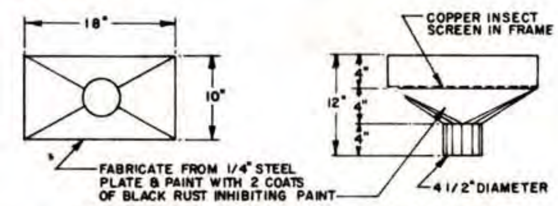
FRONT ELEVATION



SIDE ELEVATION

INSTALLATION NOTES

1. INSTALL BOILER DEAD LEVEL BOTH DIRECTIONS.
2. FILL SYSTEM SLOWLY AND CHECK FOR LEAKS.
3. OBSERVE RISE OF WATER IN SIGHT GLASS AND TEST TRY COCKS.
4. CONTACT OIL BURNER CONTRACTOR FOR BURNER START-UP.
5. DO NOT ALLOW UNHEATED FRESH WATER TO STAND IN BOILER FOR EXTENDED PERIODS AS RAPID CORROSION FROM OXIDATION MAY PIT TUBES.
6. INCREASE TEMPERATURE.
7. DO NOT OPERATE BOILER UNDER 160°F. BECAUSE CONDENSATION MAY FORM IN TUBES.
8. FIRE BOILER TO 190°F. BOILER WATER TEMPERATURE TO DRIVE OFF FREE OXYGEN.
9. CHECK TO SEE IF ADEQUATE COMBUSTION AIR (200% OF STACK SIZE) HAS BEEN PROVIDED INTO THE BOILER ROOM.
10. CHECK SAFETY RELIEF VALVES BY PULLING HANDLE.



DETAILS OF TROUGH DRAIN

DETAILS OF THE INSTALLATION OF THE THREE PASS, OIL FIRED, SCOTCH TYPE, STEAM BOILER

SCHEDULE OF CAPACITIES OF THE THREE PASS, OIL FIRED, SCOTCH TYPE, STEAM BOILER

BOILER NO.	S.B.I. GROSS OUTPUT	S.B.I. NET OUTPUT	OPERATING PRESSURE	WORKING PRESSURE RATING OF BOILER	TYPE OF FUEL OIL	OIL FIRING RATE	HEATING SURFACE WATERSIDE	HEATING SURFACE FIRESIDE	FURNACE VOLUME MINIMUM	MAXIMUM HEAT RELEASE	ELECTRIC OIL HEATER			FORCED DRAFT FAN MOTOR				
											KW	VOLTS	PHASE	C.F.M.	S.P.	H.P.	VOLTS	PHASE

DESIGNING THE INSTALLATION OF THE THREE-PASS, GAS-FIRED, SCOTCH TYPE, HOT WATER BOILER

1. DETERMINE THE REQUIRED OUTPUT OF THE BOILER BY THE USUAL METHODS AS OUTLINED IN THE ASHRAE GUIDE AND DATA BOOK. NORMALLY, THE OUTPUT IS DEFINED BY THE TWO FOLLOWING VALUES:

   A. GROSS OUTPUT IN MBH

   B. NET OUTPUT IN MBH

2. DETERMINE THE GAS FIRING RATE .

   A. CALCULATE THE REQUIRED INPUT IN BTU/HR BY DIVIDING THE SBI GROSS OUTPUT BY .80 (EFFICIENCY).

   B. CALCULATE THE REQUIRED AMOUNT OF GAS TO BE BURNED BY DIVIDING THE INPUT IN BTU/HR BY THE HEATING VALUE OF THE GAS IN BTU/CUBIC FOOT.

   THE HEATING VALUE FOR GAS CAN BE ASCERTAINED FROM THE LOCAL GAS COMPANY: IF NOT AVAILABLE, USE 1,000 BTU/CUBIC FOOT FOR NATURAL GAS.

3. ANNUAL FUEL CONSUMPTION – THE ANNUAL FUEL CONSUMPTION MAY BE ESTIMATED BY THE FOLLOWING FORMULA:

$$\text{ANNUAL GAS CONSUMPTION IN THERMS (100,000 BTU)} = \frac{\text{TOTAL HEAT LOSS (BTU/HR)} \times \text{ANNUAL DEGREE DAYS}}{\text{DESIGN TEMPERATURE DIFFERENCE} \times 3500}$$

4. CALCULATE THE AMOUNT OF COMBUSTION AIR REQUIRED – THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR AT 70 DEGREES F.

$$\text{CFM} = 0.265 \times \text{CUBIC FEET OF GAS PER HOUR}$$

   NOTE: THIS IS THE AMOUNT OF AIR REQUIRED FOR COMBUSTION AND IS NOT THE AMOUNT OF THE FLUE GASES.

