START

0030894

298

Mr. John Grantham
State of Washington
Department of Ecology
Nuclear & Mixed Waste Program
P. O. Box 47600
Olympia, WA 98504-7600

FLUOR DANIEL, INC.

Date: March 15, 1993

Reference: Hanford Waste Vitrification Plant
DOE Contract DE-AC06-86RL10838
Fluor Contract 8457

Transmittal No.: WDOE-364

Dear Mr. Grantham:

TRANSMITTAL

We enclose * copy of the items listed below. These are issued per US-DOE request.
*2 FULLSIZE (ROLLED) 1 REDUCED, 2 SPECIFICATION

Response due to Fluor: N/A
Responds to: A920 PACKAGE

NUMBER	REV	DATE	TITLE
SEE TRANSMITTAL ATTACHMENT	-----	03/15/93	FABRICATION SHOP AND SUPPORT FACILITIES PLEASE NOTE LIST OF REFERENCE DRAWINGS AND SPECIFICATIONS.

Distribution:
Reference: FRP-838, FUP-401
R. L. Long: DOE-RL w/0
TWP/AME Corresp Cntrl Cntr, MSIN A5-10
(A920 PACKAGE),w/0
P. Felise, WHC-RL (MSIN G6-16), w/1F, SPEC
Environmental Data Management Center
(MSIN H6-08), w/1F, 1 SPEC
D. Duncan, US EPA, Region X w/0

Very truly yours,

Rosalie Cadenas for

R. S. Poulter
Project Director

RSP:MJY:lh

SEP 1993
RECEIVED
EDMC

9413202.1381

PROJECT TITLE:

B-595 HWVP-HANFORD WASTE VITRIFICATION PLANT

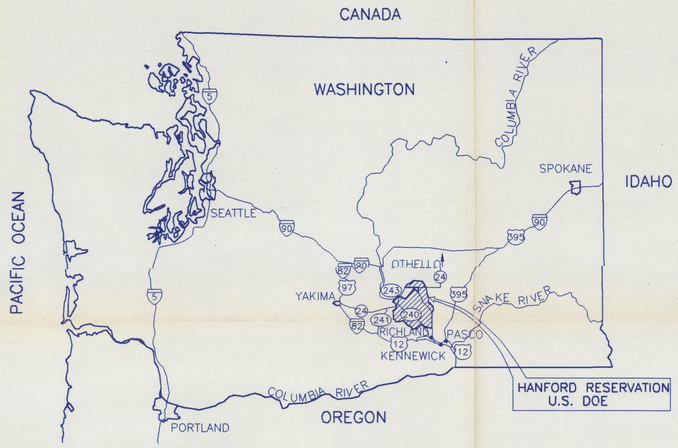
CWBS A920
FAB SHOP AND SUPPORT FACILITIES

FOR:

U.S. DEPARTMENT OF ENERGY RICHLAND OPERATIONS OFFICE

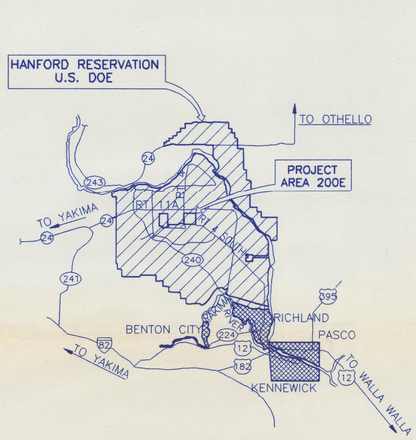
BY:

FLUOR DANIEL, INC



REGIONAL MAP

0 20 40 60 80 100
GRAPHIC SCALE
1" = 40 MILES



VICINITY MAP

0 5 10 15 20 25
GRAPHIC SCALE
1" = 10 MILES

LEGEND

DENOTES HANFORD RESERVATION U.S. DOE

DENOTES CITY LIMITS

MAR 1 1 1993

REV NO.	DATE	REVISION DESCRIPTION	APPROVAL INITIALS
0	3/10/93	APPROVED FOR CONSTRUCTION	JLD JLD

CADFILE B116029A CADCODE 2B:IBM:ACD2:10.C2:SS

ENGINEERING RELEASE
REV _____ DATE _____
ERO _____

SIGNATURE	DATE
PROJ DIR	3/10/93
QA MGR	3/9/93
INSPECTION/SAFETY MGR	3/8/93
PROJECT MGR	3-8-93
SYSTEMS MGR	3/8/93
ENGINEERING MGR	3/10/93
SUPERVISOR	3/8/93
DESIGN ENGINEER	3/8/93
CHECKED	3/8/93
DRAWN S. SAM	02/26/93

