FACILITY DESCRIPTION

This Steel Production Facility can be located on a fifty acre greenfield site with truck access, water, natural gas and high voltage electrical services. The design of the plant has a potential annual capacity of 100,000 hot metal tons per year operating 21 shifts per week. For this project, the Melt Shop and Rolling Mill is scheduled to operate just 5 shifts per week and 50 weeks per year, for an annual hot metal capacity of 25,000 tons per year. The 1/4" thick plate produced on the Rolling Mill will be fabricated into 20,000 tons of boxes (26,700 boxes) during 15 shifts per week, 50 weeks per year. To increase fabrication capabilities over the 20,000 tons per year, additional facilities must be added.

The preliminary design for this study was based upon a "mini mill" concept with used equipment where practical and new equipment where appropriate. The Plant is designed to melt scrap metal in an Electric Arc Furnace, take its product of hot metal to a Continuous Casting Machine where 4" thick x 54" wide steel slabs will be produced. The slabs will then be conveyed on a roller table to the Reversing Hot Mill for the production of 1/4" x 54" plates approximately 20'-0" in length. After cooling, these plates will be sheared and punched, and welded into 48" x 72" x 51" high boxes weighing 1500 lb. each.

Three types of furnaces were considered in the study; Electric Arc, Induction and Plasma Arc. Because of the production requirements established at the beginning of the study, only the Electric Arc Furnace was considered practical because of its ability to accommodate larger sizes of scrap materials, its flexibility in controlling the melt composition and its ability to minimize slag carryover onto the steel ladle going to the continuous casting machine.

The Induction Arc Furnace could be used if the charge material and the final melt analysis are basically the same. However, no major refining of the steel can be accomplished and any major attempts to adjust the carbon by blowing oxygen can create sudden and violent reactions because of the concentrated surface area in an induction furnace from which carbon monoxide has to escape.

Additionally, the Induction Arc Furnace must be operated with a heel of metal remaining between each tap. In operation, only 50 to 70 percent of the melted metal is tapped. For a tap weight of 33.3 tons, as determined by this study, an Induction furnace of 55 tons would be necessary. A normal crucible size would be 79 inches. The maximum scrap size should not exceed 70% of the crucible size requiring that scrap be prepared to approximately 55 inches in length or smaller. Furthermore, the charge weights into the furnace are about 10-20 percent of the furnace capacity which will require for a 33.3 ton heat, a minimum of 4 to 7 charges. Only 2 charges will be required for a 33.3 ton Arc Furnace. For a 70 ton Arc Furnace only one charge would be needed. A 33.3 ton Electric Arc Furnace can accommodate scrap up to 72 inches in length, however, smaller uniform sizing of scrap, allows for better loading and utilization of the furnace hearth with either furnace used.

Slag in an Electric Arc Furnace can be removed while the furnace is superheating or refining. An Induction furnace must be shut off or its power reduced for slagging, additional mechanical skimming devices may be required in an induction furnace.

Considerations for the use of Plasma Arc, vacuum arc and electroslag remelting furnaces where made but are not recommended because of their complexity, cost and smaller size. They should only be considered if the production requirement leans toward special alloys which require special cleanliness of the steel. Each of these processes will experience the same problems as those experienced with the induction furnace. They will also add to the overall facility and operational cost since refining may require an extra pour and a second vessel or station between the melt furnace and the casting operation.

Additional refining vessels such as an Argon-Oxygen-Decarbonization (AOD) or Ladle-Metallurgy-Station (LMS) are not recommended due to the additional cost and fume collection considerations. Neither are required for the capacity of the facility considered within this study, however, space could be provided now for addition of these refining processes in the future.

It is proposed that a covered preparation scrap bay contain a minimum of 20 days storage capacity, amounting to approximately 2000 tons of contaminated scrap. Scrap in boxes would be delivered by trucks to the scrap yard and emptied into storage piles by one of two overhead scrap cranes. It was assumed for this study that all contaminated scrap would be sized and separated by metal type prior to arrival at the facility. Room for a shear in the scrap preparation area should be considered for some scrap shearing to suitable lengths for furnace feed. Most scrap received in containers would likely be sized for furnace feed and be clean of rubble and non-ferrous metals.

The prepared scrap will then be loaded into scrap buckets by the overhead cranes and transported by one of two transfer cars into the melt shop for weighing prior to furnace charging. Each bucket will be of sufficient capacity to accept up to 23 tons of scrap depending upon scrap density. The buckets are of the clam shell or bi-parting type design and do not require any closing stand or fastening device to close the bottom. They will readily sit on a flat surface without the need of special stands or supports. The melt shop building will be approximately 450'-0" long, 80'-0" wide and 68'-0" to the bottom of the roof chord, and will be serviced by a scrap charging crane and a hot metal crane.

Loaded scrap buckets will be removed from the transfer cars by one of the electric-overhead-traveling (EOT) cranes and positioned on a platform scale where the weight will be automatically totalized and printed for record. Necessary weigh trimming will be done in this area. Once the bucket is weighed, it will be moved by the charging crane to the electric arc furnace for charging. Approximately 36 tons of scrap will be charged into the furnace during the heat cycle. The furnace will have a capacity of 33.3 tons of hot metal and shall be complete with a 20,000 KVA transformer and all auxiliary equipment, such as ladle stands, additive bins and handling facilities.

After scrap is charged, the furnace roof is swung into closed position, the electrodes are lowered and scrap meltdown takes place. After all scrap charges are melted, the refining cycle takes place during which furnace additions are added through the slagging door. Following the refining cycle, the furnace is tilted backward to tap the slag. A slag pot on a transfer car will be used for slag removal. The chemistry of the hot metal is checked and adjusted if necessary. The furnace is then tilted forward and tapped into a hot metal ladle. Additional slag will be drained through the furnace spout and into a slag pot on a second transfer car. Extra precaution should be taken to shield the slag handling and hot metal areas with stainless steel plate because of possible splashing of slag and hot metal. This will allow for periodic clean-up of contaminated slag. Removable refractory will be installed in the transfer areas to minimize spalling of the concrete from hot metal and slag. The required ferroalloys are added in the ladle as a tap is carried out.

After furnace tapping, the ladle containing 33.3 tons of molten steel will be delivered to the continuous casting machine by the hot metal crane. The hot metal ladle is placed on the casting machine superstructure and suspended from the ladle bail. The crane awaits the start of the cast and returns to the furnace only after the possibility of a breakout is eliminated.

The continuous slab casting machine, designed to cast 4" thick x 54" wide slabs, will be a low head straight mold machine with 16'-0" radius withdrawal section. The hot metal feed from the ladle into the tundish will be through a slide gate nozzle mounted on the bottom of the ladle. With the 33.3 ton heat size and a nominal casting speed of 60 inches per minute, it will take 18.37 minutes to cast the heat. The cast slab will be withdrawn from the mold and through the caster spray chamber by a withdrawal-straightener. The 4" X 54" slab will then be cut to the required lengths by a torch cut-off device. It may be questioned why a 4" thick x 54" wide slab was chosen over that of a thin slab caster design. While the thin slab caster machines are the most economical operation to produce thin gauge sheet, they will not provide the quality required or received with the thicker slab casters and the higher reduction ratio obtained when rolling slabs to plate 1/4" to 1 1/4" thick. The 54" wide width was chosen to minimize welds and provide a box with low fabrication cost.

Advantages of casting a thicker slab include:

- smaller and more economical size reheat furnace
- less scaling and higher yield
- slabs will hold more heat allowing heat recovery from the cast and allow longer working time within the rolling mill

The cut-to-length slabs will then be conveyed by roller table to the hot mill reheat furnace or conveyed to a reject transfer bed for cooling.

Located at one end of the melt shop building will be the slab reheat furnace of the pusher type, designed for end charging and end discharging. The reheat furnace will have radiant type, natural gas fired, roof mounted burners complete with recuperator, waste gas system, valves, regulators and controls designed to heat up approximately 30 tons of slabs to a rolling temperature of 2200°F in 50 minutes. The slabs will be removed individually from the furnace by extractor arms and placed on the rolling mill tables in the mill building.

The rolling mill building will be approximately 570'-0" long, 56'-0" wide and 39'-0" high to bottom of roof chord. The building will house a single reversing rolling mill stand, runout tables, plate shear and leveller arranged as shown on drawing 3229-9004. The equipment will be serviced by one 30/10 ton E.O.T. crane. The crane rail elevation will be located approximately 30'-0" above floor level with a rail span of 60'-0". The plates rolled on the mill will be side discharged from the mill tables onto a 25'-0" wide x 60'-0" long cooling bed. Adjacent to the mill building will be a building structure arranged to receive finished plate from the cooling bed for fabrication into boxes. The building will be 420'-0" long, 80'-0" wide and 39'-0" high to bottom of roof chord. The area will be serviced by one 20/10 ton capacity E.O.T. crane, and one 10 ton pendant operated crane in the fabrication area.

In this building a shearing line with cold leveller and a punch press facility will be provided for prefabricating the plate products. Beyond this, eight fitting and welding stations are provided for assembling thirty-two 1500 lb. steel boxes every 8 hours. Box products from the fabrication aisle will be placed in storage near truck access at one end of the building for shipping. The fabrication facilities will operate on a three shift per day schedule, five days per week.

In addition to the equipment and facilities identified above, the necessary auxiliary equipment and indirect production facilities have been included.

The indirect production facilities for the electric furnace and caster which have been provided include:

A. One Office Building with facilities for management, administration, accounting, engineering, health physics, personnel and training.

B. One Melt Shop Service Building with facilities which include locker room, lunchroom, storeroom and maintenance.

C. One Metallurgical and Quality Control Laboratory with facilities which include wet chemical analysis, spectrographic analysis and sample preparation room.

D. Miscellaneous other buildings; gate guard house and electrical control rooms, substations, water treatment, and air pollution buildings.

The indirect production facilities for the rolling mill and fabrication department which have been provided include:

A. One Mill Motor Room, approximately 90'-0" long by 80'-0" wide.

B. One Roll and Maintenance Shop, approximately 210'-0" long by 20'-0" wide serviced by two jib cranes.

C. One two story Washer and Locker Room approximately 90'-0" long by 40'-0" wide.

A Communications System will be provided for the following areas:

A. Mill Crane Operator (1 Station)
B. Bar Mill Floor Operator (5 Stations)
C. Melt Shop Crane Operators (4 Stations)
D. Melt Shop Floor Stations (6 Stations)

This will be a unitized audio system with all cranes and all floor stations using the same paging circuit. The system will be a combination of unitized audio stations and trolley phones on the cranes. This system is basically a two channel operation. The operator will page all stations on the system by depressing the page button and speaking his message. This message is broadcasted over all system speakers. When the called party picks up his handset this ties the two stations together via the party line.

ALPHA ENGINEERS, INC.
STUDY
CENTERLINE PROJECT NO. CL-3229

EQUIPMENT LIST

1. One - 33.3 ton nominal capacity electric furnace with 20 MVA transformer - 12'-6" diameter, heat time about 2.4 hours for ASTM 304L stainless steel.
   Furnace Rate 12.5 TPH; 3 Heats/Turn
   Annual Capacity; One Turn, 5 Days/Wk. = 25000 Tons
   Annual Capacity; Two Turns, 5 Days/Wk. = 50000 Tons

2. Four - 790 Cu.Ft. capacity claim shell charging buckets/bails approximately 10'-3" dia. x 10'-3" high.

3. Two - 50 ton capacity flat bed charging bucket transfer cars.

4. Five - 35 ton hot metal ladles - about 7'-6" top dia. x 7'-9" high.

5. Three - 35 ton capacity ladle bails for above ladles.

6. One - Melt shop baghouse with supplemental HEPA Filters for electric furnace and fugitive emissions evacuation, about 600000 ACFM @ 275°F.

7. One - 4" x 54" straight mold slab caster for 35 ton ladles; for 9 ft. to 20 ft. long slabs - approximate radius 16'-0" withdrawal section.

8. One - 25TPH slab holding pusher furnace with extractor.
   Capacity: Six 54" x 4" x 20'-0 long slabs.
   Approximate rate 36,000,000 BTU/Hr.

9. One - 32" dia. x 56" reversing mill with about 8000 H.P. drive for rolling 4" slabs into ¼" plate. Rolling rate about 25 TPH. Max output speed about 1000 FPM. Equipped with 30'-0" long front and back tables with adjustable side guides.

10. One - 56" wide ingoing mill roller table from the slab holding furnace with high pressure hydraulic descale box. About 135'-0" lg. table.

11. One - 56" wide mill delivery roller table about 175'-0" long with parting shear and gauge for cutting up to 25'-0" long plates to length.

12. One - 56" wide hot eleven roll leveller with pinch rolls and backup rolls, mounted on 150'-0" of adjustable speed leveller table with end stop; for levelling 25'-0" long 304L stainless steel plates at ambient temperature up to 1800° Fahrenheit.

13. One - 25'-0" wide x 60'-0" long cooling bed for handling up to 4'-6" wide x 25'-0" long plates at a rate of 25 TPH. Thickness range - ¼" to 1¼", maximum transfer velocity 30 FPM, incoming temperature 1800°F; cooled temperature 400°F.

14. One - 56" wide cooling bed exit roller table about 66'-0" long.

15. One - 20 ton capacity plate piler for handling up to ¼" to 1¼" thick x 56" x 25'-0" lg. plates in lifts up to 10" in thickness.

16. One - 65/15 ton hot metal crane x 75'-0" span with 75'-0" lift. 8 to 1 safety factor on cables. Hoist speed of 20 FPM preferred.

17. One - 40/10 ton charging crane x 75'-0" span with 75'-0" lift. 8 to 1 safety factor on cable. Hoist speed of 25 FPM preferred.

18. Two - 15/5 ton scrap yard cranes x 75'-0" span with 30'-0" lift. 5 to 1 safety factor on cable. Hoist speed of 60 FPM preferred.

19. One - 30/10 ton mill crane x 60'-0" span with 30'-0" lift. 5 to 1 safety factor on cables. Hoist speed of 25 FPM preferred.

20. One - 20/10 ton plate handling crane x 75'-0" span with 30'-0" lift. 5 to 1 safety factor on cables. Hoist speed of 40 FPM preferred.

21. One - 10 ton pendent operated plate handling crane x 75'-0" span with 30'-0" lift. 5 to 1 safety factor on cables. Hoist speed of 40 FPM preferred.

22. Eight - 5 ton jib cranes with 30'-0" boom.

23. Six - Miscellaneous jib cranes.

24. One - 54" x 25'-0" cold depiler.

25. One - 56" cold leveller with pinch rolls and backup rolls for up to ½" plate.

26. One - 60" x ½" plate shear.

27. One - 120" x ½" plate shear.

28. One - Lot 56" shear line roller table x 120'-0" long with 120" caster bed and four plate kickoffs.

29. One - 300 ton punch press with 54" x 78" bed.

30. One - 150 ton punch press with 18" x 96" bed.

31. One - Lot 56" assembly roller table x 30'-0" long.

32. Eight - Welding stations with dual head robotic manipulators.

33. Two - Tundish preheat stations.

34. Two - Ladle preheat stations.

35. Two - Ladle reline stations.

36. One - Roll grinder.

37. One - Roll Lathe.

38. One - Lot miscellaneous machine tools.

39. Two - 20 ton capacity slag pot cars.

40. Five - 130 Cu. Ft. slag pots.

ROLLING MILL REQUIREMENTS /CALCULATIONS

66000 Lb. Heats Into 4" x 54" Slabs (216 Sq. In. or 725 Lb/Ft.)

Casting Length = (66000 Lb)
(.283 Lb./IN^3)(216/IN^2) = 1079" = 89.98'-0" Lg. = Le

Rolled Length = L_R
L_R= 1/4" PL (1104) 4/.25 = 17264" = 1438'-0" = 57 PLs @ 25'
L_R= 1/2" PL (1104) 4/.5 = 8632" = 719'-0" - 28 PL @ 25'
L_R= 3/4" PL (1104) 4/.75 - 5754" = 419'-8" = 19 PL @ 25'
L_R= 1" PL (1104) 4/1 = 4316" = 359'-0" = 14 PL @ 25'
L_R= 1 1/4" (1104) 4/1.25 = 3452" = 287" = 11 PL @ 25'

If Mill Table Capacity is 6 Pls @ 25' or 150'-0"

Total Slab Length Per Rolling = L_S
L_S 1/4" PL 150 x .25/4 = 9.375' = 1 Slab @ 9.375'
L_S 1/2" PL 150 x .5/4 = 18.75' = 1 Slab @ 18.75'
L_S 3/4" PL 150 x .75/4 = 28.125' = 2 Slabs @ 14.06
L_S 1" PL 150 x 1/4 = 37.5' = 2 Slabs @ 18.75'
L_S 1 1/4 PL 150 x 1.25/4 = 46.875' = 3 Slabs @ 15.62'

Reheat Furnace Slabs Required Per Heat = N_S
N_S 1/4" PL 92' Total Lg. ÷ 9.375 = 10 Slabs/Heat
N_S 1/2" PL 92' Total Lg. ÷ 18.75 - 5 Slabs/Heat
N_S 3/4" PL 92' Total Lg. ÷ 14.06 = 6 Slabs/Heat
N_S 1" PL 92' Total Lg. ÷ 18.75 = 5 Slabs/Heat
N_S 1 1/4" PL 92' Total Lg. ÷ 15.62 = 6 Slabs/Heat

Max. Hearth Capacity of Fce. 10 Slabs, 4.5' Wide x 9.375' Lg.
Use Pusher Fce Hearth 22'-0" Wide x 25'-0" Lg.
Set Fce Tables 35'-0" Center to Center
Cooling Bed Requirement/Rolling
1/4" PL 6 PLs x (4.5' + 1')(25) = 825 Sq. Ft. x 10 Rollings/Heat = 8700 Sq. Ft.
1/2" PL 6 PLs x (4.5' + 1')(25) = 825 Sq. Ft. x 5 Rollings/Heat = 4125 Sq. Ft.
3/4" PL 3 PLs x (4.5' + 1')(25) = 412 Sq. Ft. x 6 Rollings/Heat = 2475 Sq. Ft.
1" PL 3 PLs x (4.5' + 1')(25) = 412" x 5 Rollings/Heat = 2060 Sq. Ft.
1 1/4" PL 2 Pls x (4.5' + 1')(25) = 250" x 6 Rollings/Heat = 1500 Sq. Ft.
If Cooling Bed is 30'-0" wide x 80'-0" long table To table, bed capacity (effective Lg. = 60'-0") = 12 Pls @ 5' x 25'.
If Bed is designed for a max rate of clearing bed/15 Min, the clearing rate is one plate every 1.25 Min. and the ave. bed velocity is 60' ÷ 15 = 4 FPM.