5. CALCULATE THE AMOUNT OF FREE AREA REQUIRED IN THE COMBUSTION AIR LOUVERS – THE FOLLOWING FORMULA ALLOWS FOR 30 PERCENT EXCESS AIR ABOVE THE REQUIRED UNDER NO. 4 ABOVE AND IS THE AMOUNT REQUIRED FOR COMBUSTION AND FOR THE VENTILATION OF THE BOILER ROOM.

$$\text{CFM} \times 1.3 \div 250 \text{ FT. PER MINUTE} = \text{FREE AREA OF COMBUSTION AIR LOUVERS.}$$

   IT SHOULD BE NOTED THAT MOST LOUVERS HAVE ONLY ABOUT 50 PERCENT FREE AREA AND THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SIZING THE LOUVER. DOUBLING THE AMOUNT GIVEN BY THE ABOVE FORMULA IS USUALLY ADEQUATE FOR THE GROSS SIZE OF THE COMBUSTION AIR LOUVER. CAUTION – DO NOT USE INSECT SCREEN ON THE LOUVER: USE 1/2-INCH MESH BIRD SCREEN.

6. DETERMINE THE REQUIRED STACK SIZE AND HEIGHT – CONSULT THE MANUFACTURER'S CATALOG FOR THIS DATA. BE CAREFUL NOT TO COMBINE THE BOILER STACK WITH AN INCINERATOR STACK.

7. BOILER SELECTION – THE BOILER SELECTED SHOULD HAVE A NET RATING EQUAL TO THE COMPUTED BLOCK HEAT LOAD FOR THE BUILDING. WHERE TWO BOILERS ARE TO BE USED, EACH BOILER SHOULD HAVE A NET RATING EQUAL TO 66-2/3 PERCENT OF THE COMPUTED BLOCK HEAT LOAD. CAREFUL CONSIDERATION SHOULD BE GIVEN TO FUTURE ADDITIONS TO THE BUILDING WHEN COMPUTING THE BLOCK HEAT LOAD FOR THE BUILDING.

8. WATER TRIM – THE BOILER SHOULD BE EQUIPPED WITH THE FOLLOWING MINIMUM WATER TRIM:

   A. HIGH LIMIT AQUASTAT TO SHUT OFF THE GAS BURNER IF THE BOILER WATER TEMPERATURE REACHES A PREDETERMINED HIGH LIMIT SETTING.

   B. PROVIDE AN OPERATING AQUASTAT TO START AND STOP THE GAS BURNER TO MAINTAIN THE WATER TEMPERATURE. IF MORE THAN ONE BOILER IS USED, LOCATE A MASTER AQUASTAT IN THE MAIN HEADER TO START AND STOP ALL GAS BURNERS.

   C. THERMOMETER – A HIGH QUALITY MERCURY FILLED THERMOMETER AT LEAST 8-INCHES LONG SHOULD BE MOUNTED ON THE BOILER IN A CLEARLY VISIBLE LOCATION TO INDICATE THE BOILER WATER TEMPERATURE.

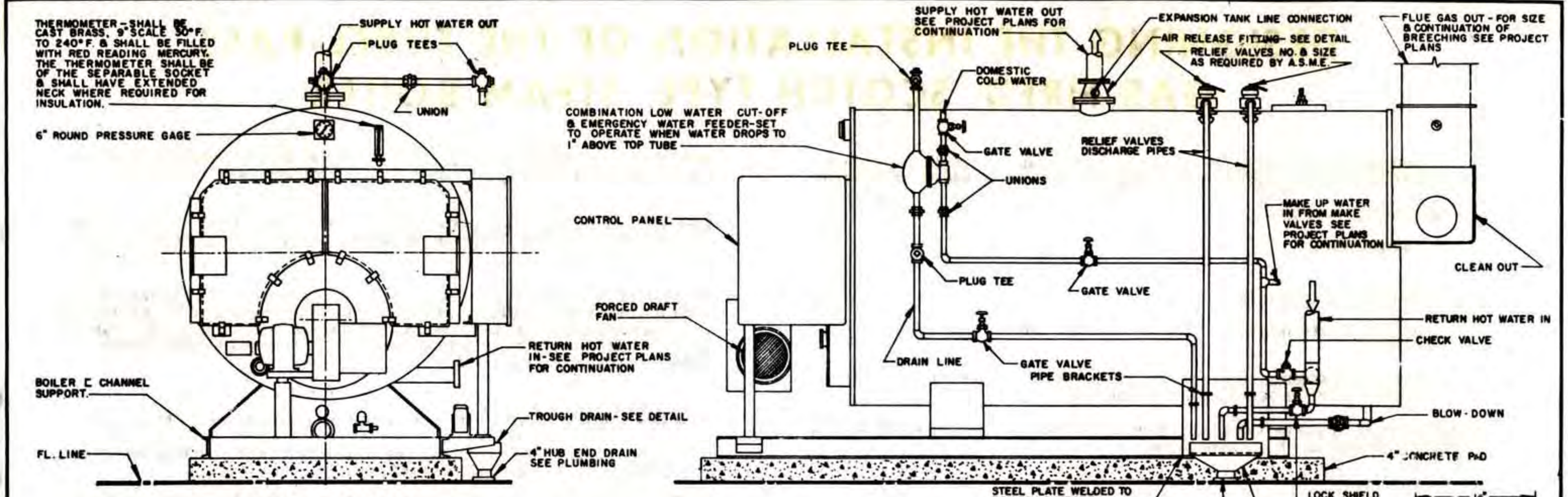
   D. PRESSURE GAGE – PROVIDE A PRESSURE GAGE TO INDICATE THE PRESSURE IN THE BOILER.