U.S. DEPARTMENT OF ENERGY
Richland Field Office
DE - AC06-86RL10838

FLUOR DANIEL, INC.
ADVANCED TECHNOLOGY DIVISION

FAB SHOP AND SUPPORT FACILITIES TITLE SHEET

PROJECT TITLE: HANFORD WASTE VITRIFICATION PLANT

PROJECT	FLUOR CONTRACT NO.	CWBS NO.
B-595	8457	A920

SCALE	BLDG NO.	INDEX NO.
NONE	18	

CLASSIFICATION	BY	DRAWING NUMBER	SHEET	OF	REV
NONE	NOT REQD	H-2-116029	1	1	0

DWG NO.	DRAWING TITLE
	REFERENCE DRAWINGS
NEXT USED ON	

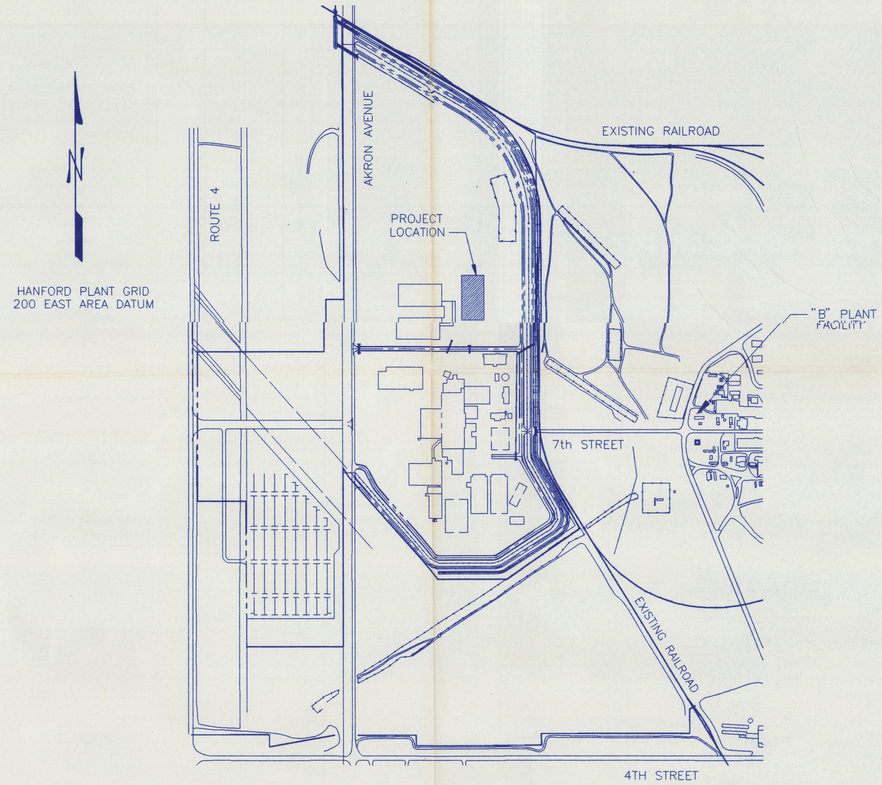
9 2 0 H-2-116029 0 1 1 A F C

DISTRIBUTION CODE: 301 T1 ACAD INITIALS: SS DATE: 03/04/93

MRG Mar 03 15:02:21 1993 P:CAD2 Q:\PLOTS\PAA275CB.PLT

DRAWING INDEX

DRAWING NO.	CODE NO.	TITLE	REV
GENERAL			
H-2-116029	T1	FAB SHOP AND SUPPORT FACILITIES TITLE SHEET	0
H-2-116030	T2	FAB SHOP AND SUPPORT FACILITIES DRAWING INDEX	0
CIVIL			
H-2-117077	C1	CIVIL INFORMATION SHEET	0
H-2-117078	C2	CIVIL FINISH GRADING, PAVING AND DRAINAGE PLAN	0
H-2-117079	C3	CIVIL SECTIONS AND DETAILS	0
ARCHITECTURAL			
SK-2-91458	A1	ARCHITECTURAL FAB SHOP GENERAL NOTES & ABBREVIATIONS	0
SK-2-91459	A2	ARCHITECTURAL FAB SHOP FLOOR PLAN	0
SK-2-91460	A3	ARCHITECTURAL FAB SHOP EXTERIOR ELEVATIONS	0
SK-2-91461	A4	ARCHITECTURAL FAB SHOP BLDG SECTIONS	0



PROJECT AREA MAP
NOT TO SCALE

MAR 1 1 1993

NOTE

1. SEE DWG H-2-117154 (CWBS A160) FOR UTILITY POINT OF CONNECTIONS

DWG NO.	DRAWING TITLE
H-2-117154 (CWBS A160)	CIVIL UNDERGROUND UTILITY PLAN

REFERENCE DRAWINGS
NEXT USED ON

REV NO.	DATE	REVISION DESCRIPTION	APPROVAL INITIALS
0	3/10/93	APPROVED FOR CONSTRUCTION	JLD SS JLD

CADFILE B116030A CADCODE 2B:IBM:ACD2:10.C2:SS

ENGINEERING RELEASE
REV _____ DATE _____
ERO _____

SIGNATURE	DATE
PROJ DIR	3/10/93
QA MGR	3/9/93
INDEPENDENT SAFETY MGR	3/10/93
PROJECT MGR	3-8-93
SYSTEMS MGR	3/8/93
ENGINEERING MGR	3/8/93
SUPERVISOR	3/8/93
DESIGN ENGINEER	3/8/93
CHECKED	3/8/93
DRAWN S. SAM	02/26/93