The maximum temperature of the plates off the bed at maximum rolling rate of 12-54" x 1/4" PLs x 25'-0" every 15 min. (or 6.89 tons/.25 Hr. = 27.54 TPH) is 410°F if the plates enter the bed at 1800°F. Each 4" x 54" x 112.5" slab must be rolled in = 7.5 Min. to meet this requirement, which is the worst case.

PASS SCHEDULE

The rolling schedule could be as follows:

PASS	DEL. THK. (IN)	LENGTH (FT)	TOTAL ELONG	TEMP (°F)	DEL. VEL. (FPM)	MOTOR (H.P.)	PASS TIME (SEC)	DELAY TIME (SEC)	TOTAL TIME (SEC)
0	4.00"	9.375'		2200				30	
1	2.66"	14.125'	1.51	2150	600	10080	1.42	3	
2	1.77"	21.125'	2.25	2135	600	8060	2.12	3	
3	1.18"	31.625'	3.37	2110	600	6310	3.17	3	
4	.79"	47.625'	5.08	2050	600	5260	4.77	3	
5	.52"	71.500'	7.63	1980	600	4170	7.15	3	
6	.35"	107.375'	11.45	1860	900	5430	7.16	3	
7	.25"	150.000'	16.00	1890	1000	5470	9.00		
DESCALING								30	
SHEARING 6 CUTS								180	
							34.79	258	293
									or 4.9 Min.

If this passwork were reduced to maintain, say 6000 H.P. Level, the mill could still roll and cool 25 TPH of all sizes as follows:

<u>COOLING BED</u>

THICKNESS (IN.)	NO. PASSES	BED CAPACITY (TONS) (60' X 25' X 80% = 1200 SQ.)	TIME ON BED	FINAL TEMP. (INITIAL 1800°F)
1/4	9	1200 X .0051 T/FT^2 = 6.12	14.69 MIN.	410°F
1/2	7	1200 X .0102 T/FT^2 = 12.24	29.38 MIN.	400°F
3/4	7	1200 X .0153 T/FT^2 = 18.36	44.07 MIN.	420°F
1	5	1200 X .0204 T/FT^2 = 24.48	58.76 MIN.	400°F
1 1/4	5	1200 X .0255 T/FT^2 = 30.60	73.45 MIN.	380°F

BOX FABRICATION PLAN

1. **SHEARING**

Plate 1	2 Cuts @ 54"	=	108
2 Plate 2	4 Cuts @ 54"	=	216
2 Plate 2	2 Cuts @ 72"	=	144
Plate 3	2 Cuts @ 54"	=	108
Plate 3	1 Cut @ 96"	=	96
Plate 3	1 Cut @ 51"	=	51
Plate 3	1 Cut @ 3"	=	3
Plate 4	3 Cuts @ 54"	=	162
Plate 4	1 Cut @ 73"	=	73
Plate 4	1 Cut @ 5"	=	5
	--		----
	18 Cuts		966 Lin. In.

2. **PUNCHING**

LID

2 Rows of 7 Holes @ 9.5" = 57"
2 Rows of 5 Holes @ 13" = 52"
24 - 5/8" ∅

FLANGES

Sides - 2 Rows of 7 Holes @ 9.5" = 57"
Ends - 2 Rows of 5 Holes @ 13" = 52"
24 - 5/8" ∅

3. **WELDING**

A. **Corners** 4 Passes @ 51" - 204"

B. **Top Flanges**

4 Passes @ 3"	12"	
Sides 2 Passes @ 72"	144"	
Ends 2 Passes @ 48"	96"	
Corners 4 Passes @ 3"	12"	

		264"

B. **Bottom**

Sides 2 Passes @ 72"	144"	
Ends 2 Passes @ 48"	96"	

		240"

Total Length 708" @ 10"/Min. = 71 Min.

TIME STUDY

Electric Furnace Hot Metal 66,000 Lb./Heat
Box Yield From Hot Metal = 80%
48" x 51" x 72" x 1/4" Plate Box Weight = About 1500 Lb.
No. Boxes/Heat = $\frac{(66,000)\ (80\%)}{1500} = 35$

If Melt Shop Runs 3 Heats/Day and Boxes are Fabricated in 3 Turns/Day, Each Box must be produced in 1.83 Hours

Production Rate is 105 Boxes/Day

$\frac{105 \text{ Boxes/Day}}{8 \text{ Stations}} = 13.13$ Boxes/Station

$\frac{24 \text{ Hours/Day}}{13.13 \text{ Boxes/Station}} = 1.83$ Hours/Box

SHEARING (2 Men)

One 54" Shear	8 Cuts/15 Min.	1.875 Min. Cut/Hdlg.
One 96" Shear	6 Cuts/15 Min.	2.5 Min. Cut/Hdlg.

PUNCHING (1 Man)

24 Lid Holes - One Punch Mce. 4 Rows/15 Min. 5.00 Min./Gang/Hdlg.
24 Flanges Holes - One Punch Mce. 4 Rows/15 Min. 2.50 Min./Row/Hdlg.

LID/FLANGE ASSY./SCARF/WELD (2 Men)

12" Scarf - 12" Weld - 10 Bolts - Two Stations - 15 Min./Lid

FINAL ASSEMBLY/WELD 2 Torches/Station (16 Men)

Provide 8 Stations @ 120 Min./Box x 12 Boxes/Day Sta. = 96 Boxes
Side Welding - 102" Passwork ÷ 10"/Min. = 10.2 Min. + 8 Min. Starts = 18.2 Min.
Lid Welding - 108" Passwork ÷ 10"/Min. = 10.8 Min. + 8 Min. Starts = 18.8 Min.
Bottom Welding - 108" Passwork ÷ 10"/Min. = 10.8 Min. + 8 Min. Starts = 18.8 Min.
Welding Time 55.8 Min.

Side Assembly/Fitting 4 Moves @ 5 Min.	= 20 Min.
Lid Assembly/Fitting 1 Move @ 5 Min.	= 5 Min.
Bottom Assembly/Fitting 3 Moves @ 5 Min.	= 15 Min.
Inspection/Transfer	= 15 Min.
	--------
	55 Min.

Delay Time = 120 Min. Cycle - 55.8 - 55 = 9.2 Min.

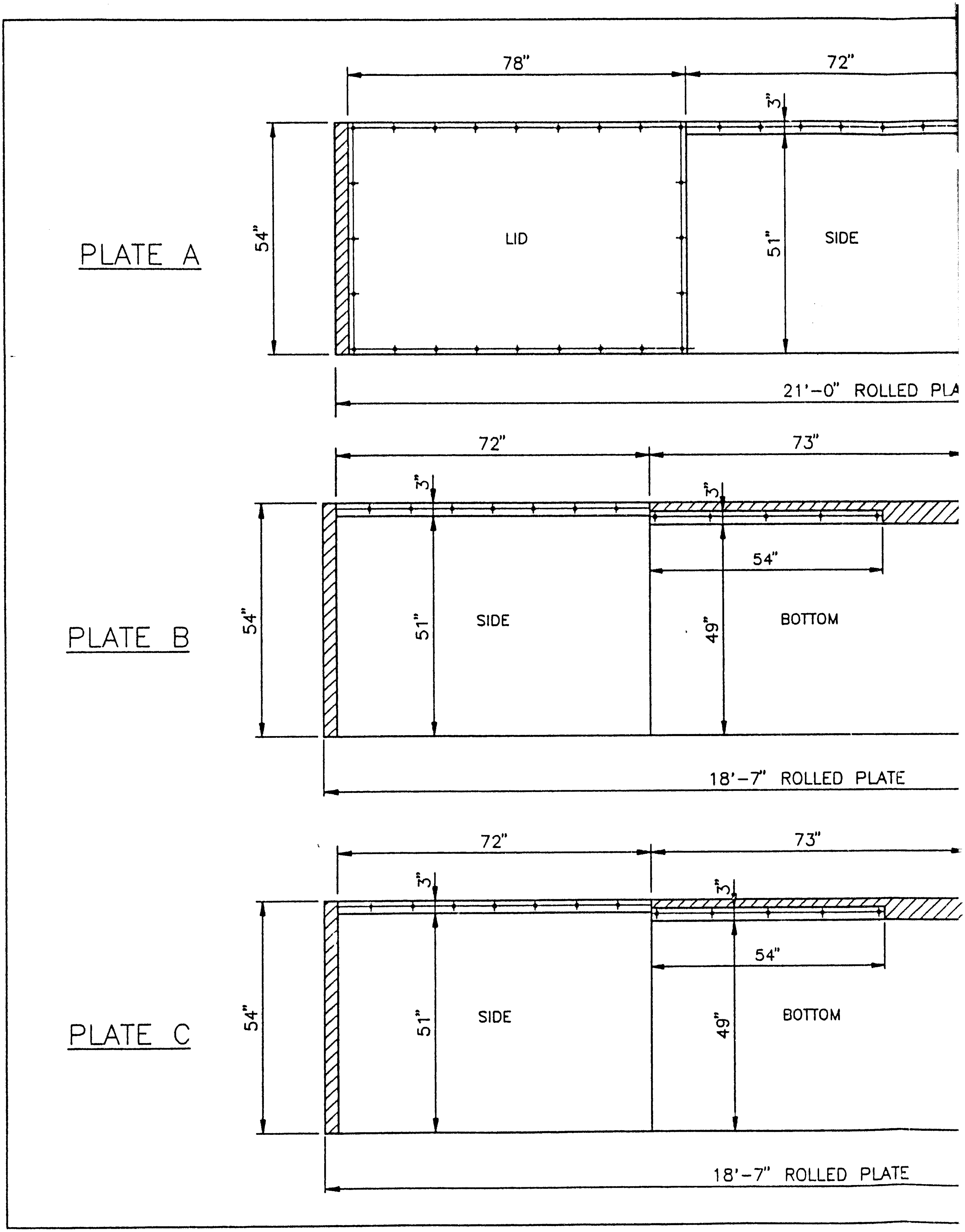
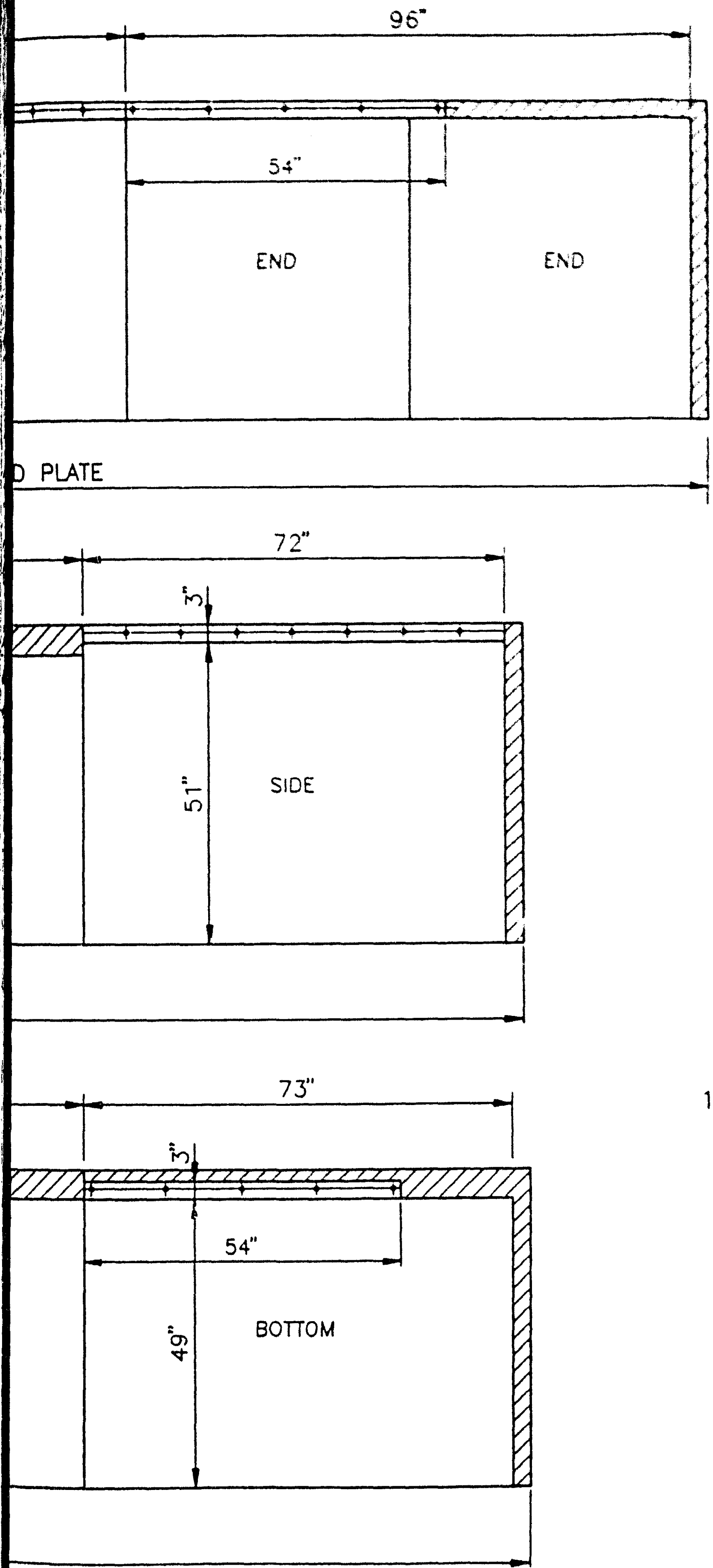


PLATE A
78"
72"
3"
54"
LID
51"
SIDE
21'-0" ROLLED PLA
PLATE B
72"
73"
3"
3"
54"
54"
51"
SIDE
49"
BOTTOM
18'-7" ROLLED PLATE
PLATE C
72"
73"
3"
3"
54"
54"
51"
SIDE
49"
BOTTOM
18'-7" ROLLED PLATE



NOTE:

3 PLATE A's, 1 PLATE B AND
1 PLATE C WILL MAKE 3 BOXES

INDICATES SCRAP

TESTING

It is anticipated that the inspection of the fabricated boxes will take place by an inspector at the eight welding stations in the Fabrication Department. Upon completion of welding on any box, the welders will remove the box from the welding station with the overhead hoist boom and set it aside for inspection. Inspection will comprise an air pressure test of the box for 10 minutes with a soap bubble test of all welds if necessary. Since all welds are external, manual repairs to the welds will be provided by the station welders till the boxes pass the 10 minute leak test. Testing air hoses will be provided at each welding station, and each box will be built containing a permanent air valve and fitting.

For this study it was assumed the boxes would be assembled with a non-flammable gasket between the box and the box flange. This gasket will be preassembled with the top flange and lid at the flange assembly station. All lid bolts will be torqued with each gasket in place. When the top flange is welded in place at the final welding station, the box assembly will be complete. With this procedure inspection, testing and approval stamping for each box should not exceed 30 minutes.

Coatings for carbon steel boxes was not included in this study.

OPTIMIZING THE HEAT SIZE FOR MAXIMUM YIELD

The yield off the Caster will be only 89% from hot metal because of the small size of the Furnace heats. The heat sizes should be optimized to produce an exact number of required plates to minimize end loss. Since we require 21'-0" and 18'-7" long 1/4" plates for boxes, the optimum length of slabs to be cast should be as follows:

Plate
A - 7 Plates @ 21' = 147' Pl. x .25"/4" x 9 Slabs/Cast = 82.69' Useable Slab 59,535 Lb

Cut Off Front/Tail Loss =	5.00' Loss	3,600 Lb
	87.69' Cast Length	63,135 Lb
Tundish Waste		3,758 Lb
59,535/.89 = Hot Metal Per Heat		66,893 Lb

Plate B
or C - 8 Plates @ 18.58' = 148.65' Pl x .25"/4" x 9 Slab/Cast = 83.61 Useable Slab 60,200 Lb

Cut Off Front/Tail Loss =	5.00 Loss	3,600 Lb
	88.61 Cast Length	63,800 Lb
Tundish Waste		3,840 Lb
60,200/.89 = Hot Metal Per Heat		67,640 Lb

The above calculations show that the nominal 33.3 ton Electric Furnace must produce 67,640 lbs of hot metal in some heats, which is practical for this equipment. In addition the Continuous Caster will cast 88.61 ft. long slabs. If the casting rate range is 60 to 110 inches per minute, the maximum casting time will be 88.61' x 12/60 IPM = 17.72 Min./Cast. Under these conditions the Caster cooling water would probably not be used for more than 45 minutes per cast. The Furnace cooling water, however, is normally left running continuously. The exhaust air system also operates continuously.