   E. EMERGENCY LOW WATER CUT-OFF AND WATER FEEDER – A COMBINATION LOW WATER CUT-OFF AND WATER FEEDER SHOULD BE USED TO CUT OFF THE GAS BURNER AND SUPPLY MAKE-UP WATER UNDER FULL DOMESTIC WATER PRESSURE WHEN THE WATER IN THE BOILER FALLS TO ONE-INCH ABOVE THE TOP TUBES. THE WATER FEEDING FEATURE OF THIS DEVICE IS NOT TO BE CONSIDERED AS A MAKE-UP WATER FEEDER WHICH NORMALLY COMES IN THRU A PRESSURE REDUCING VALVE TO MAINTAIN A PREDETERMINED PRESSURE ON THE SYSTEM, BUT AS AN EMERGENCY FEED.

   F. WATER PRESSURE RELIEF VALVES OF THE NUMBER AND CAPACITY AS REQUIRED BY THE ASME CODE.

9. WATER VALVES – BOILER STOP VALVES ARE REQUIRED TO BE OF THE OS&Y RISING STEM TYPE AND MAKE-UP WATER FEED MUST BE CONNECTED ON THE BOILER SIDE OF ALL VALVES.

10. GAS TRAIN – A GAS TRAIN WHICH MEETS THE FIA REQUIREMENTS SHOULD BE PROVIDED.

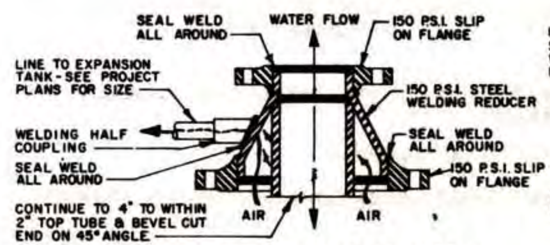


FRONT ELEVATION

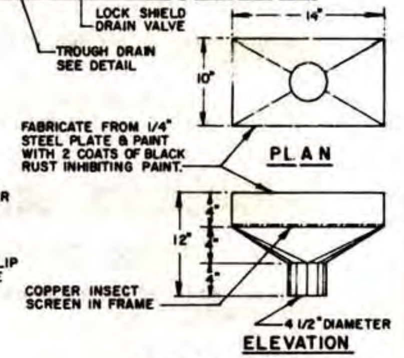
SIDE ELEVATION

INSTALLATION NOTES

1. INSTALL BOILER DEAD LEVEL BOTH DIRECTIONS.
2. FILL SYSTEM SLOWLY AND CHECK FOR LEAKS.
3. OBSERVE RISE OF WATER IN SIGHT GLASS AND TEST TRY COCKS.
4. CONTACT GAS BURNER CONTRACTOR FOR BURNER START-UP.
5. DO NOT ALLOW UNHEATED FRESH WATER TO STAND IN BOILER FOR EXTENDED PERIODS AS RAPID CORROSION FROM OXIDATION MAY PIT TUBES.
6. INCREASE TEMPERATURE.
7. DO NOT OPERATE BOILER UNDER 160°F BECAUSE CONDENSATION MAY FORM IN THE TUBES
8. FIRE BOILER TO 190°F. BOILER WATER TEMPERATURE TO DRIVE OFF FREE OXYGEN.
9. CHECK TO SEE IF ADEQUATE COMBUSTION AIR (200% OF STACK SIZE) HAS BEEN PROVIDED INTO THE BOILER ROOM.
10. CHECK SAFETY RELIEF VALVES BY PULLING HANDLE.



DETAILS OF AIR RELEASE FITTING



DETAILS OF TROUGH DRAIN

DETAILS OF THE INSTALLATION OF THE THREE PASS, GAS FIRED, SCOTCH TYPE, HOT WATER BOILER

NO SCALE

SCHEDULE OF CAPACITIES OF THE THREE PASS, GAS FIRED, SCOTCH TYPE, HOT WATER BOILER

BOILER NO.	S.B.I. GROSS OUTPUT	S.B.I. NET OUTPUT	OPERATING PRESSURE	WORKING PRESSURE RATING OF BOILER	TYPE OF GAS	GAS INPUT	HEATING SURFACE WATERSIDE	HEATING SURFACE FIRESIDE	FURNACE VOLUME MINIMUM	MAXIMUM HEAT RELEASE	GAS			FORCED DRAFT FAN MOTOR				
											B.T.U./HR.	CU. FT.	FIRING RATE	C.F.M.	S.P.	H.P.	VOLT	PHASE