U.S.DEPARTMENT OF ENERGY
Richland Field Office
DE - AC06-86RL10838

FLUOR DANIEL, INC.
ADVANCED TECHNOLOGY DIVISION

FAB SHOP AND SUPPORT FACILITIES DRAWING INDEX

PROJECT TITLE: HANFORD WASTE VITRIFICATION PLANT

PROJECT	FLUOR CONTRACT NO.	CWBS NO.
B-595	8457	A920

SCALE	BLDG NO.	INDEX NO.
NONE	18	

CLASSIFICATION	BY	DRAWING NUMBER	SHEET	OF	REV
NONE	NOT REQD	H-2-116030	1	1	0

9 2 0 H-2-116030 0 1 1 A F C

DISTRIBUTION CODE: 301 T2 ACAD INITIALS: SS DATE: 03/04/93

WED MAR 03 14:59:16 1993 P CADD Q:\PLOTS\PAA27SCA.PLT

ABBREVIATIONS

&	AND
@	AT
A.C.	ASPHALTIC CONCRETE
ACI	AMERICAN CONCRETE INSTITUTE
APPROX	APPROXIMATE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
BLDG	BUILDING
BM	BENCHMARK
CB	CATCH BASIN
℄	CENTER LINE
CLR	CLEAR
COL	COLUMN
CONC	CONCRETE
CMP	CORRUGATED METAL PIPE
DIA OR Ø	DIAMETER
DB	DIRECT BURY ELECTRICAL LINE
DWG/DWGS	DRAWING(S)
E	EAST
EL	ELEVATION
ETC	ETCETERA
FD	FOUNDATION
FF	FINISH FLOOR
FG	FINISHED GRADE
FL	FLOW LINE
FWX	FIRE WATER LINE
FS	FINISHED SURFACE
GALV	GALVANIZED
GB	GRADE BREAK
HP	HIGH POINT
HVAC	HEATING VENTILATION AND AIR CONDITIONING
HWVP	HANFORD WASTE VITRIFICATION PLANT
ICR	INFORMATION/CHANGE REQUEST
IE	INVERT ELEVATION
L=	LENGTH
LF	LINEAR FEET
MH	MANHOLE
MAX	MAXIMUM
MIN	MINIMUM
N	NORTH
#	NUMBER
OC	ON CENTER
%	PERCENT
PI	POINT OF INTERSECT
PR	PAIR
PVC	POLYVINYL CHLORIDE PIPE
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
REF	REFERENCE
RR	RAILROAD
S	SOUTH
SE	SOUTH EAST
S=	SLOPE
SCHD	SCHEDULE
SPEC	SPECIFICATION
SS	SANITARY SEWER
SQ	SQUARE
SW	SOUTH WEST
SWX	SANITARY (POTABLE) WATER LINE
TC	TOP OF CURB
TOG	TOP OF GRATE
TR	TOP OF RAIL
TYP	TYPICAL
W	WEST
W/	WITH
WSDOT	WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
WWF	WELDED WIRE FABRIC

LEGEND

- EXISTING SECURITY FENCE
- WELDED WIRE FABRIC
- NEW CHAIN LINK FENCE
- FENCE (BY OTHERS)
- NEW RAILROAD (BY OTHERS)
- UNIFORM SLOPE
- SUBGRADE
- RIPRAP
- POWER POLES (EXISTING)
- LIGHT POLE (EXISTING)
- LIGHT POLE (BY OTHERS)
- 710.00 — NEW SPOT ELEVATION
- (710.00) — EXISTING SPOT ELEVATION
- BENCHMARK
- SOIL BORING LOCATION
- DENOTES CENTERLINE
- NEW CONTOUR TO BE MATCHED TO EXISTING GRADE
- (700) — EXISTING CONTOURS
- 700 — NEW CONTOURS
- ---DB--- DIRECT BURY ELECTRICAL LINES (BY OTHERS)
- ---(FWX)--- FIRE WATER LINE W/SIZE INDICATED (BY OTHERS)
- ---(SS)--- SANITARY SEWER LINE (BY OTHERS)
- ---(SWX)-- SANITARY WATER LINE W/SIZE INDICATED (BY OTHERS)
- NEW UNDERGROUND UTILITY (AS NOTED)
- FLOW LINE
- 5 / 117056 — DENOTES DETAIL OR SECTION CALLOUT "5" ON DRAWING NUMBER H-2-117056
- CONCRETE (SECTIONAL VIEW)
- CONCRETE (PLAN VIEW)
- 3 — DENOTES REVISION AND NUMBER
- MH — SANITARY SEWER MANHOLE (BY OTHERS)
- CO — NEW SANITARY SEWER CLEANOUT
- FIRE HYDRANT (BY OTHERS, UNLESS NOTED OTHERWISE)
- BARRICADE POSTS (BY OTHERS, UNLESS NOTED OTHERWISE)
- CAPPED PIPE (BY OTHERS)
- NEW CAPPED PIPE
- POST INDICATOR VALVE (BY OTHERS)
- GATE VALVE W/VALVE BOX (BY OTHERS)
- NEW POST INDICATOR VALVE
- LIMITS OF NEW ASPHALT PAVING
- EXISTING UNKNOWN OBJECT (SEE GENERAL NOTE 12 THIS DRAWING)

GENERAL NOTES:

1. THE SELLER SHALL VERIFY CONDITIONS AT THE JOB SITE PRIOR TO STARTING CONSTRUCTION AND THE ENGINEER SHALL BE NOTIFIED, IN WRITING, OF ANY DISCREPANCIES OR INCONSISTENCIES.