COOLING WATER REQUIREMENTS

The cooling water required for processing the steel will be of two types: Non Contact Water and Contact Water

The Non Contact Water will be contained in closed loops within the plant and will not be exposed to contaminated wastes. Outdoors it will be pumped from a Hot Well over a Cooling Tower where evaporation and drift will occur providing some blowdown. If additional blowdown is required, some water will be bled into the Contact Water loop as makeup water. All the Non Contact Water will be used for internal cooling of bustubes, ductwork, molds, machinery and platework. The following listing shows the estimated Non Contact Water requirements:

Electric Furnace Transformer/Cable	100 GPM
Electric Furnace Bustubes, Arms, Holders	250 GPM
Electric Furnace Fourth Hole	450 GPM
Electric Furnace Water Cooled Duct	800 GPM
Electric Furnace Roof	350 GPM
Electric Furnace Sidewall Panels	750 GPM
Electric Furnace Door	50 GPM
Hydraulic Systems	50 GPM
Caster Mold Cooling	2000 GPM
Caster Machinery Cooling	2000 GPM
Reheat Furnace Door Cooling	50 GPM

The Contact Water will be flushed over cast steel slabs, rolled plates, scale, hot machinery, and structures as well as 3000°F Electric Furnace dusts for cooling. This water will pick up scale, scrap, oil and debris which must be settled out in enclosed Scale Pits outside the buildings. The major portion of this hot water which is not evaporated enroute to the scale pits in flumes is recycled back through the plant for reuse. Flocculents and chemical treatments are induced into the water to make it suitable for reuse. The amount of fresh makeup water for Contact Water system is critical to keep the cleanliness to acceptable levels; and furthermore, all blowdowns will contain all the contaminants associated with the steel produced. Therefore, the blowdown stream must be evaporated in the quench tank facility through which the waste gases from the electric furnace pass for cooling ahead of the Baghouse. The estimated quantities of Contact Water are as follows:

Electric Furnace Quench Tank	140 GPM	
Caster Spray Water	1000 GPM	(Intermittent)
Caster Kerf and Scale Flush	1500 GPM	
Scale Breaker Water	500 GPM	(Intermittent)
Mill Roll Cooling	2000 GPM	
Mill Flume Flush	500 GPM	

FUME AND DUST COLLECTION-AIR HANDLING SYSTEM

The air handling system is shown in schematic form on drawing F-2 with major equipment shown on the facility plans. This system is based upon providing the following functions:

A. Fresh air and heat for workers in a year around operation

B. Control the spread of radioactive contamination to minimize the exposure to workers

C. Collect fumes and vapors near sources

D. Cool and filter exhaust gases to environmentally acceptable levels

E. Evaporation of waste process water and dust and slag encapsulation

To accomplish the above the air will be drawn into the various buildings from outside through gas fired air handling units with control dampers and electric powered fans. These units will be sized to supply sufficient fresh air year around and to heat the air to a minimum of 60 degrees F in the winter months. Control dampers in the units will be operated to maintain a negative static pressure inside the facility relative to barometric pressure outside the facility to ensure any contamination is retained inside the facility .

Inside the facility air will flow from radioactive clean areas to areas of increasing contamination levels to minimize the potential spread of contamination. The highest contamination levels are expected to be in the melt shop area. Fume and dust collection hoods will be located in areas where dust and fumes are generated such as the ladle and tundish preheat stations , slag pot cooling area, caster water pit , preheat furnace, rolling mill, caster mold area, and the electric furnace enclosure . Air from these collection hoods will be ducted to the furnace exhaust duct down stream of the quench tank to further cool the hot exhaust gases from the furnace. Preliminary design indicates that about 600,000 ACFM of exhaust air will be drawn into the gas cleaning system and discharged at a final temperature of 180°F.

The gas cleaning equipment will consist of a conventional reverse air baghouse followed by a nuclear grade double HEPA filter with pre-filter. This equipment will be located outside and adjacent to the melt shop to minimize duct lengths and reduce friction loses. A pre-filter is recommended to protect the HEPA filters from possible bag breakage in the baghouse. Multiple centrifugal fans will draw gasses through the filters and into a stack. An estimated 3000hp will be required to drive all the fans.

Vapor generated in the quench tank will mix with the furnace fumes and flow through the gas treatment system. It is estimated that 140 gpm of water can be disposed in this manner without adversely affecting the baghouse or HEPA filters with condensation. With an exhaust temperature of 180°F the humidity will not increase by more than 20% above entering relative humidity. Since it is not known where this facility will be located there may be reason for some concern regarding moisture in the gas stream if it is located in areas with higher humidity.

Dust from the baghouse will be conveyed from the bottom of the baghouse to a dust treatment facility located at the end of the baghouse . A location adjoining the baghouse is recommended for the dust and slag treatment facility to minimize handling and reduce the potential spread of contamination. In the treatment facility dust and fractured slag will be combined with cement and water in a pug mill to encapsulate the radioactive waste that is expected to be concentrated in these waste materials. This low grade concrete could then be poured into one of the boxes manufactured by this facility. It is estimated that one or two boxes per week will be needed for this purpose.

RECOMMENDED AREAS OF FURTHER STUDY

As the preliminary design and cost estimate were developed for this metal recycling facility a number of questions arose. Attempts were made to answer as many of the questions in the preliminary design as possible, however additional thought and research may be warranted for these and other questions listed below:

A. Scrap delivery, form, size, identification, contamination levels, quantity, etc. is not established. Information in this area is necessary to establish plant size, scrap handling methods, scrap containment and storage requirements.

B. Research data concerning the degree to which radioactivity will remain in the steel or concentrate in the slag. Information is needed to predict radiation levels in slag and metal for handling, shielding, personnel exposure and waste disposal.

C. Container sizes and number to be manufactured . The preliminary design is based upon one container size. Plant design cannot be optimized if the resulting products are not known.

D. Product material specifications are not established.

E. Codes which will be applied to container design and fabrication have not been completely identified. Lack of information affects the size of the fabrication facility, tools for fabrication , welding methods, testing and quality control.

ALPHA ENGINEERS INC.
STUDY CL-3229

PERSONNEL REQUIREMENTS

MAIN OFFICE (3600 SQUIRE FT.)

Plant Manager	1
Assistant Manager	1
Purchasing Agent	1
Plant Engineer	1
Electrical Engineer	1
Quality Control Manager	1
Metallurgist	1
Safety Engineer	1
Health Physicists	4 (3 truns)
Personnel Manager	1
Receptionist	1
Janitor	2
Guard	8 (3 Turns)
Shipping/Receiving Clerks	2 (2 Turns)
Secretaries	3
	--
	29 People (19 - 1st Turn)

MAINTENANCE/ROLL SHOP LOCKER ROOM (1600 SQ. FT.)

Foreman	1
Machinist/Roll Grinder	2
Bearing Assembler	2
Millwrights	4
Electricians	4
Instrument Man	1
Tool Room Support	1
	--
	15 People (One Turn)

MELT SHOP LOCKER ROOM (1600 SQ. FT.)

Superintendent	1
Foreman	1
Melters	2
Slag Man	1
Slide Gate Repairmen	1
Refractory Repairmen	2
Scrap Stockers	2
Scrap Yard Cranemen	2
Melt Shop Cranemen	1
Tractor Operator	1
Laborer	1
Lab Technician	1
	--
	16 People (1 Turn)

CASTER LOCKER ROOM (1000 SQ. FT.)

Foreman	1
Mold Operator	1
Ladlemen	2
Torch Table Operator	1
Tundish Repairmen	2
Caster Craneman	1
Tractor Operator	1
Mold Repairman	1
	--
	10 People (1 Turn)

HOT MILL LOCKER ROM (1100 SQ. FT.)

Superintendent	1
Foreman	1
Furnace Stocker	1
Craneman	1
Furnace Operator	1
Roller	1
Roller Helper	1
Shearman	1
Leveller Operator	1
Cooling Bed Operator	1
Marker	1
Piler Operator	1
	--
	12 People (1 Turn)

FABRICATION/SHIPPING (4500 SQ. FT.)

Turn Foreman	3
Plate Handling Craneman	3
Depiler/Leveller Operator	3
Shearmen	6
Punch Press Operator	3
Lid Assemblymen	6
Parts/Scrap Fork Truck Operators	6
Final Assemblymen/Welders	48
Box Handling Craneman	3
Inspection/Testing/Shipping Men	9
	--
	90 People (3 Turns)

PRELIMINARY ESTIMATE

100.0 Engineering & Construction Management

Engineering	$2,000,000
Site Management	800,000
Site Per Diem	200,000
Training	100,000

	$3,100,000

200.0 Site Prep & Yard Work

Soil Investigation	$ 20,000
Grading/Yardwork	300,000
Fencing	150,000
Paving	60,000
Roadways	150,000

	$ 680,000

300.0 Foundations

Building Foundations	$ 778,000
Floor Slabs	528,000
Melt Shop Foundations	570,000
Mill Foundations	1,047,000
Fabrication Equipment Foundations	130,000

	$3,053,000

400.0 Structural & Platework

Main Building Structures	$5,150,000
Major Facilities Structures	2,565,000
Main Building Roofing	427,000
Main Building Siding	572,000
Main Building Doors, Louver, Insulation	273,000

	$8,987,000

500.0 <u>Architectural Buildings</u>

Small Buildings

Transformer Vault	$ 72,000
Furnace Control Pulpit/Office	38,000
Caster Control Room	25,000
Furnace Hydraulic/MCC Room	30,000
Baghouse Control Room	36,000
Dust Processing	450,000
Outdoor Substation Control Room	12,000
Water Treatment Control Room	20,000
Met Lab	40,000
Receiving Office	12,000
Melt Shop/Caster Locker Room	192,000
Mill Office	306,000
Mill/Fab/Main Locker Rm	576,000
Maintenance Tool Crip	36,000
Machine Shop Enclosure	36,000
Roll Shop Enclosure	36,000
Mill Hydraulic/Lube Room	48,000
Furnace Maintenance Bldgs.	25,000
	$1,990,000

600.0 <u>Process and Auxiliary Equipment</u>

601 <u>HVAC</u>

Main Building Heating	$ 312,000
Small Bldg. HVAC	92,000
Dust Processing	150,000
	$ 554,000

602 <u>Cranes (Installed)</u>

2 - 15/5 Ton Scrap Yard Crane	$ 500,000
1 - 40/10 Ton Charging Crane	425,000
1 - 60/15 Ton Hot Metal Crane	450,000
1 - 30/10 Ton Mill Crane	350,000
1 - 20/10 Ton Plate Handling Crane	325,000
1 - 10 Ton Plate Handling Crane	220,000
8 - 5 Ton Fab Shop Jib Cranes x 30' Boom	120,000
6 - Miscellaneous Maintenance Jib Cranes	90,000
	$ 2,480,000

603 Process Equipment (Installed)

30 Ton Electric Furnace	$ 1,500,000
5 Slag Pots	100,000
4 Charging Buckets	120,000
5 Ladles	125,000
3 Ladle Bails	15,000
Mobile Scrap Shear	225,000
2 Slag Pot Cars	60,000
2 Scrap Transfer Cars	100,000
Melt Shop Baghouse (Used)	3,000,000
HEPA Filters (New)	6,000,000
I.D. Fans	300,000
Continuous Slab Caster	9,600,000
Slab Reheat Furnace	1,000,000
Reversing Hot Mill (Used)	15,000,000
Shearing Line	1,100,000
Lid Assembly Line	600,000
8 Box Assembly/Welding Stations	2,400,000
2 Ladle Preheat Stations	125,000
1 Tundish Preheat Station	100,000
2 Ladle Reline Stations	40,000
1 Roll Grinder (Used)	150,000
1 Roll Lathe (Used)	100,000
Miscellaneous Machine Tools	200,000
Cooling Towers	120,000
Scales (Used)	30,000
Refractory Gun	15,000
Tote Boxes	50,000
Mobile Equipment	400,000
Lab Equipment	120,000
Stack Monitoring Equipment	125,000
Air Compressors, etc.	60,000
Service Water Pumps, etc.	200,000
Instrumentation	220,000

	$43,400,000

700.0 Electrical

Main Substation	$ 825,000
13.8 KV and 4160 V Distribution	300,000
480 V Distribution	450,000
Collector Rail Systems	70,000
Main Building Lighting/Outlets	143,000
Grounding Loops	90,000
Communications	60,000
Miscellaneous Equipment	200,000

	$2,138,000

900.0 **Building Piping**

Natural Gas	$ 195,000
Compressed Air	$ 170,000
Oxygen Piping	$ 79,000
Potable Water	$ 68,000
Service Water	$ 483,000
Sanitary Sewers	$ 36,000
Storm Sewers	$ 125,000
	$ 1,156,000

ESTIMATE SUMMARY

100.0 Engineering & Construction Management	$ 3,100,000
200.0 Site Prep & Yard Work	$ 680,000
300.0 Foundations	$ 3,053,000
400.0 Structural & Platework	$ 8,987,000
500.0 Architectural Buildings	$ 1,990,000
600.0 Process & Auxiliary Equipment	
601 HVAC	$ 554,000
602 Cranes (Installed)	$ 2,480,000
603 Process Equipment (Installed)	$43,400,000
700.0 Substations and Building Electrical	$ 2,138,000
900.0 Building Piping	$ 1,156,000
TOTAL	$67,538,000

The above estimate is based upon used equipment available at this time. Cost will change if this equipment is taken off the equipment market. It is recommended that a contingency of 15-20% be added to the above cost until additional engineering is performed on this project.

ESTIMATED DIRECT PRODUCTION COSTS
Starting material - 26,900 T/Yr Scrap

MELT SHOP AND SCRAP YARD
(a) Yield - 93%
(b) Production - 25,000 T/YR of Hot Metal
(c) 5 shifts per week - 50 weeks per year
(d) Tap to tap time - 166 minutes, one 33 Ton capacity electric furnace

Metallics	Amount	Unit Cost Dollar	Cost Per Ton in $
Scrap	2,150 Lb/Ton	.05/Lb Delivery	107.50
Additives	25 Lbs/T		31.00
		Total Cost of Metallics	138.50
Cost Above			
Direct labor, Incl. Fringes	33,280 Hrs.	$30.00/Hr	39.94
Maintenance & Administration Labor	24,960 Hrs.	30.00/Hr	29.95
Furnace & Ladle Refractories			3.77
Operating Supplies/Tools/Misc.			5.07
Electrodes	10 Lb/T	1.50/Lb	15.00
Lime	80 Lb/T	0.031/Lb	2.48
Fluorspar	12 Lb/T	0.084/Lb	1.01
Oxygen	625 CF/T	0.61/100 CF	3.81
Electric Power (melting)	475 kwh/T	0.045/kwh	21.38
Electric Power (utilities)	40 kwh/	0.045/kwh	1.80
Natural Gas	0.4MM BTU/T	2.50/MM BTU	1.00
Water	450 Gal/T	0.46/1000 Gal	0.21
Air	600 CF/T	0.25/1000 CF	0.15
Slag Disposal			3.25
Baghouse Dust Disposal			5.00
		Total Cost Above	133.82
		Total Cost of Hot Metal	272.32

NOTE: Cost of scrap could be eliminated if contaminated scrap is received at no cost or a disposal charge is added by the facility.