2. HORIZONTAL AND VERTICAL CONTROL IS BASED ON THE EXISTING HANFORD PLANT 200E AREA SYSTEM. THE PROJECT BENCHMARKS TO BE USED IN THE CONSTRUCTION OF THE HANFORD WASTE VITRIFICATION PLANT ARE LISTED IN THE TABLE BELOW AND ARE INDICATED IN THE KEY PLAN ON THIS DRAWING.

BENCHMARK NAME	DESCRIPTION	HANFORD 200E AREA DATUM (USE FOR CONSTRUCTION)		WASHINGTON COORDINATE SYSTEM (LAMBERT)*
		COORDINATES(FT)	ELEVATION(FT)	COORDINATES (METERS)
2E-50	BRASS CAP SET IN CONCRETE	N 42499.94 W 55599.84	706.09	N 136,431.11 E 572,945.31
2E-51	BRASS CAP SET IN CONCRETE	N 43897.51 W 56725.52	698.61	N 136,856.09 E 572,601.03
2E-52	BRASS CAP SET IN CONCRETE	N 40950.18 W 56725.10	713.50	N 135,957.83 E 572,603.72

*FOR INFORMATION ONLY

3. THE COORDINATES AND ELEVATIONS SHOWN FOR THESE BENCHMARKS ARE BASED ON THE SURVEY DATA REPORT PREPARED BY KAISER ENGINEERS, TITLED "HANFORD WASTE VITRIFICATION PLANT", DATED 9-15-89 (FILE NUMBER 2ESW-039).

4. THE EXISTING UTILITIES AND ITEMS LOCATED IN THE PLANS, WHICH ARE NOT CONSTRUCTED BY OTHERS, ARE SHOWN IN AN APPROXIMATE MANNER ONLY. THE LOCATIONS OF EXISTING UTILITY LINES SHOWN HAVE BEEN PROVIDED BY THE OWNER BASED ON EXISTING AS-BUILT DRAWINGS. THE SELLER SHALL TAKE NECESSARY MEASURES TO HOLD SAFE AND PREVENT DAMAGING THE EXISTING UTILITY LINES AND ASSOCIATED APPURTENANCES.

5. EXISTING CONTOURS SHOWN REFLECT THE SITE CONDITIONS AFTER SITE PREPARATION OPERATIONS UNDER CWBS NO. A130.

6. THE SELLER SHALL ROUTE AND INSTALL, FIRE WATER, SANITARY WATER, AND SEWER SERVICE LINES FROM THE TIE-IN SOURCES INDICATED ON THE PLANS TO THE FABRICATION SHOP BUILDING PLUMBING CONNECTION POINTS. SERVICE LINES SHALL MAINTAIN A MINIMUM COVER OF 42" TO THE TOP OF PIPE BELOW FINISHED GRADE.

7. SEWER, FIRE WATER AND SANITARY WATER LINES SHALL BE PRESSURE TESTED IN ACCORDANCE WITH SPECIFICATION B-595-C-A920-02100, PRIOR TO CONNECTION TO EXISTING FACILITIES.

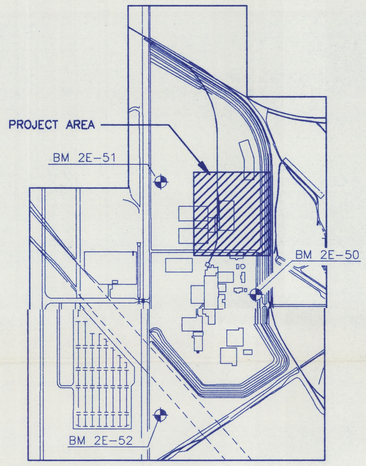
8. SELLER SHALL PROVIDE HORIZONTAL AND VERTICAL AS-BUILTS DATA ON ALL SITE IMPROVEMENTS CONSTRUCTED AS PART OF THIS WORK TO INCLUDE UNDERGROUND UTILITIES, STORM DRAINAGE FACILITIES, GRADING, PAVING AND BUILDING FEATURES.

9. SELLER SHALL IDENTIFY UNKNOWN FIELD OBJECTS AND NOTIFY BUYER OF ANY CONFLICTS.

10. DRAINAGE DITCHES, CULVERTS, AND MISCELLANEOUS STRUCTURES SHALL BE CONSTRUCTED TO THE LINES AND GRADES INDICATED ON DRAWINGS. ANY DEVIATIONS WILL REQUIRE THE SELLER TO SUBMIT AN ENGINEERING OR FIELD CHANGE REQUEST TO THE BUYER FOR APPROVAL PRIOR TO ANY CONSTRUCTION.

11. UNPAVED AREAS DISTURBED DURING CONSTRUCTION OR GRADING ACTIVITIES SHALL BE OVERLAYED WITH 4" OF COMPACTED ROCK SURFACING TO THE FINISH GRADE ELEVATIONS INDICATED ON THE DRAWINGS.

12. A CLEAR DISTANCE OF 8'-6" SHALL BE MAINTAINED FROM THE CENTER LINE OF RAILROAD TO THE FACE OF THE FABRICATION SHOP BUILDING.