Operating Personnel Classification	No. Per Shift	No. Per Week
Superintendent	1	1
Foreman	1	1
Heat Melter	1	1
First Melter	1	1
Slab Man	1	1
Slide Gate Repairman	1	1
Refractory Repairman	2	2
Stocker Scrap	2	2
Craneman Scrap Yard	2	2
Craneman Melt Shop	1	1
Tractor Operator	1	1
Laborer	1	1
Lab Technician	1	1
		Total 16

Total No. of Payroll Hours 16 x 2,080 = 33,280

PRODUCTION COSTS

CONTINUOUS CASTER

(a) Yield - 89%
(b) Production - 22,250 T/YR of Slabs
(c) 5 Shifts per week - 50 weeks per year
(d) One, 1 strand, 4" x 54" Slab Caster, Casting Speed 100 IPM

Metallics	Amount	Unit Cost Dollar	Cost Per Ton in $
Cost of Hot Metal			272.32
	Net Metallics Loss =	$272.32/0.89 - 272.32 =	33.66
Cost Above			
Production Labor	20,800 Hrs.	30.00/Hr	28.04
Maintenance & Administration Labor	16,640 Hrs.	30.00/Hr	22.44
Maintenance Materials			5.09
Refractories (Tundish) Etc.	15 Lb/T	0.30/Lb	4.50
Mold Replacement			2.75
Gates			1.35
Mold Lubricant			1.00
Temperature Control			0.50
Acetylene and Oxygen			1.71
Misc. Oil and Grease			0.95
Electric Power	73 kwh/T	0.045/kwh	3.29
Natural Gas	0.3/MM BTU/T	2.50/MM BTU	0.75
Water	1,500 Gal/T	0.46/1,000 Gal	0.69
Air	1,000 CF/T	0.25/1,000 CF	0.25
		Total Cost Above	$ 73.31
		Conversion Cost Per Ton	$106.97
		Total Slab Cost	$379,29

Operating Personnel Classification	No. Per Shift	No. Per Week
Foreman	1	1
Mold Operator	1	1
Ladlemen	2	2
Torch Table Operator	1	1
Tundish Repairman	2	2
Craneman	1	1
Tractor Operator	1	1
Mold Repairman	1	1
		Total 10

Total No. of Payroll Hours 10 x 2,080 = 20,800

REVERSING HOT PLATE MILL

(a) Yield - 94%
(b) Production - 20,915 T/YR of Hot Rolled Plate
(c) 5 Shifts per week - 50 weeks per year

Metallics	Amount	Dollar	Ton in $
Cost of Slabs			379.29
	Net Metallics Loss =	$379.29/0.94 - 379.29 =	24.21

Cost Above			
Production Labor, Incl. Fringes	24,960 Hrs.	30.00/Hr	35.80
Maintenance & Administrative Labor	29,120 Hrs.	30.00/Hr	41.77
Maintenance Material			7.96
Roll Replacement			7.00
Slab Furnace Relining			3.54
Operating Supplies/Tools/Misc.			7.08
Electric Power	100 kwh/T	0.045/kwh	4.50
Natural Gas	2.0 MM BTU/T	2.50/MM BTU	5.00
Water	3,000 Gal/T	0.46/1,000 Gal	1.38
Air			0.10
	Total Cost Above		$114.13
	Conversion Cost Per Ton		$138.30
	Total Cost of Hot Rolled Plate	$517.63	

Operating Personnel

Classification	No. Per Shift	No. Per Week
Superintendent	1	1
Foreman	1	1
Furnace Stocker	1	1
Craneman	1	1
Furnace Operator	1	1
Roller	1	1
Roller Helper	1	1
Shear Operator	1	1
Leveller Operator	1	1
Cooling Bed Operator	1	1
Marker	1	1
Piler Operator	1	1
		Total 12

Total No. of Payroll Hours 12 x 2,080 = 24,960

FABRICATION DEPARTMENT

(a) Yield - 95.5%
(b) Production - 20,000 T/YR of 48" X 72" X 51" High Boxes
(c) 15 Shifts per week - 50 weeks per year

Metallics	Amount	Dollar	Ton in $
Cost of Plate			517.63
	Net Metallics Loss =	$517.63/0.955 - 517.63 =	24.39

Cost Above			
Production Labor, Incl. Fringes	187,200 Hrs.	30.00/Hr	280.00
Maintenance & Administrative Labor	20,800 Hrs.	30.00/Hr	31.20
Maintenance Material			7.25
Welding Rod	9 Lb/T	5.50/Lb	49.50
Operating Supplies/Tools/Misc.			10.00
Electric Power	100 kwh/T	0.045/kwh	4.50
Natural Gas (Heating)	4.8 MM BTU/T	2.50/MM BTU	12.00
Air			0.25
	Total Cost Above		$394.70
	Conversion Cost Per Ton		$419.09
	Total Cost of Boxes		$936.72

Cost Per Box = $936.72/2000 Lb/Ton x 1500 Lb = $702.54 Per Box

Operating Personnel

Classification	No. Per Shift	No. Per Week
Turn Foreman	1	3
Plate Handling Craneman	1	3
Depiler/Leveller Operator	1	3
Shearmen	2	6
Punch Press Operator	1	3
Lid Assemblymen	2	6
Parts/Scrap Fork Truck Operators	2	6
Final Assemblymen/Welders	16	48
Box Handling Craneman	1	3
Inspection/Testing/Shipping Men	3	9
	Total	90

Total No. of Payroll Hours 90 x 2,080 = 187,200

INDIRECT LABOR PERSONNEL

Maintenance And Roll Shop

Classification	No. Per Shift	No. Per Week
Foreman	1	1
Machinist	1	1
Roll Grinder	1	1
Roll Bearing Assembler	2	2
Millwright	4	4
Electrician	4	4
Instrument Man	1	1
Tool Room Operator	1	1
		Total 15

Total Payroll Hours 15 x 2,080 = 31,200 Hrs/Year

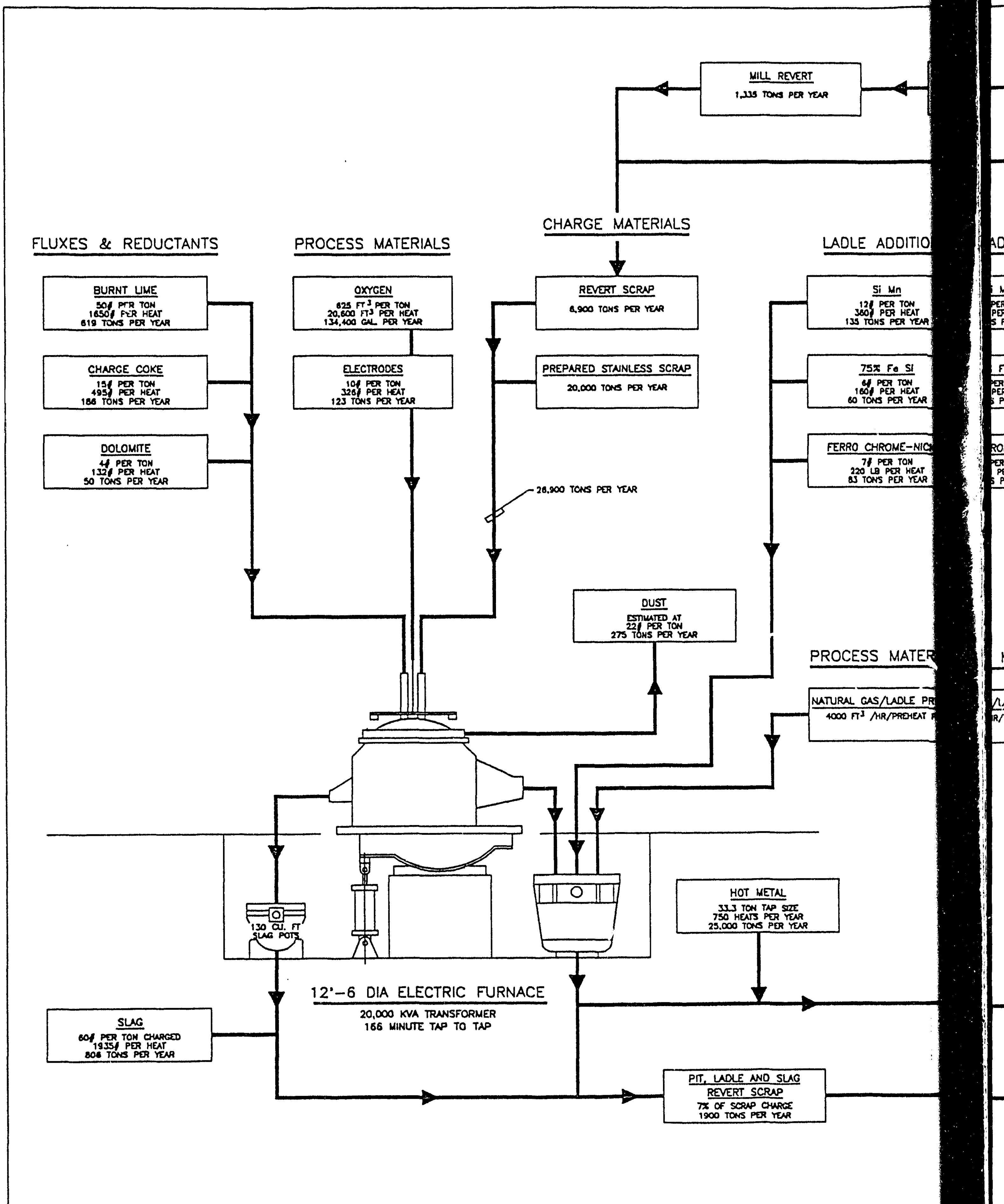
OFFICE AND ADMINISTRATION	No. Per Shift	No. Per Week
Plant Manager	1	1
Assistant Manager	1	1
Purchasing Agent	1	1
Plant Engineer	1	1
Electrical Engineer	1	1
Quality Control Manager	1	1
Metallurgist	1	1
Safety Engineer	1	1
Health Physicists	1	4
Personnel Manager	1	1
Receptionist	1	1
Janitor	1	2
Guard	2	8
Shipping/Receiving Clerks	1	2
Secretaries	3	3
	17	29

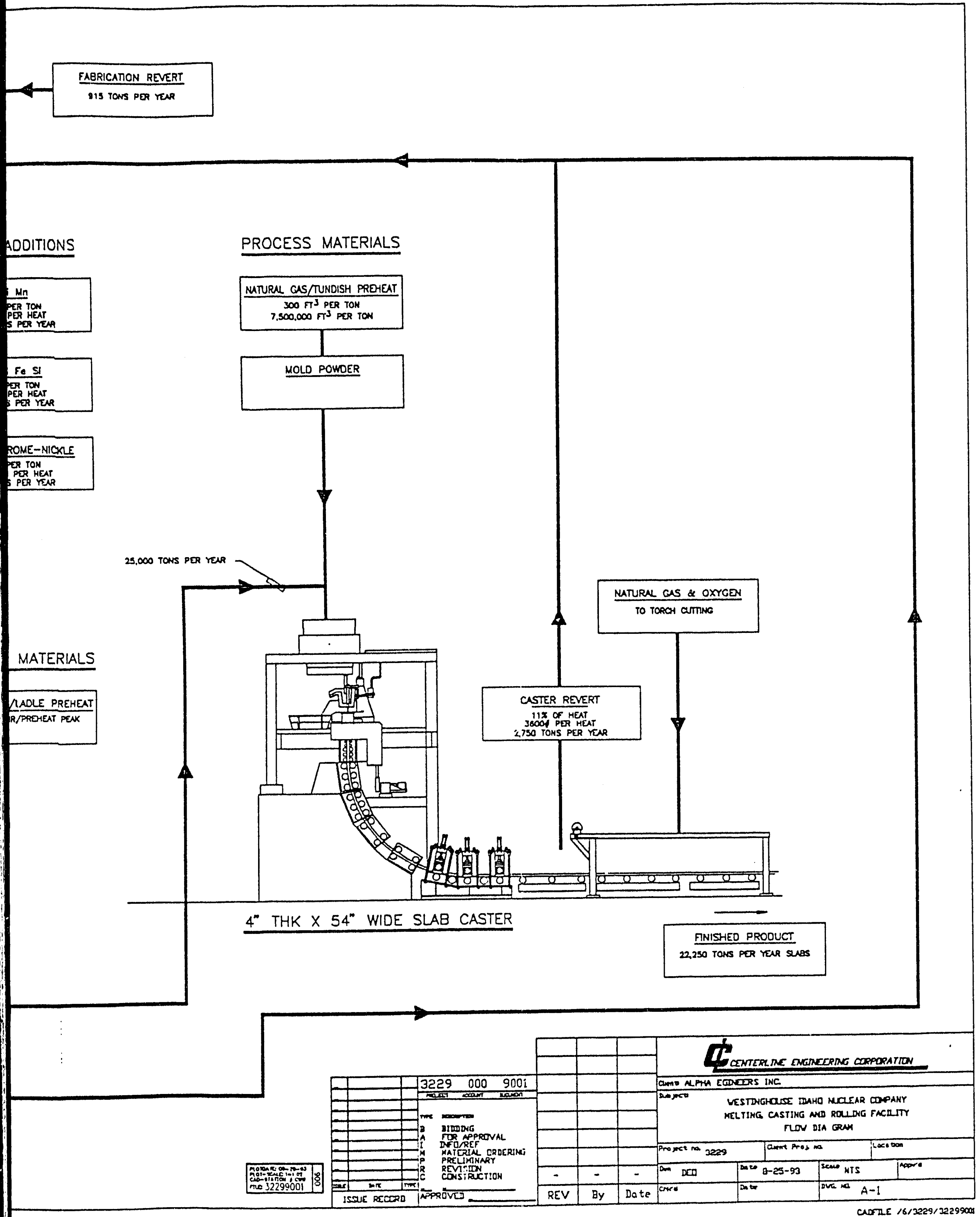
Total Payroll Hours 29 x 2080 = 60,320 Hrs/Year

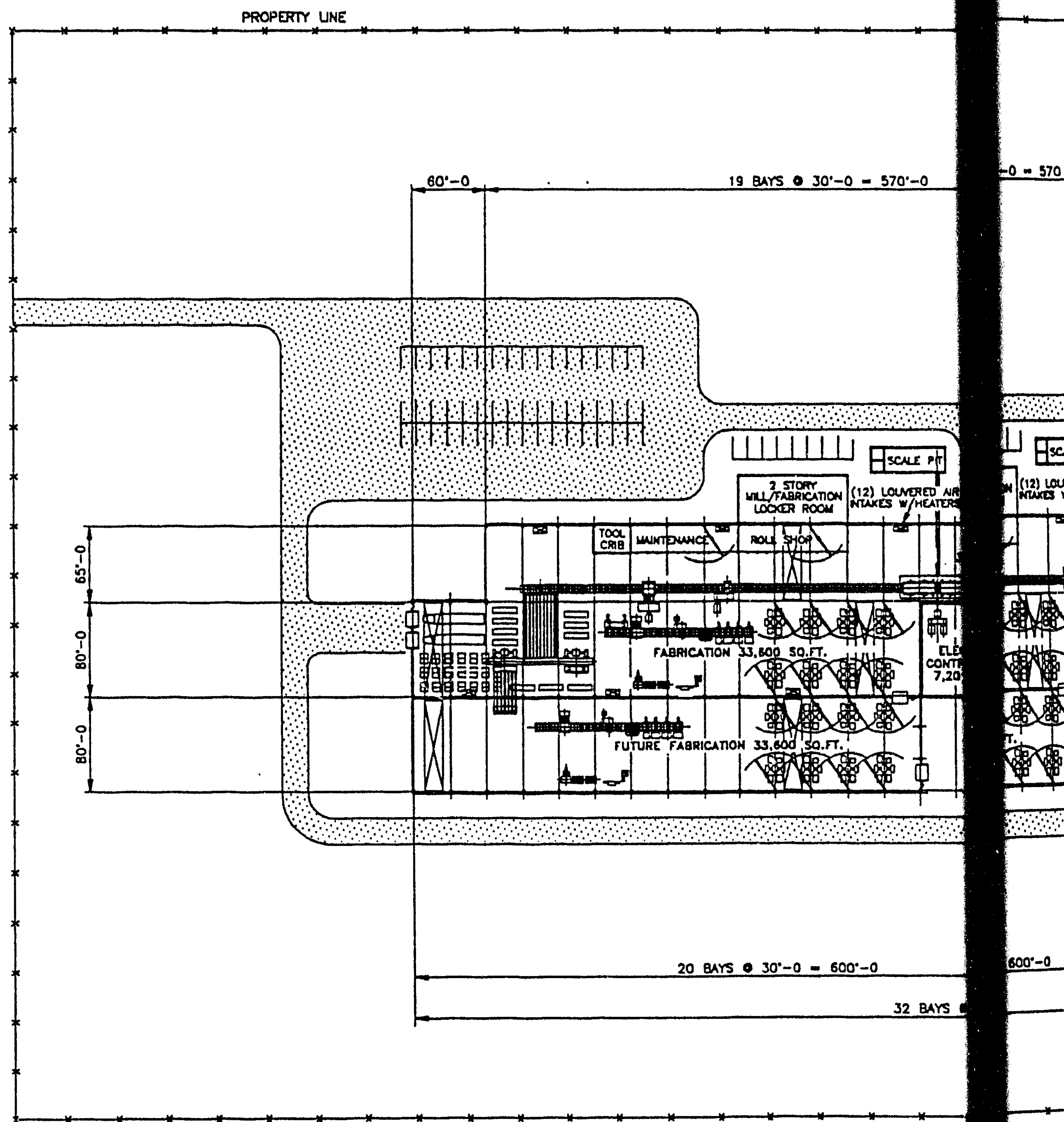
DISTRIBUTION OF INDIRECT LABOR HOURS BY OPERATING DEPARTMENT

31,200 Maintenance Hrs. + 60,320 Administration Hrs. = 91,520 Hrs/Year

OPERATING DEPARTMENTS	Percent	No. Personnel	Manhours
Melt Shop	28%	12	24,960
Continuous Caster	18%	8	16,640
Reversing Plate Mill	31%	14	29,120
Fabrication	23%	10	20,800
TOTAL	100%	44	91,520

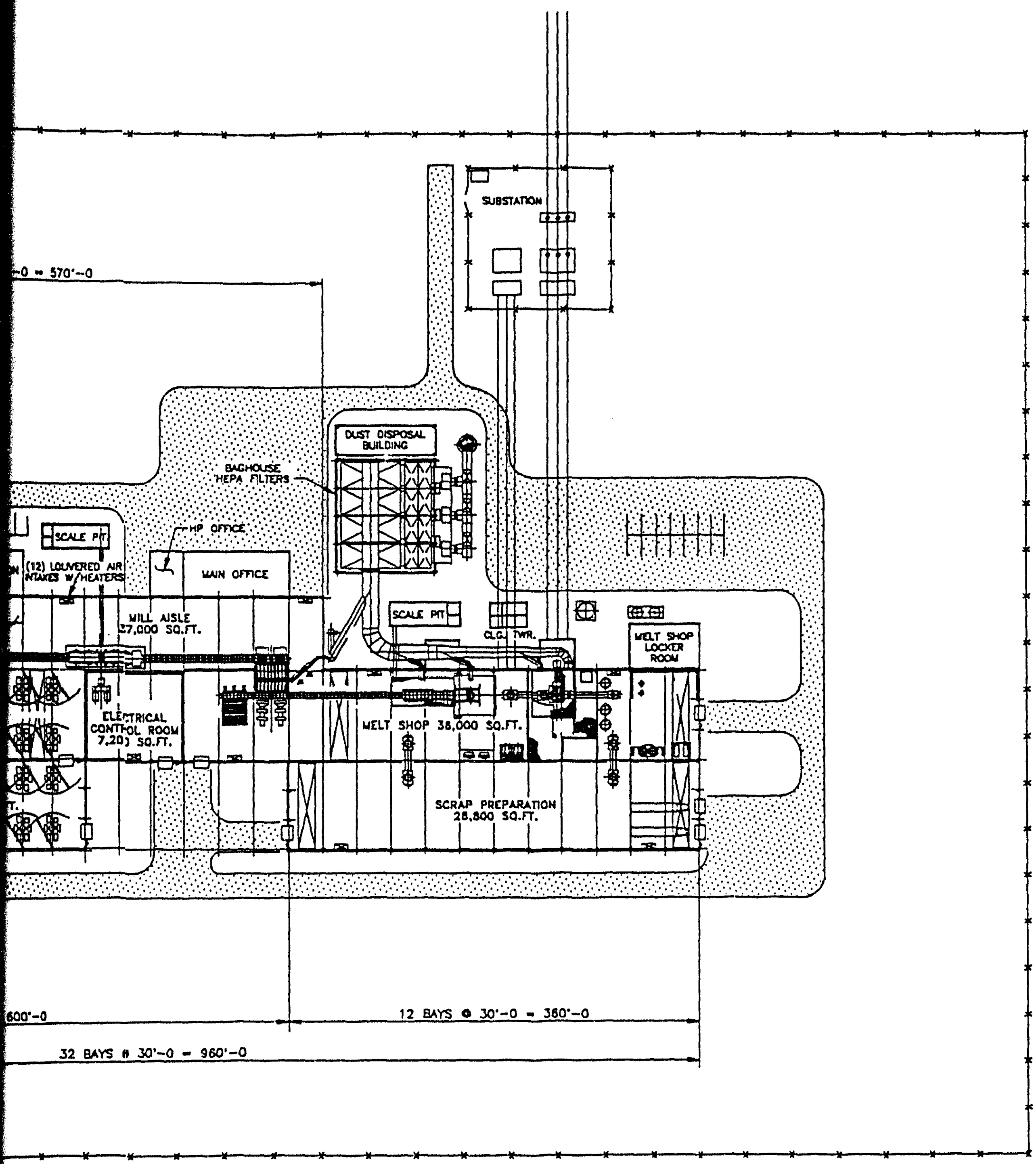

MILL REVERT
1,335 TONS PER YEAR
CHARGE MATERIALS
FLUXES & REDUCTANTS
PROCESS MATERIALS
BURNT LIME
50# PER TON
1650# PER HEAT
619 TONS PER YEAR
CHARGE COKE
15# PER TON
495# PER HEAT
186 TONS PER YEAR
DOLOMITE
4# PER TON
132# PER HEAT
50 TONS PER YEAR
OXYGEN
625 FT³ PER TON
20,600 FT³ PER HEAT
134,400 GAL. PER YEAR
ELECTRODES
10# PER TON
326# PER HEAT
123 TONS PER YEAR
REVERT SCRAP
6,900 TONS PER YEAR
PREPARED STAINLESS SCRAP
20,000 TONS PER YEAR
26,900 TONS PER YEAR
Si Mn
12# PER TON
360# PER HEAT
135 TONS PER YEAR
75% Fe Si
6# PER TON
160# PER HEAT
60 TONS PER YEAR
7# PER TON
220 LB PER HEAT
83 TONS PER YEAR
DUST
ESTIMATED AT
22# PER TON
275 TONS PER YEAR
4000 FT³ /HR/PREHEAT
130 CU. FT
SLAG POTS
HOT METAL
33.3 TON TAP SIZE
750 HEATS PER YEAR
25,000 TONS PER YEAR
12'-6 DIA ELECTRIC FURNACE
20,000 KVA TRANSFORMER
166 MINUTE TAP TO TAP
SLAG
60# PER TON CHARGED
1935# PER HEAT
806 TONS PER YEAR
PIT, LADLE AND SLAG
REVERT SCRAP
7% OF SCRAP CHARGE
1900 TONS PER YEAR


FABRICATION REVERT
915 TONS PER YEAR
ADDITIONS
Mn
PER TON
PER HEAT
S PER YEAR
Fe Si
PER TON
PER HEAT
S PER YEAR
ROME-NICKLE
PER TON
PER HEAT
S PER YEAR
PROCESS MATERIALS
NATURAL GAS/TUNDISH PREHEAT
300 FT3 PER TON
7,500,000 FT3 PER TON
MOLD POWDER
25,000 TONS PER YEAR
MATERIALS
/LADLE PREHEAT
R/PREHEAT PEAK
NATURAL GAS & OXYGEN
TO TORCH CUTTING
CASTER REVERT
11% OF HEAT
3600# PER HEAT
2,750 TONS PER YEAR
4" THK X 54" WIDE SLAB CASTER
FINISHED PRODUCT
22,250 TONS PER YEAR SLABS
CENTERLINE ENGINEERING CORPORATION
Client ALPHA EGINEERS INC.
Subject
WESTINGHOUSE IDAHO NUCLEAR COMPANY
MELTING, CASTING AND ROLLING FACILITY
FLOW DIA GRAM
3229 000 9001
PROJECT ACCOUNT
TYPE DESCRIPTION
B BIDDING
A FOR APPROVAL
I INFO/REF
M MATERIAL ORDERING
P PRELIMINARY
R REVISION
C CONSTRUCTION
APPROVED
ISSUE RECORD
DATE TYPE
REV By Date
Project no. 3229
Client Proj. no.
Location
Dwn DED
Date 8-25-93
Scale NTS
Chk'd
Date
DWG. NO. A-1
FILE 32299001
006
CADFILE /6/3229/32299001



MILL BUILDING TOTALS

SCRAP PREPARATION	28,800 SQ.FT.
MELT SHOP	36,000 SQ.FT.
MILL AISLE	37,000 SQ.FT.
FABRICATION	33,600 SQ.FT.
ELECTRICAL CONTROL ROOM	7,200 SQ.FT.
TOTAL:	142,600 SQ.FT.
FUTURE FABRICATION	33,600 SQ.FT.
TOTAL:	176,200 SQ.FT.



CENTERLINE ENGINEERING CORPORATION

Client: ALPHA ENGINEERS INC.

Subject: VESTINGHOUSE IDAHO NUCLEAR CO.
MELTING, CASTING AND ROLLING FACILITY
SMALL SCALE PLANT LAYOUT

Project no. 3229	Client Proj. no.	Location	
Dwn DED	Date 8-24-93	Scale 1"=60'	Appv'd
Chk'd	Date	Dwg. no. A-2	