KEY PLAN
SCALE: NONE

5. STRUCTURAL MATERIALS
CONCRETE: (28 DAY COMPRESSIVE STRENGTH)

STRUCTURAL	4000 PSI
NON-STRUCTURAL	2500 PSI
SHOTCRETE	3000 PSI
REINFORCING STEEL:	ASTM A615-GRADE 60
WELDED WIRE FABRIC:	ASTM A185
STEEL CULVERT PLATE:	SKID RESISTANT 33,000 PSI YIELD STRENGTH
STAINLESS STEEL:	ASTM A240 OR A276 TYPE 304 OR 304L
MISCELLANEOUS STEEL:	ASTM A36

HOLD NO. 246
NOTE: REFERENCE CR 0881, FAB SHOP RELOCATION

MAR 1 1 1993

GENERAL DESIGN CRITERIA

1. NEW FINISHED ROADS AND PAVED AREAS FOR THE HWVP PROJECT ARE DESIGNED FOR HS20 TRUCK LOADING.

2. EARTH RETENTION STRUCTURES SUCH AS CULVERT HEADWALL AND RETAINING WALLS ARE DESIGNED FOR AN ACTIVE PRESSURE COEFFICIENT EQUAL TO 0.27 AND SOIL DENSITY OF 110 POUNDS PER CUBIC FOOT.

3. EXCAVATION, BACKFILL COMPACTION AND ROAD DESIGN ARE BASED ON RECOMMENDATIONS GIVEN IN THE GEOTECHNICAL INVESTIGATION REPORT PREPARED BY DAMES & MOORE FOR KAISER ENGINEERS, JOB NO. 10805-383-016 DATED NOVEMBER 15, 1989 AND SUPPLEMENTS THEREOF.

4. FINISH GRADES AND DRAINAGE STRUCTURES HAVE BEEN ESTABLISHED AND SIZED TO BE CONSISTENT WITH THE OVERALL SITE DRAINAGE REQUIREMENTS.

DWG. NO.	DRAWING TITLE
H-2-116030	FAB SHOP AND SUPPORT FACILITIES DWG INDEX

REFERENCE DRAWINGS
NEXT USED ON

REV NO.	DATE	REVISION DESCRIPTION	APPROVAL INITIALS
0	3/10/93	APPROVED FOR CONSTRUCTION	

CADFILE B117077A — CADCODE 2B:IBM:ACD2:10.C2:SS

ENGINEERING RELEASE
REV _____ DATE _____
ERO _____

SIGNATURE	DATE
PROJ DIR	
QA MGR	
INDEPENDENT SAFETY MGR	
PROJECT MGR	
SYSTEMS MGR	
ENGINEERING MGR	
SUPERVISOR	3/9/93
DESIGN ENGINEER	3/8/93
QC CHECK	3/10/93
DRAWN H. CHANG	02-25-93

U.S.DEPARTMENT OF ENERGY
Richland Field Office
DE - AC06-86RL10838

FLUOR DANIEL, INC.
ADVANCED TECHNOLOGY DIVISION

CIVIL INFORMATION SHEET

PROJECT TITLE: HANFORD WASTE VITRIFICATION PLANT

PROJECT	FLUOR CONTRACT NO.	CWBS NO.
B-595	8457	A920

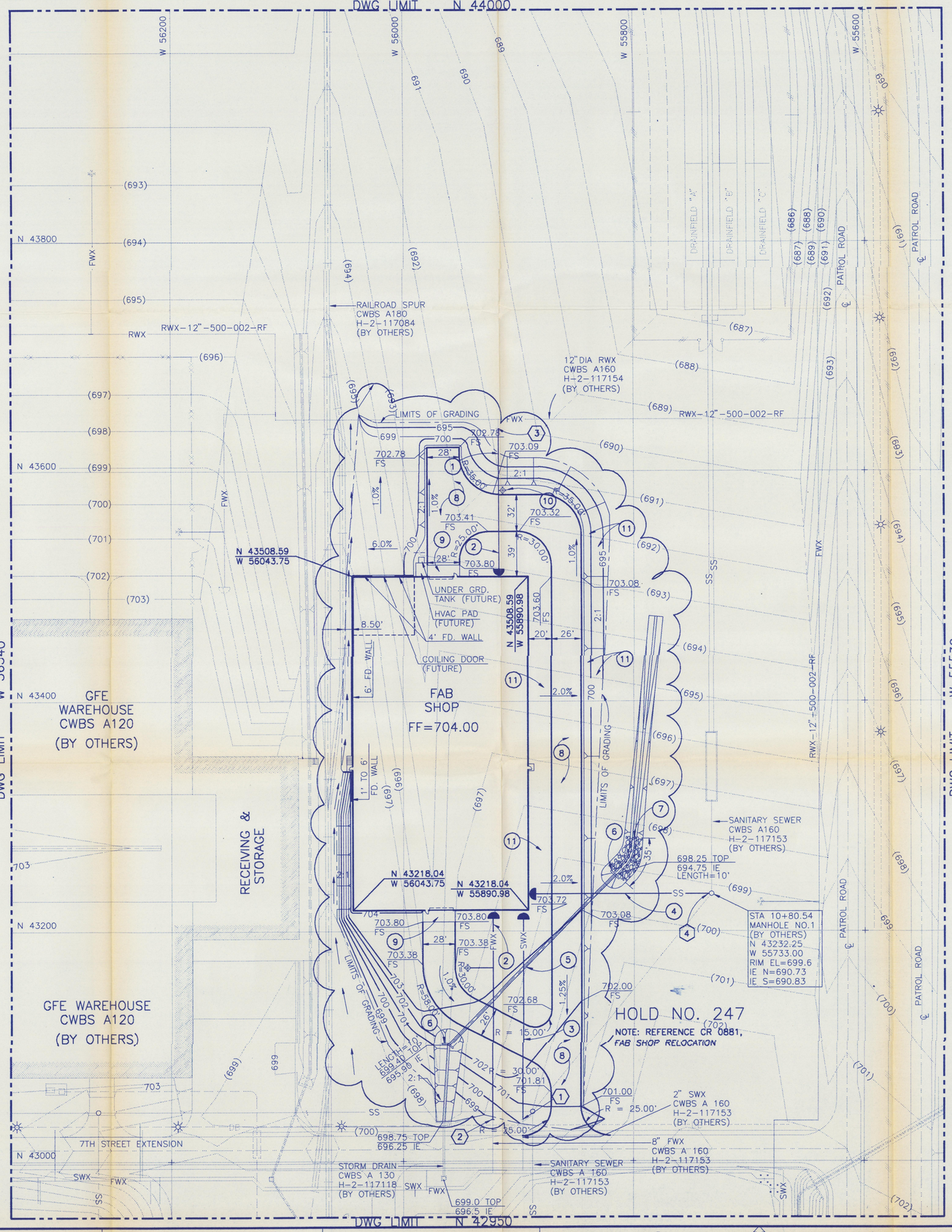
BLDG NO. — INDEX NO.
SCALE 1"=40'