3229 000 9002
PROJECT ACCOUNT DOCUMENT

TYPE DESCRIPTION
B BIDDING
A FOR APPROVAL
I INFO/REF
M MATERIAL ORDERING
P PRELIMINARY
R REVISION
C CONSTRUCTION

APPROVED

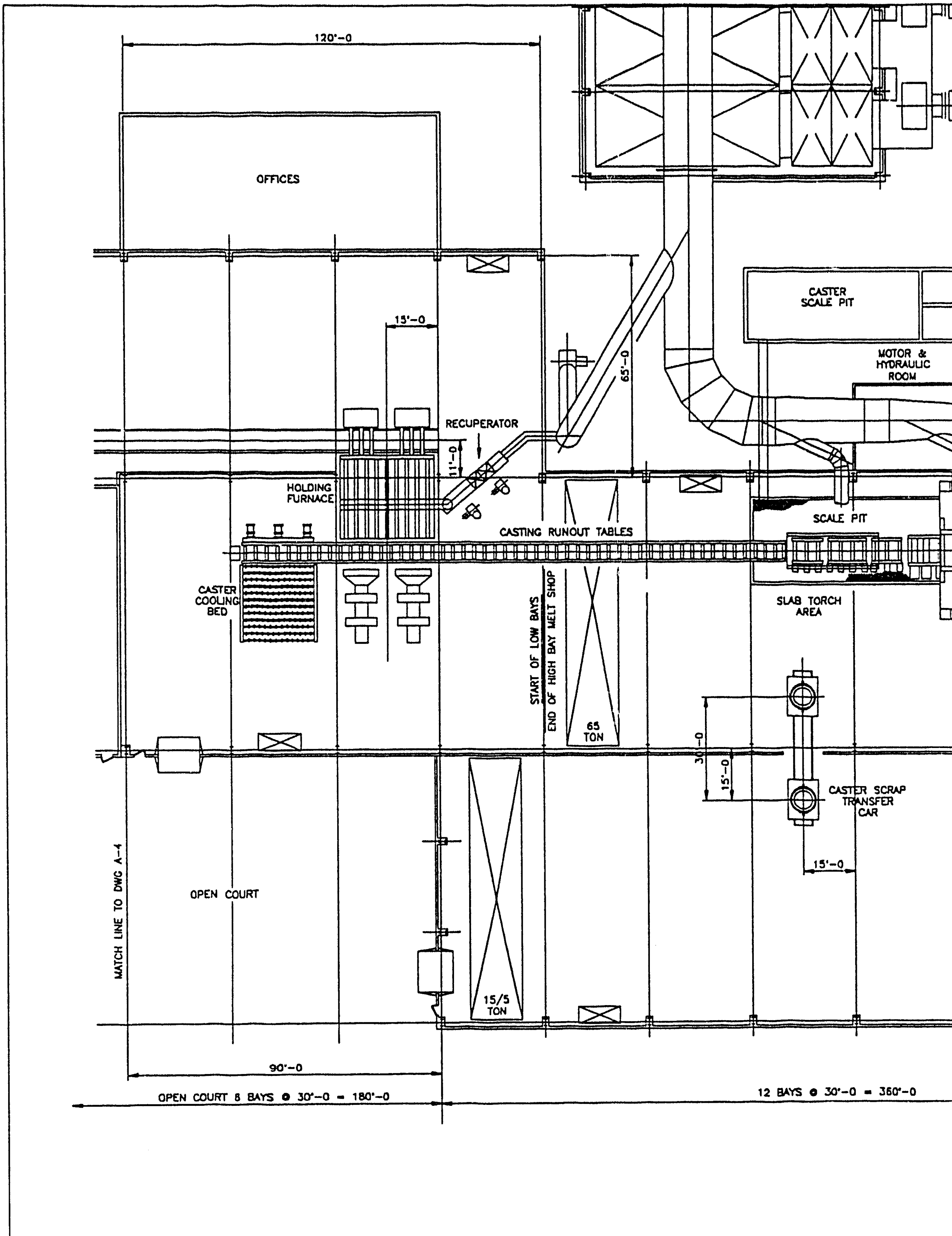
ISSUE RECORD

REV | By | Date
- | - | -

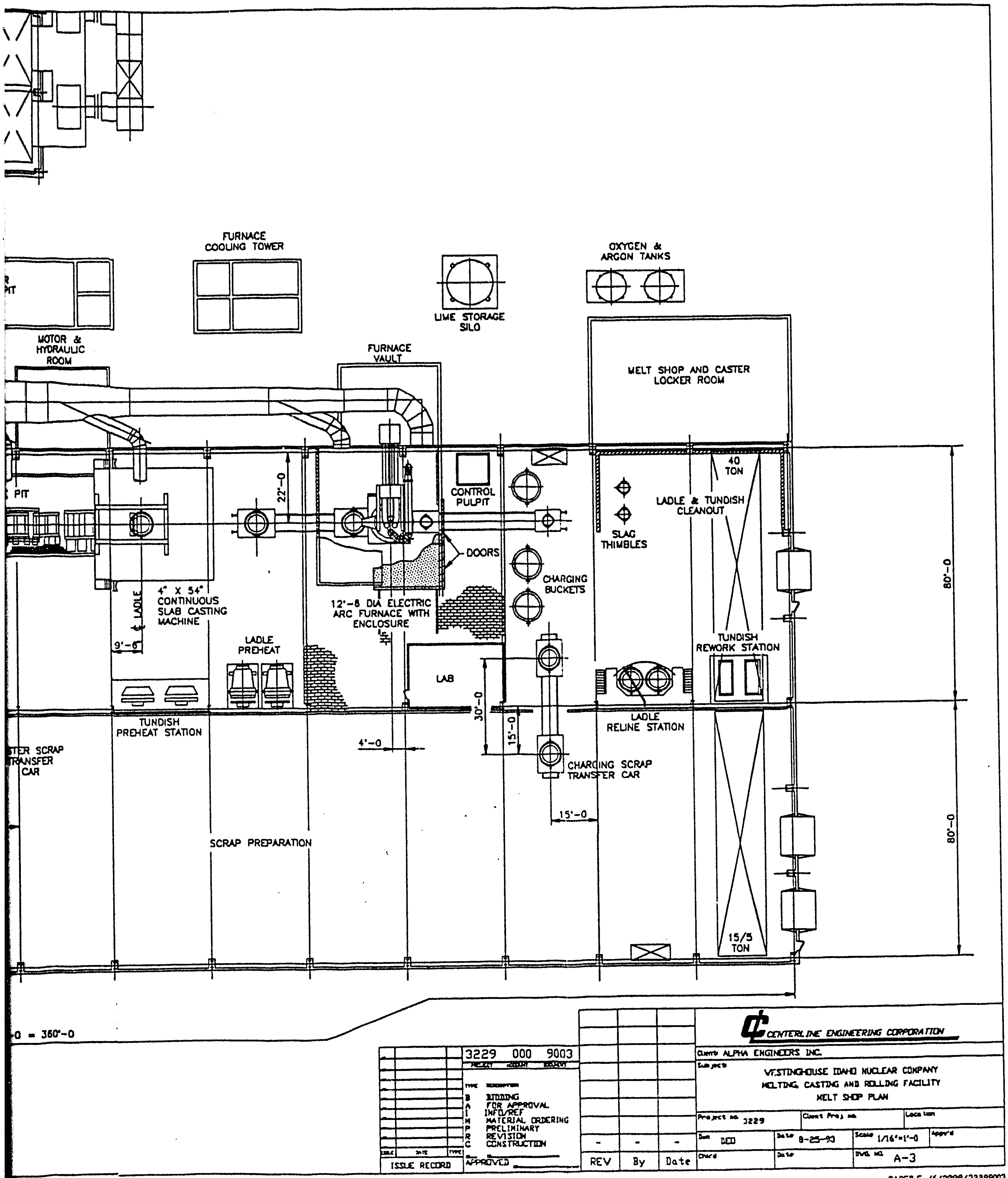
PLOTDATE: 09-29-93
PLOT-SCALE: 1=720.00
CAD-STATION # CWW
FILE: 32299002

005

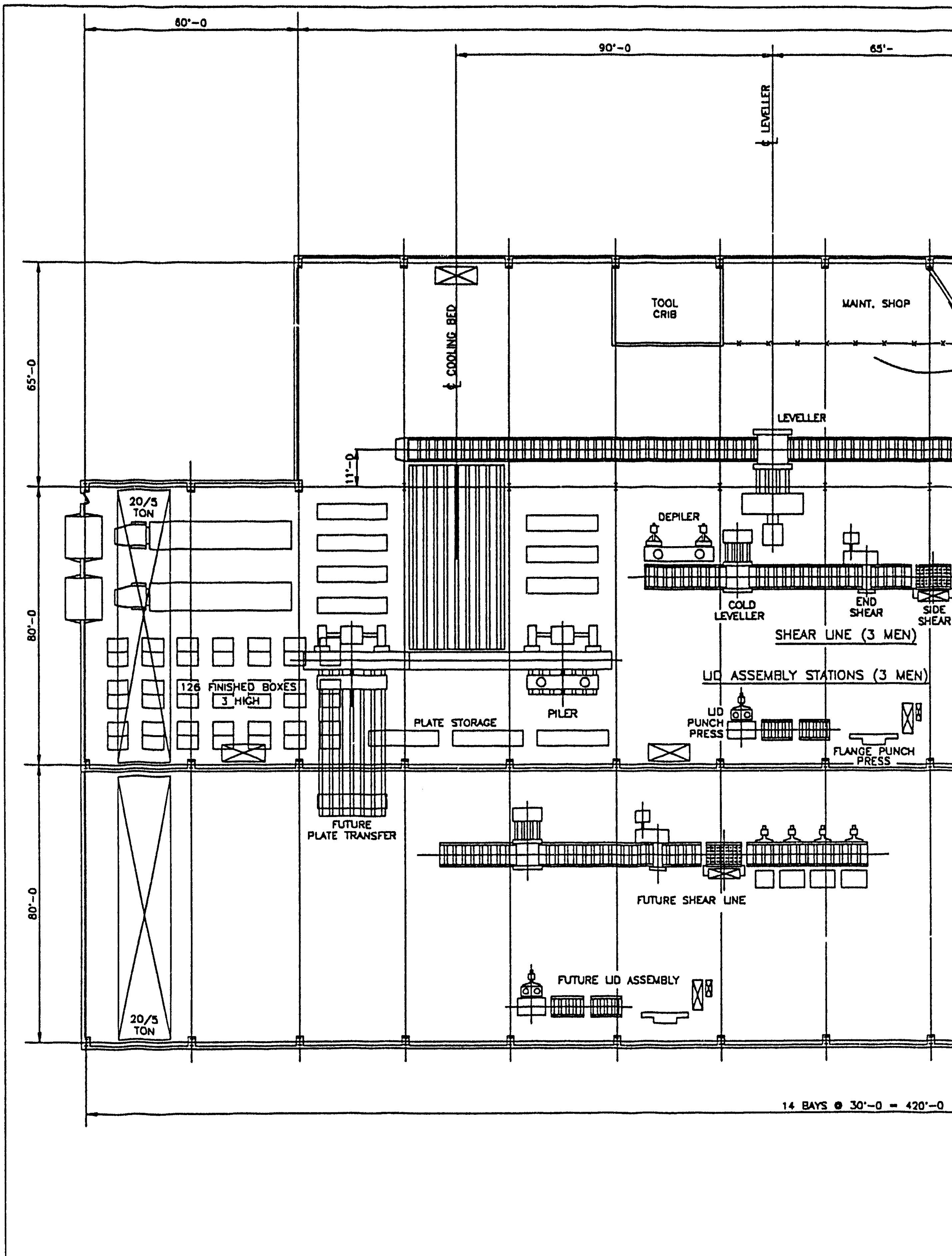
CADFILE /6/3229/32299002



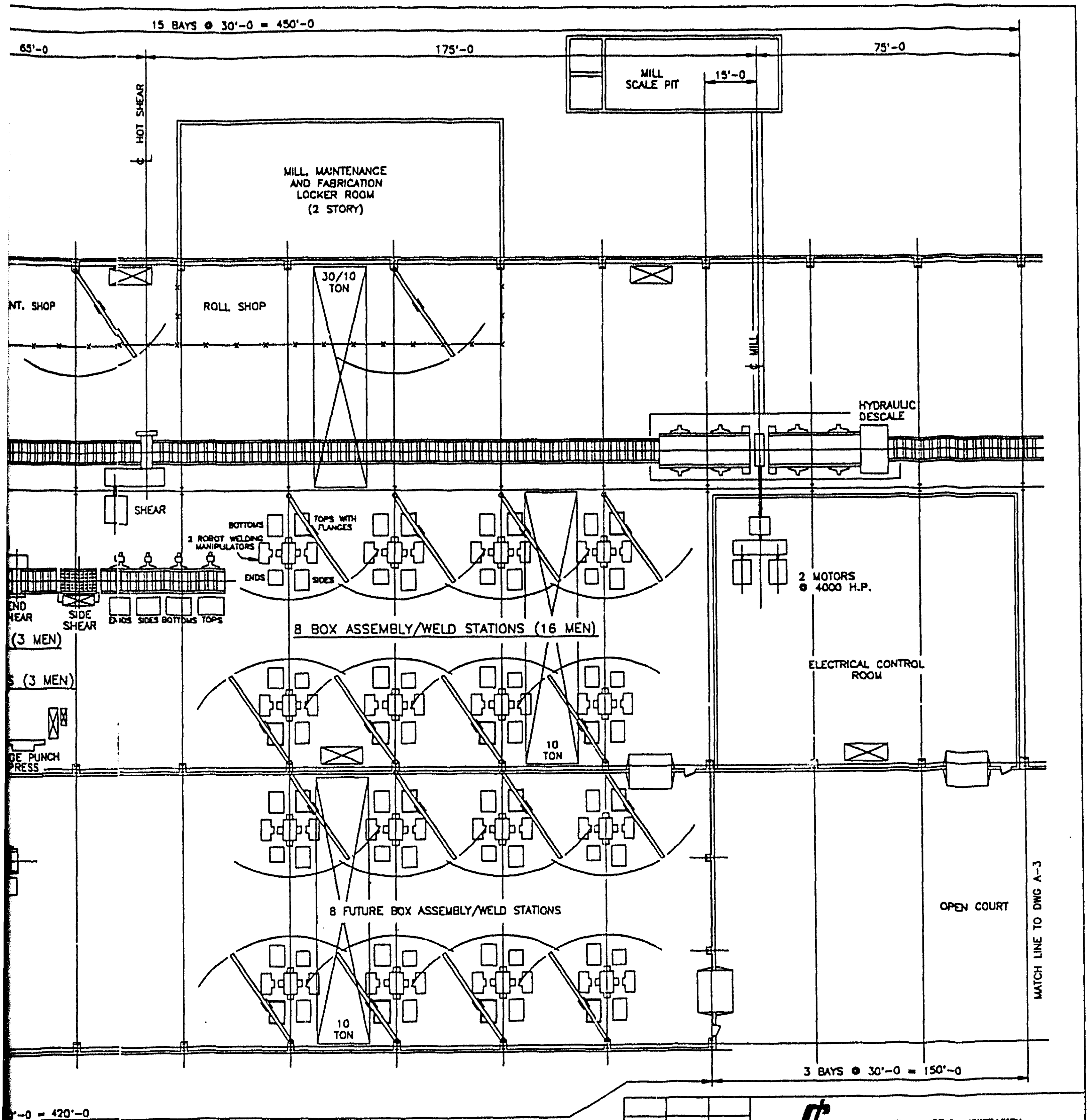
120'-0
OFFICES
15'-0
65'-0
RECUPERATOR
11'-0
HOLDING FURNACE
CASTING RUNOUT TABLES
CASTER SCALE PIT
MOTOR & HYDRAULIC ROOM
SCALE PIT
CASTER COOLING BED
START OF LOW BAYS
END OF HIGH BAY MELT SHOP
SLAB TORCH AREA
65 TON
30'-0
15'-0
CASTER SCRAP TRANSFER CAR
15'-0
MATCH LINE TO DWG A-4
OPEN COURT
15/5 TON
90'-0
OPEN COURT 8 BAYS @ 30'-0 = 180'-0
12 BAYS @ 30'-0 = 360'-0



FURNACE COOLING TOWER
OXYGEN & ARGON TANKS
LIME STORAGE SILO
MOTOR & HYDRAULIC ROOM
FURNACE VAULT
MELT SHOP AND CASTER LOCKER ROOM
PIT
22'-0
CONTROL PULPIT
40 TON
LADLE & TUNDISH CLEANOUT
SLAG THIMBLES
DOORS
80'-0
CHARGING BUCKETS
4" X 54" CONTINUOUS SLAB CASTING MACHINE
℄ LADLE
12'-8 DIA ELECTRIC ARC FURNACE WITH ENCLOSURE
9'-6
LADLE PREHEAT
LAB
TUNDISH REWORK STATION
30'-0
TUNDISH PREHEAT STATION
LADLE RELINE STATION
15'-0
4'-0
STER SCRAP TRANSFER CAR
CHARGING SCRAP TRANSFER CAR
15'-0
SCRAP PREPARATION
80'-0
15/5 TON
-0 = 360'-0
CENTERLINE ENGINEERING CORPORATION
Client ALPHA ENGINEERS INC.
Subject VESTINGHOUSE IDAHO NUCLEAR COMPANY
MELTING, CASTING AND ROLLING FACILITY
MELT SHOP PLAN
3229 000 9003
TYPE DESCRIPTION
B BIDDING
A FOR APPROVAL
I INFO/REF
M MATERIAL ORDERING
P PRELIMINARY
R REVISION
C CONSTRUCTION
ISSUE RECORD
APPROVED
REV By Date
Project no. 3229
Client Proj no.
Location
Dwn DED
Date 8-25-93
Scale 1/16"=1'-0
Appv'd
Chk'd
Date
DWG. NO. A-3
CADFILE /6/3229/32299003



80'-0
90'-0
65'-
℄ LEVELLER
TOOL CRIB
MAINT. SHOP
℄ COOLING BED
65'-0
LEVELLER
11'-0
20/5 TON
DEPILER
COLD LEVELLER
END SHEAR
SIDE SHEAR
SHEAR LINE (3 MEN)
80'-0
126 FINISHED BOXES 3 HIGH
LID ASSEMBLY STATIONS (3 MEN)
LID PUNCH PRESS
PILER
PLATE STORAGE
FLANGE PUNCH PRESS
FUTURE PLATE TRANSFER
FUTURE SHEAR LINE
80'-0
FUTURE LID ASSEMBLY
20/5 TON
14 BAYS @ 30'-0 = 420'-0



CENTERLINE ENGINEERING CORPORATION

3229 000 9004

PROJECT ACCOUNT DOCUMENT

TYPE	DESCRIPTION
B	BIDDING
A	FOR APPROVAL
I	INFO/REF
M	MATERIAL ORDERING
P	PRELIMINARY
R	REVISION
C	CONSTRUCTION

ISSUE RECORD — ISSUE DATE TYPE

APPROVED ______

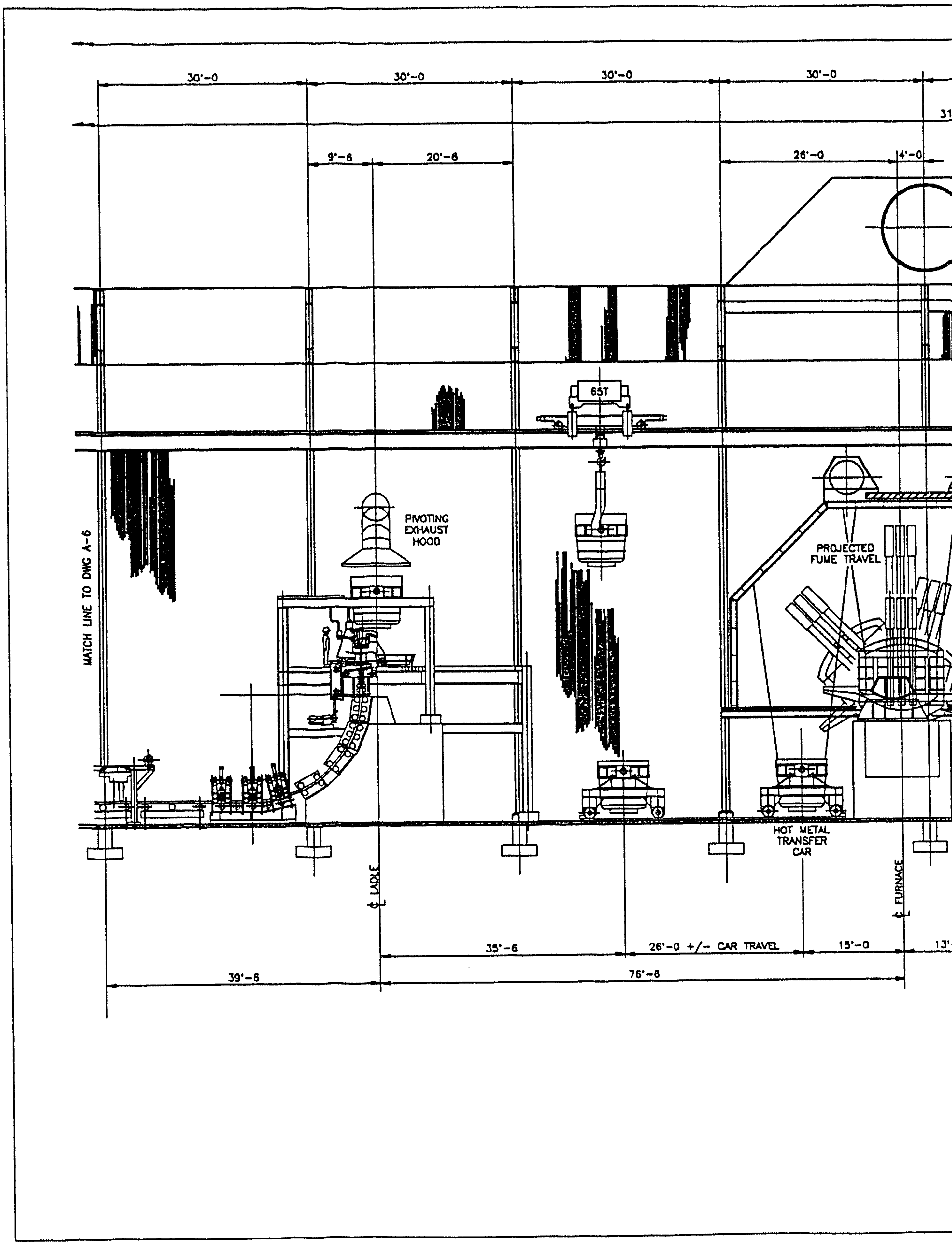
REV	By	Date
-	-	-

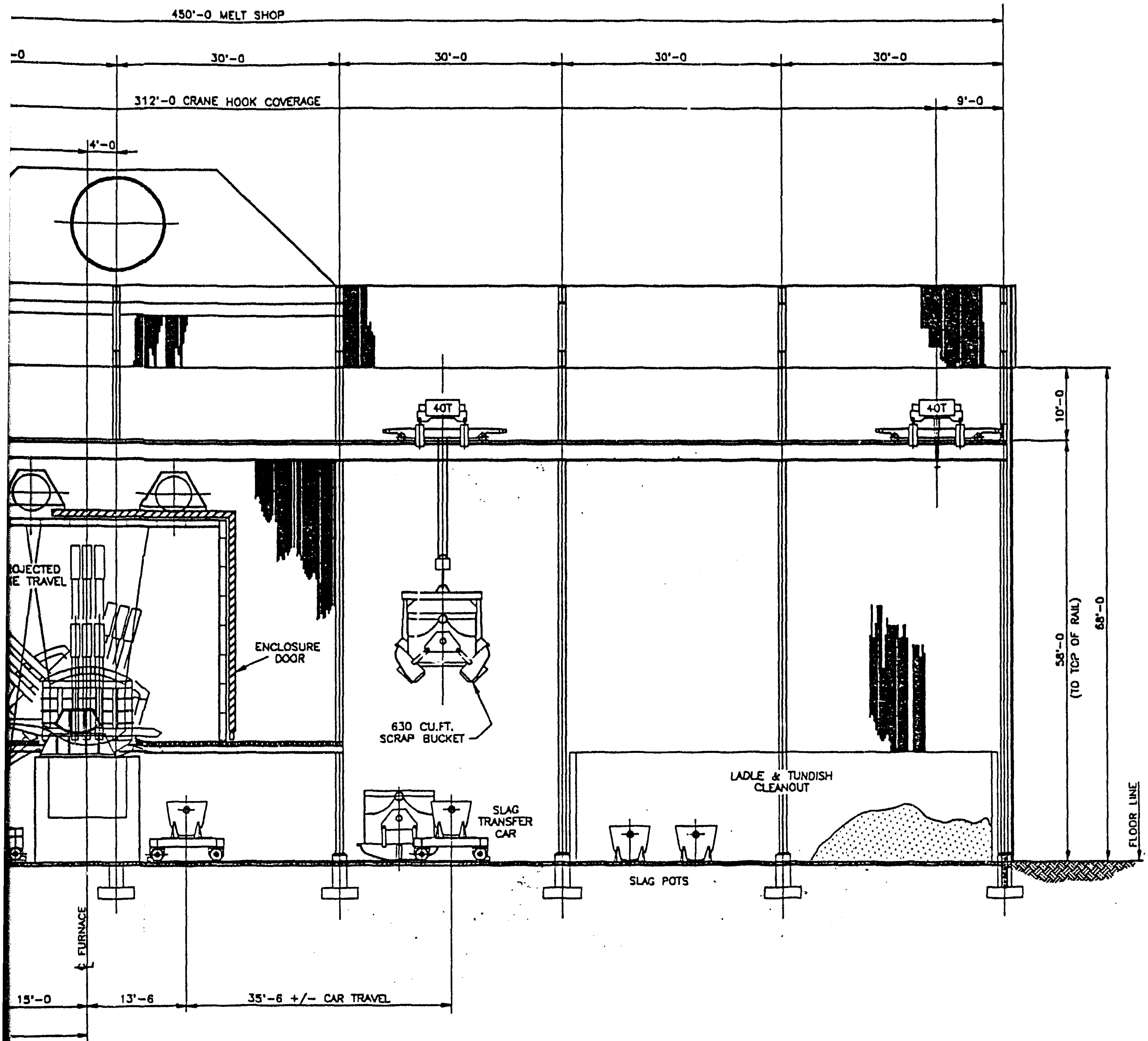
Client ALPHA ENGINEERS INC.