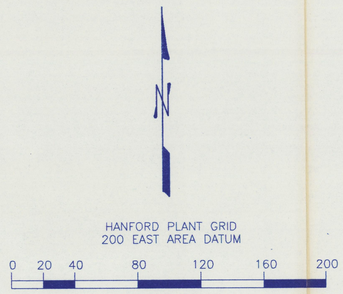
CLASSIFICATION	BY	DRAWING NUMBER	SHEET	OF	REV
NONE	NOT REQD	H-2-117077	1	1	0

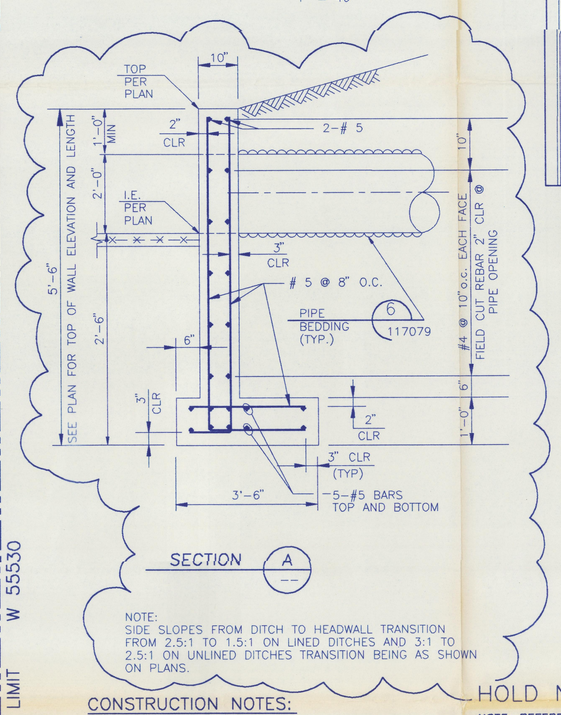
A920 H-2-117077 0 1 1 — AFC

DISTRIBUTION CODE: 053 — C1 — ACAD

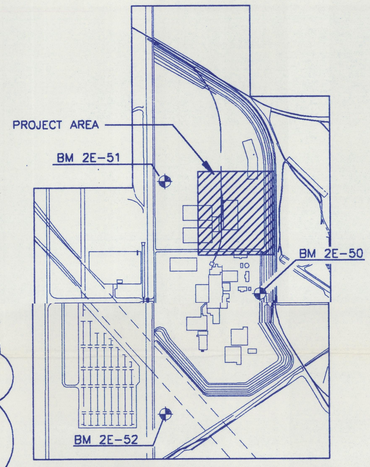
INITIALS: HLC
DATE: 02-25-93







NOTE:
SIDE SLOPES FROM DITCH TO HEADWALL TRANSITION FROM 2.5:1 TO 1.5:1 ON LINED DITCHES AND 3:1 TO 2.5:1 ON UNLINED DITCHES TRANSITION BEING AS SHOWN ON PLANS.



KEY PLAN
SCALE: NONE

TIE-IN POINT COORDINATES		INVERT ELEVATION
1	N 43035.93 W 55895.39	696.20
2	N 43035.93 W 55922.39	695.50
3	N 43637.00 W 55916.89	687.30
4	N 43232.25 W 55735.00	690.93

CONSTRUCTION NOTES:

1. INSTALL 8" DIA FIRE WATER LINE (FINAL PIPE ROUTE TO BE ESTABLISHED BY SELLER)
2. INSTALL 6" DIA FIRE WATER LINE (FINAL PIPE ROUTE TO BE ESTABLISHED BY SELLER)
3. INSTALL 2" DIA SANITARY WATER LINE (FINAL PIPE ROUTE TO BE ESTABLISHED BY SELLER)
4. INSTALL 6" DIA SANITARY SEWER LATERAL (FINAL PIPE ROUTE TO BE ESTABLISHED BY SELLER)
5. INSTALL 24" DIA RCP STORM DRAIN LINE IN ACCORDANCE WITH DETAIL 6 / 117079
6. CONSTRUCT STORM DRAIN HEADWALL IN ACCORDANCE WITH SECTION A
7. INSTALL ROCK RIPRAP IN ACCORDANCE WITH DETAIL D / 117079
8. CONSTRUCT ACCESS ROAD IN ACCORDANCE WITH DETAIL E / 117079
9. CONSTRUCT CONCRETE APRON IN ACCORDANCE WITH SECTION C / 117079
10. INSTALL FIRE HYDRANT IN ACCORDANCE WITH DETAIL 3 / 117079
11. INSTALL ROCK SURFACING IN ACCORDANCE WITH DETAIL 5 / 117079

HOLD NO. 247
NOTE: REFERENCE CR 0881, FAB SHOP RELOCATION

MAR 1 1 1993

QUALITY LEVEL II
SAFETY CLASS 4

REV NO.	DATE	REVISION DESCRIPTION	APPROVAL INITIALS
0	3/10/93	APPROVED FOR CONSTRUCTION	

CADFILE B117078A CADCODE 2B:IBM:ACD2:10.C2:SS

ENGINEERING RELEASE
REV ____ DATE ____
ERO ____

SIGNATURE	DATE
PROJ DIR	
QA MGR	
INDEPENDENT SAFETY MGR	
PROJECT MGR	
SYSTEMS MGR	
ENGINEERING MGR	
SUPERVISOR	3/9/93
DESIGN ENGINEER	3/9/93
CHECKED BY	3/9/93
DRAWN H. CHANG	02-25-93

U.S. DEPARTMENT OF ENERGY
Richland Field Office
DE - AC06-86RL10838

FLUOR DANIEL, INC.
ADVANCED TECHNOLOGY DIVISION

CIVIL
FINISH GRADING, PAVING AND DRAINAGE PLAN

PROJECT TITLE: HANFORD WASTE VITRIFICATION PLANT
PROJECT B-595 | FLUOR CONTRACT NO. 8457 | CWBS NO. A920
BLDG NO. | INDEX NO.
SCALE 1"=40'
CLASSIFICATION NONE | BY NOT REQD | DRAWING NUMBER H-2-117078 | SHEET 1 | OF 1 | REV 0

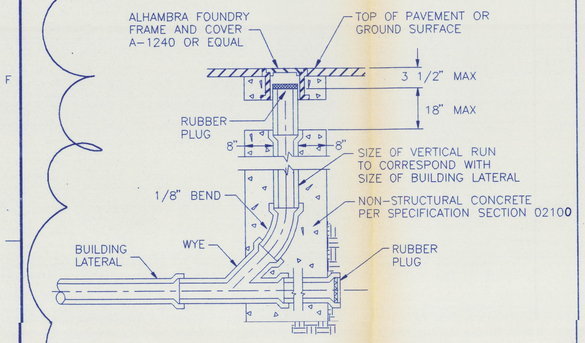
DWG NO.	DRAWING TITLE
H-2-117011	CWBS-A130, DRAWING INDEX
H-2-117150	CWBS-A160, DRAWING INDEX
H-2-116030	FAB SHOP AND SUPPORT FACILITY DWG INDEX