Subject WESTINGHOUSE IDAHO NUCLEAR COMPANY
MELTING, CASTING AND ROLLING FACILITY
PLAN VIEW - BUILDINGS & EQUIPMENT

Project no. 3229	Client Proj no.	Location
Dsn DEO	Date 8-25-93	Scale 1/16"=1'-0	Apprd
Chk'd	Date	DWG NO. A-4

CADFILE /6/3229/32299004


30'-0
30'-0
30'-0
30'-0
312'
9'-6
20'-6
26'-0
4'-0
65T
PIVOTING
EXHAUST
HOOD
PROJECTED
FUME TRAVEL
MATCH LINE TO DWG A-6
HOT METAL
TRANSFER
CAR
℄ LADLE
℄ FURNACE
35'-6
26'-0 +/- CAR TRAVEL
15'-0
13'-
39'-6
76'-6



CENTERLINE ENGINEERING CORPORATION

3229 000 9005
PROJECT ACCOUNT DOCUMENT

TYPE DESCRIPTION
B BIDDING
A FOR APPROVAL
I INFO/REF
M MATERIAL ORDERING
P PRELIMINARY
R REVISION
C CONSTRUCTION

ISSUE RECORD — APPROVED

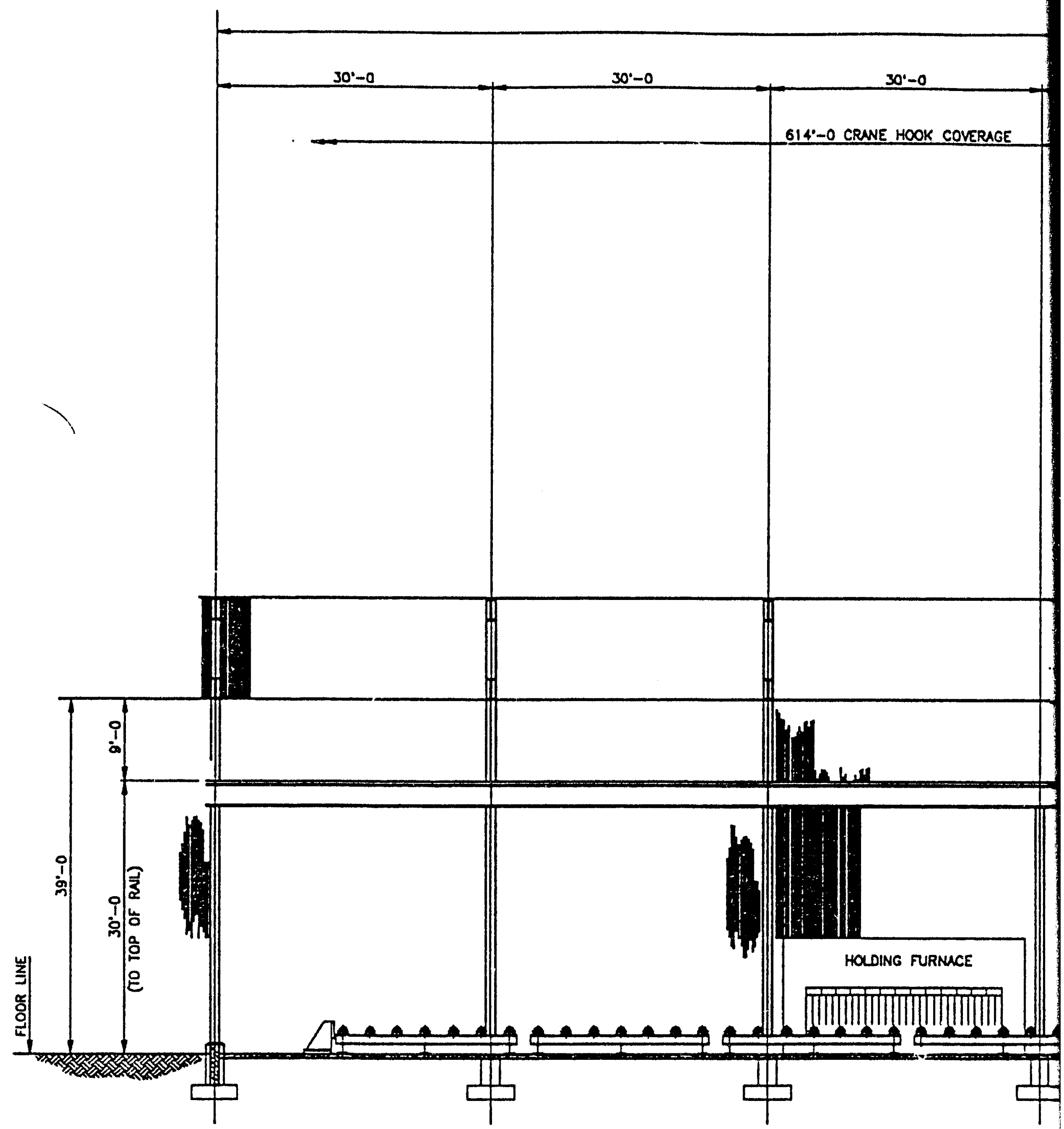
REV	By	Date
-	-	-

Client ALPHA ENGINEERS INC.

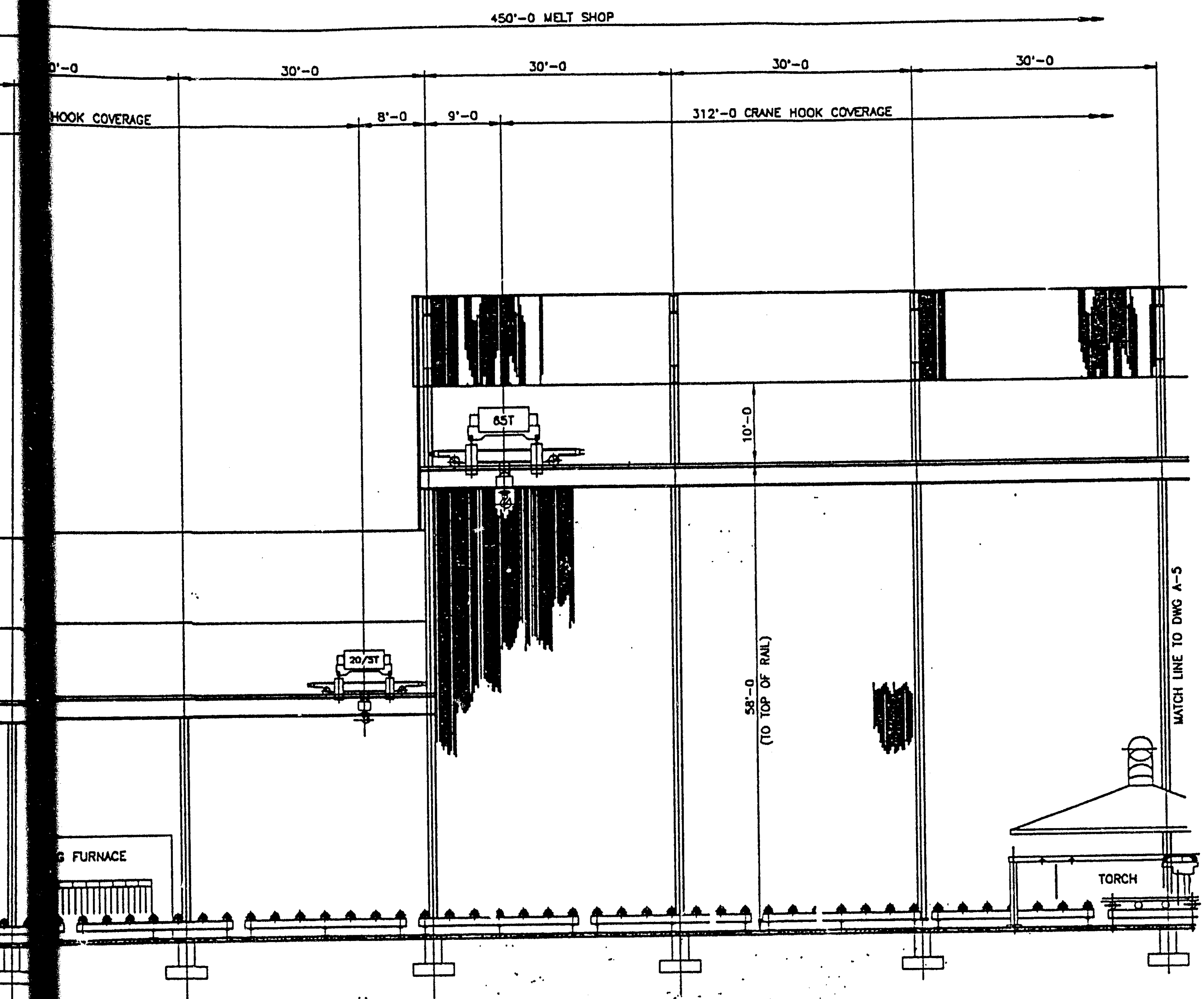
Subjects: VESTINGHOUSE IDAHO NUCLEAR COMPANY
MELTING, CASTING AND ROLLING FACILITY
ELEVATION THRU MELT SHOP

Project no. 3229	Client Proj no.	Location	
Dsn DEO	Date 8-25-93	Scale 1/8"=1'-0"	Appv'd
Chk'd	Date	Dwg. No. A-5	

CADFILE /6/3229/32299005



30'-0
30'-0
30'-0
614'-0 CRANE HOOK COVERAGE
9'-0
39'-0
30'-0
(TO TOP OF RAIL)
FLOOR LINE
HOLDING FURNACE



3229 000 9006
PROJECT ACCOUNT DOCUMENT

TYPE DESCRIPTION
B BIDDING
A FOR APPROVAL
I INFO/REF
M MATERIAL ORDERING
P PRELIMINARY
R REVISION
C CONSTRUCTION

ISSUE RECORD
APPROVED

REV	By	Date
-	-	-

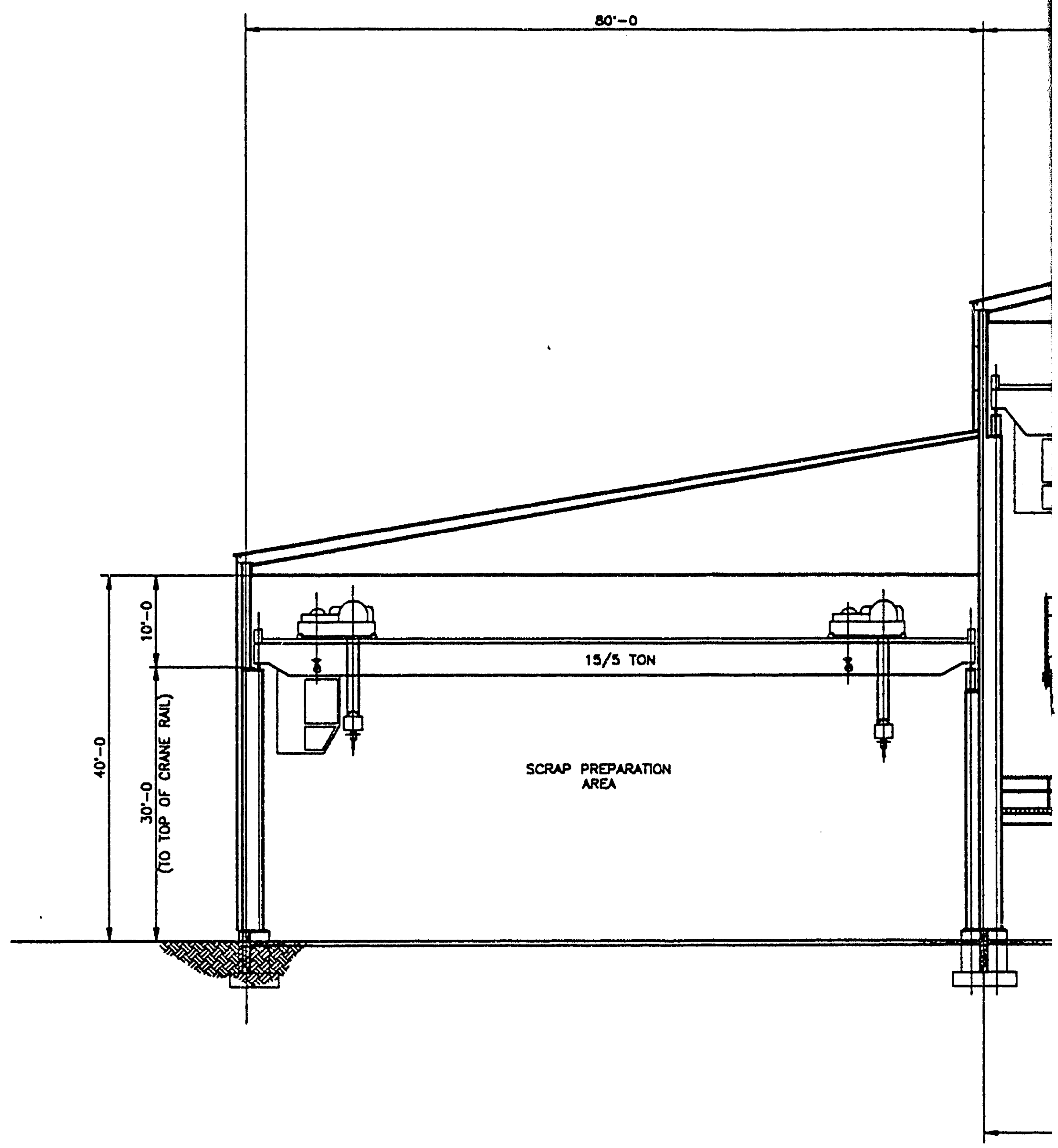
CENTERLINE ENGINEERING CORPORATION

Client: ALPHA ENGINEERS INC.

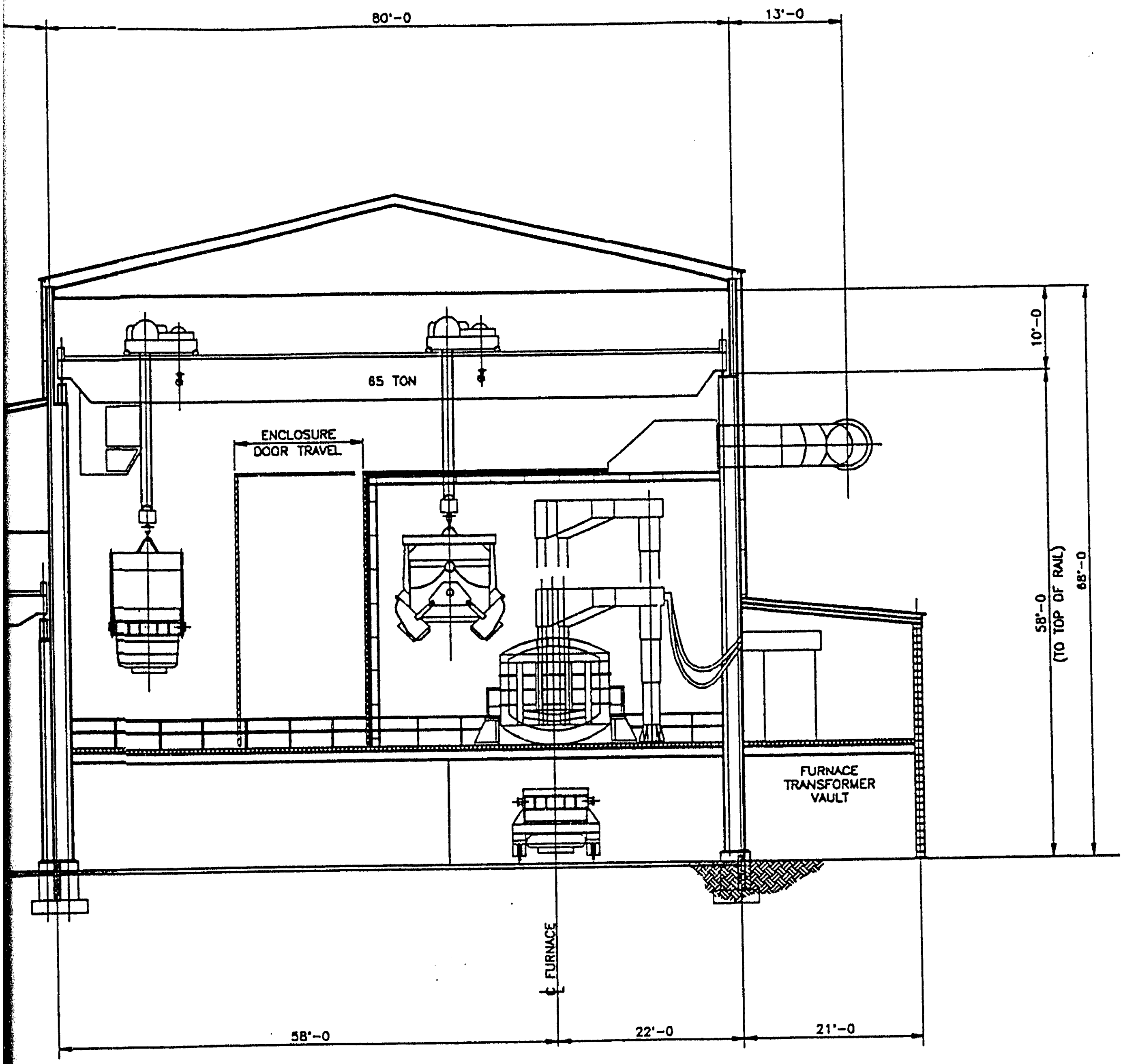
Subject: VESTINGHOUSE IDAHO NUCLEAR COMPANY
MELTING, CASTING AND ROLLING FACILITY
ELEVATION THRU MELT SHOP

Project no. 3229	Client Proj no.	Location
Dsn DED	Date 8-25-93	Scale 1/8"=1'-0"	Appr'd
Chk'd	Date	DWG NO. A-6

CADFILE /6/3229/32299006



80'-0
15/5 TON
SCRAP PREPARATION AREA
40'-0
10'-0
30'-0
(TO TOP OF CRANE RAIL)



CENTERLINE ENGINEERING CORPORATION

Client ALPHA ENGINEERS

Subject WESTINGHOUSE IDAHO NUCLEAR COMPANY
MELTING, CASTING AND ROLLING FACILITY
CROSS SECTION THRU MELT SHOP AT FURNACE

Project no. 3229	Client Proj no.	Location	
Dsn DEO	Date 8-28-93	Scale 1/8"=1'-0"	Appr'd
Chk'd	Date	DWG. NO. A-7	

REV	By	Date
-	-	-

3229 000 9007
PROJECT ACCOUNT DOCUMENT

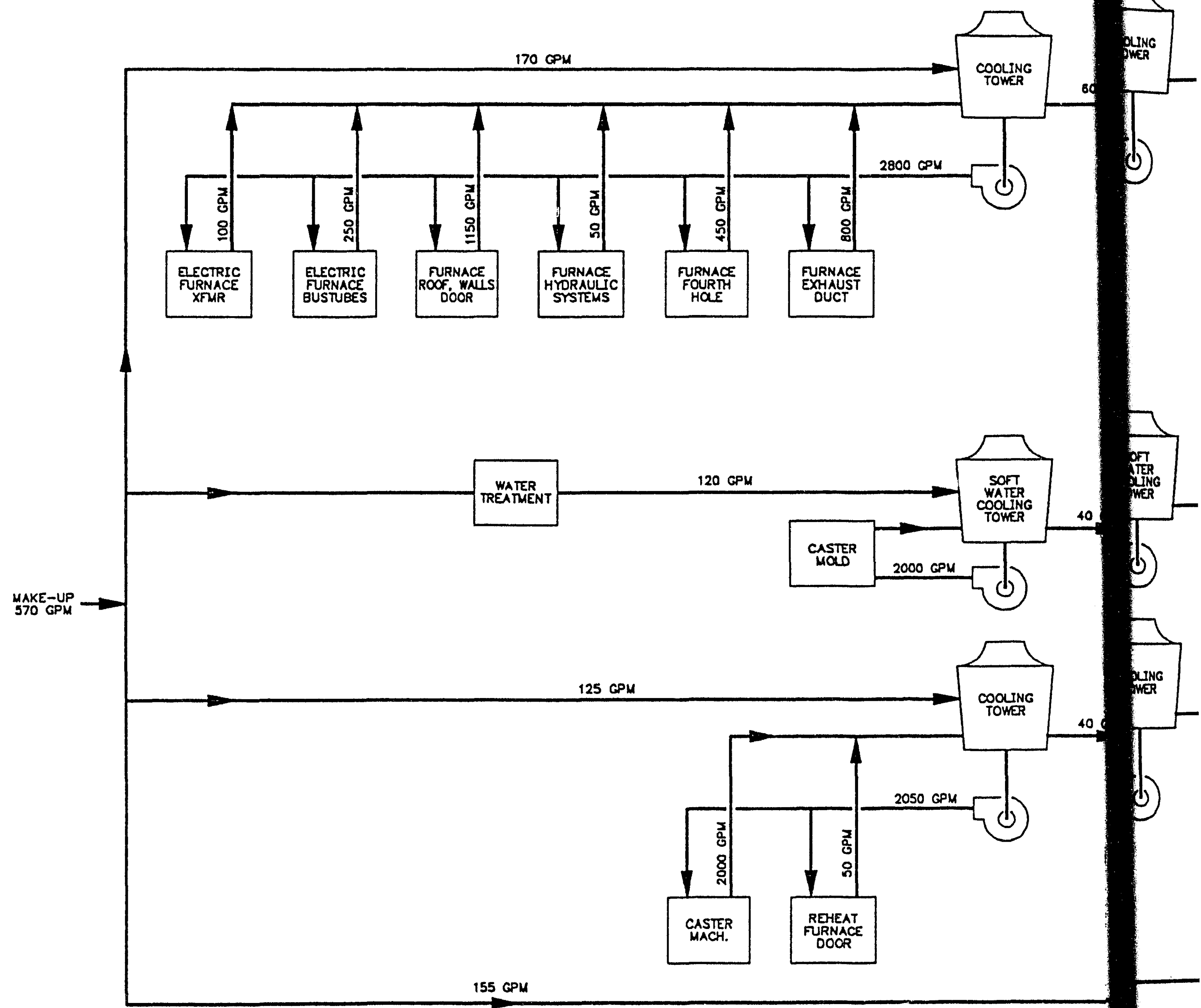
TYPE	DESCRIPTION
B	BIDDING
A	FOR APPROVAL
I	INFO/REF
M	MATERIAL ORDERING
P	PRELIMINARY
R	REVISION
C	CONSTRUCTION

APPROVED ______

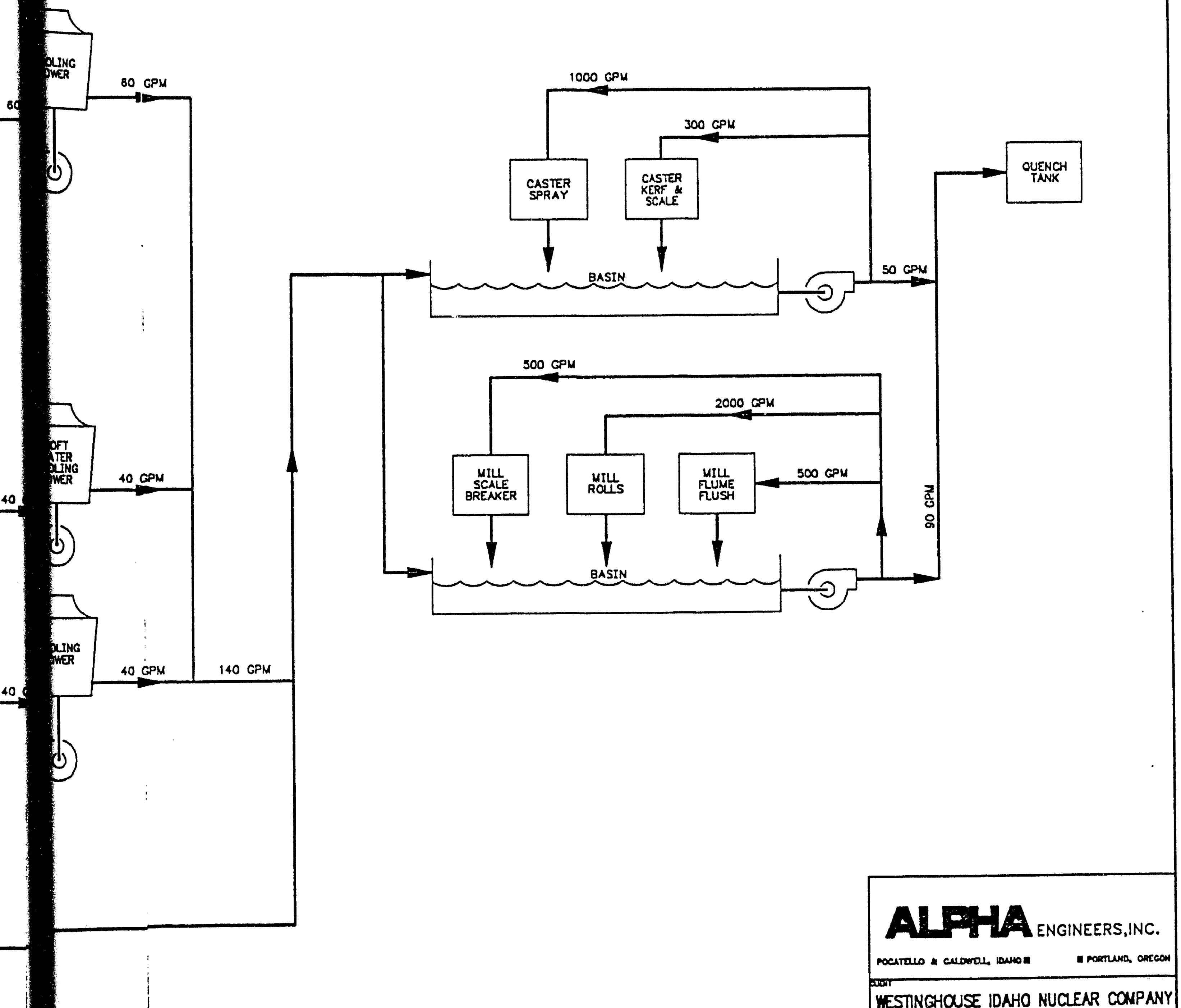
ISSUE	DATE	TYPE

ISSUE RECORD

CADFILE /6/3229/32299007



REFERENCES				REVISIONS				
NO.	DESCRIPTION	NO.	DESCRIPTION	NO.	BY	DATE	DESCRIPTION	NO.



W3259F01

010

ALPHA ENGINEERS, INC.

POCATELLO & CALDWELL, IDAHO ■ PORTLAND, OREGON

CLIENT

WESTINGHOUSE IDAHO NUCLEAR COMPANY

MELTING, CASTING AND ROLLING FACILITY COOLING WATER FLOW DIAGRAM

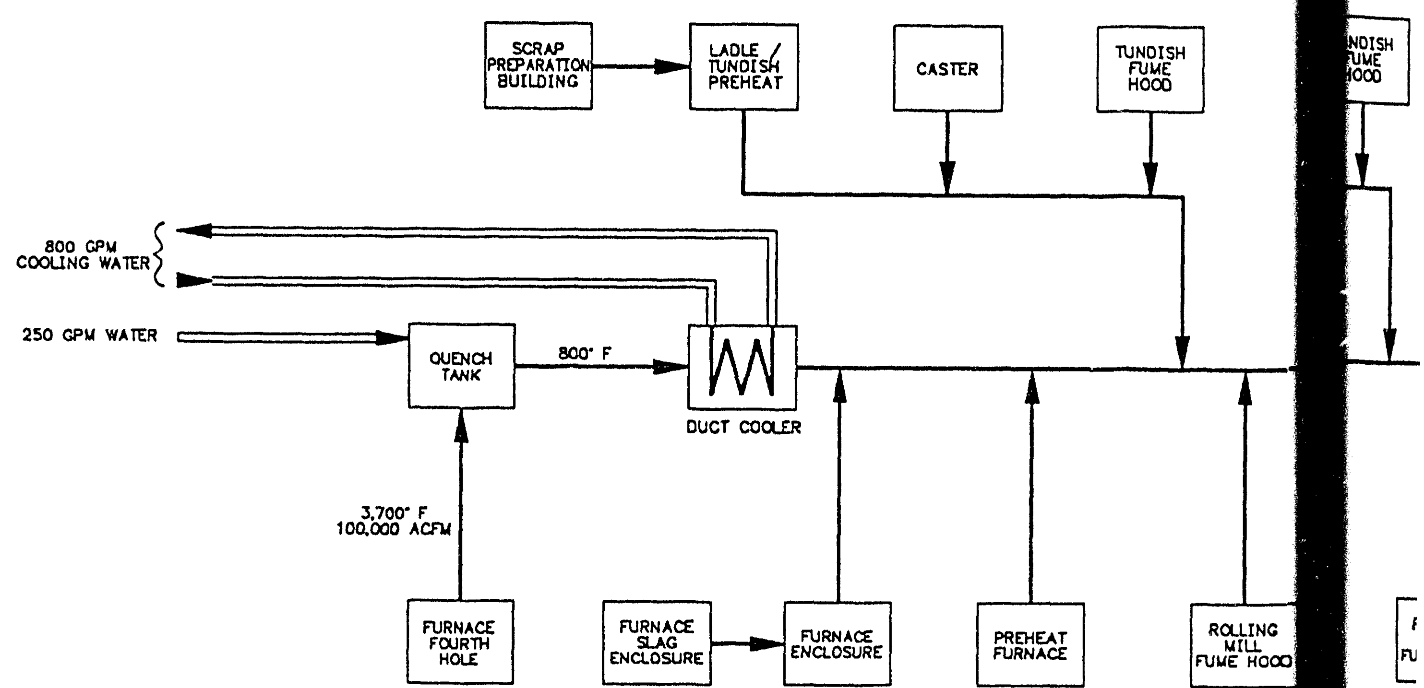
NO.	BY	DATE	DESCRIPTION

DESIGNED BY:	C.L.W.	
DRAWN BY:	C.W.W.	9-27-93
CHECKED BY:		
APPV'D. BY:		

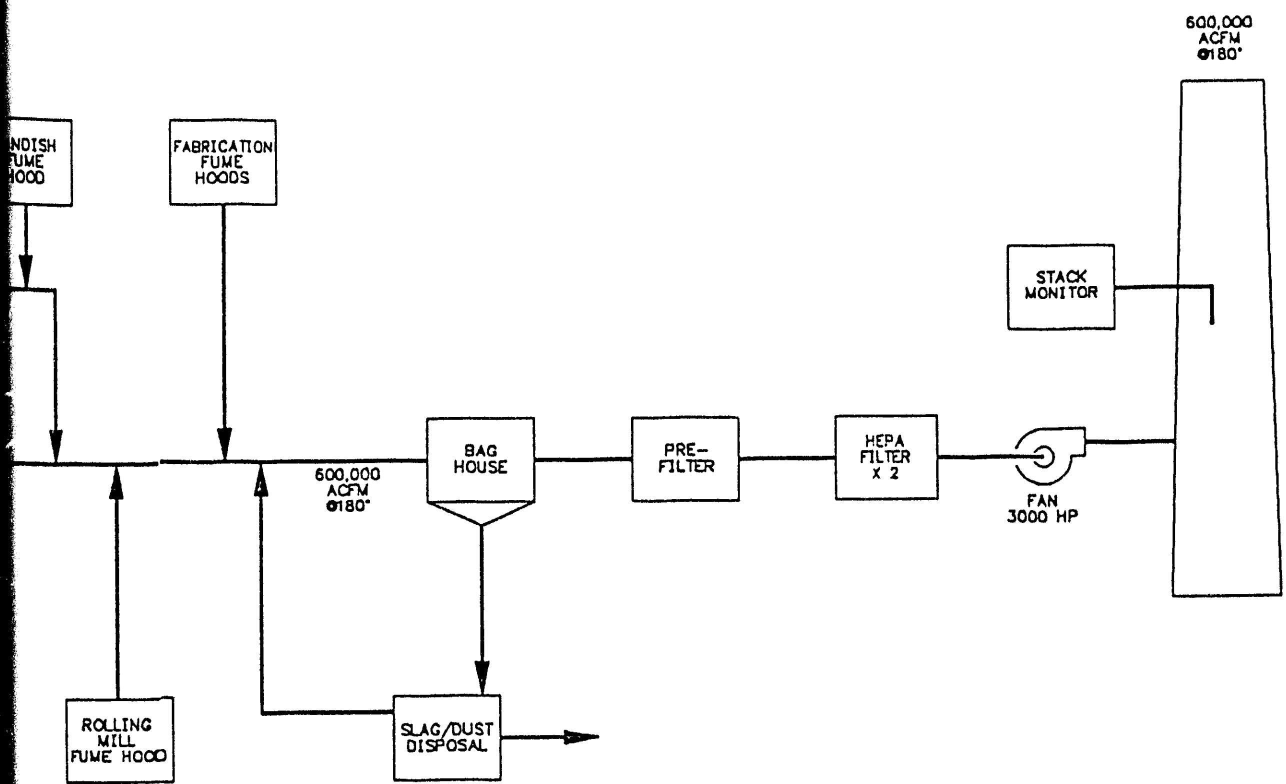
JOB NO. 93A259 CAD DWG. #: 93A259-WEST

SCALE: 1" = 1"

DWG. NO. F-1



REFERENCES					REVISIONS				
	NO.	DESCRIPTION	NO.	DESCRIPTION	NO.	BY	DATE	DESCRIPTION	NO.



ALPHA ENGINEERS, INC.

POCATELLO & CALDWELL, IDAHO ■ ■ PORTLAND, OREGON

CLIENT: WESTINGHOUSE IDAHO NUCLEAR COMPANY

DWG. TITLE:

METAL RECYCLING FACILITY
FUME EXHAUST
SYSTEM FLOW DIAGRAM

FILE: W3259F02

NO.	BY	DATE	DESCRIPTION	
DESIGNED BY:	C.L.W.			
DRAWN BY:	C.W.W.	9-28-93		
CHECKED BY:				
APPV'D. BY:				

JOB NO. 93A259 CAD DWG. # 93A259-WEST

SCALE: 1" = 1"

DWG. NO. F-2

END

DATE FILMED

5/3/94