REFERENCE DRAWINGS
NEXT USED ON

A920 H-2-117078 0 1 1 AFC

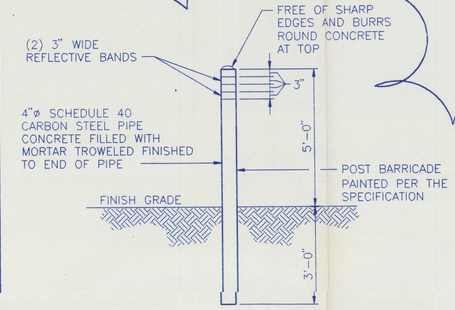
DISTRIBUTION CODE: 053 C2 ACAD INITIALS: HLC DATE: 02-25-93

VGP: Mar 08 17:15:07 1993 P:CAD1 P:\PLOTS\PA3778A.PLT



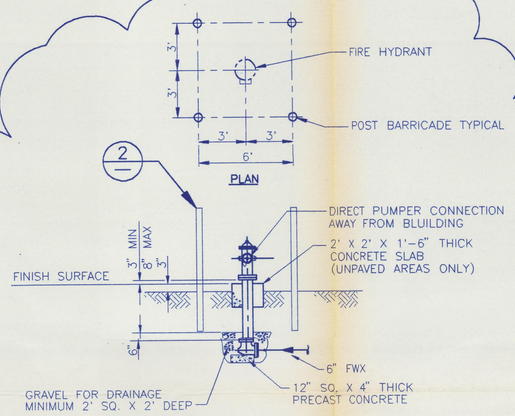
SANITARY SEWER CLEANOUT

DETAIL 1
SCALE: NONE



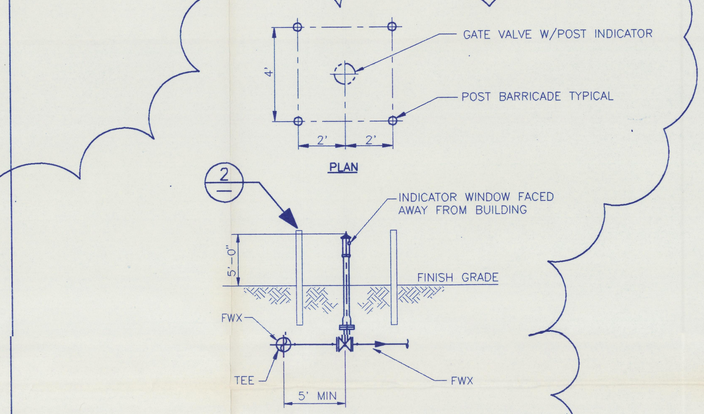
POST BARRICADE

DETAIL 2
SCALE: NONE



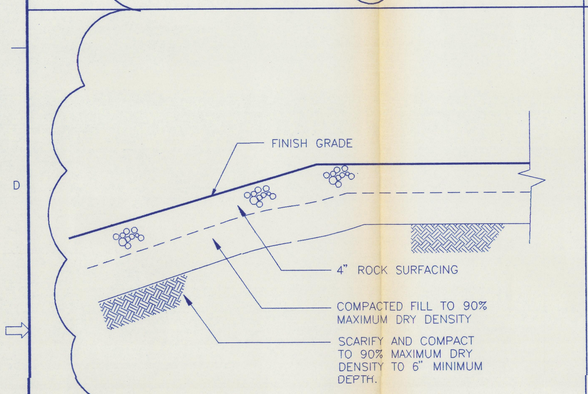
FIRE HYDRANT

DETAIL 3
SCALE: NONE



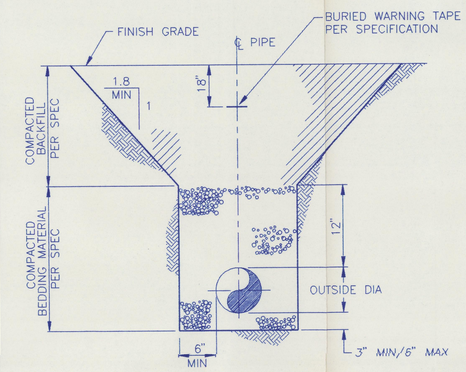
GATE VALVE WITH POST INDICATOR

DETAIL 4
SCALE: NONE



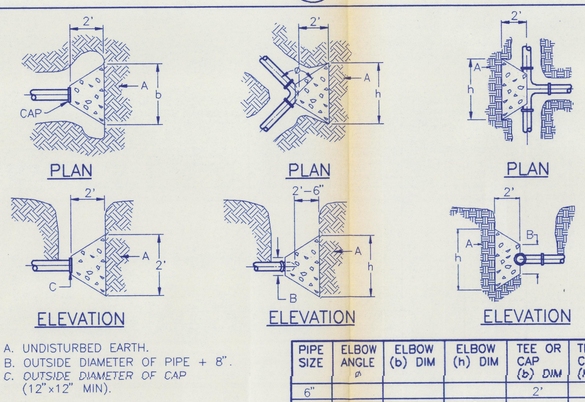
TYPICAL ROCK SURFACING

DETAIL 5
SCALE: NONE



TYPICAL PIPE TRENCH DETAIL

DETAIL 6
SCALE: NONE

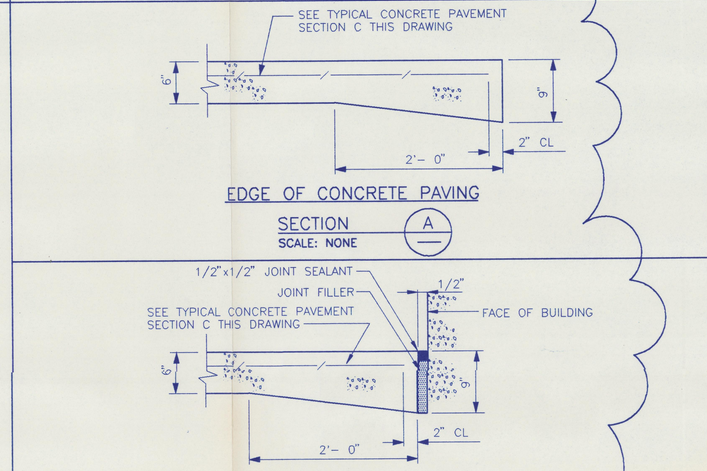


A. UNDISTURBED EARTH.
B. OUTSIDE DIAMETER OF PIPE + 8".
C. OUTSIDE DIAMETER OF CAP (12"x12" MIN).

THRUST BLOCKS

DETAIL 7
SCALE: NONE

PIPE SIZE	ELBOW ANGLE ø	ELBOW (b) DIM	ELBOW (h) DIM	TEE OR CAP (b) DIM	TEE OR CAP (h) DIM
6"				2'	2'
6"	30°,45°,60°	2'	2'		
6"	90°	2'-6"	2'-6"		
8"				3'	3'
8"	90° 60°	3'	3'		
8"	45°	2'-6"	2'-6"		
8"	30°	2'	2'		
10"				3'	3'
10"	90° 60°	3'-6"	3'-6"		
10"	45°	3'	3'		
10"	30°	3'	3'		

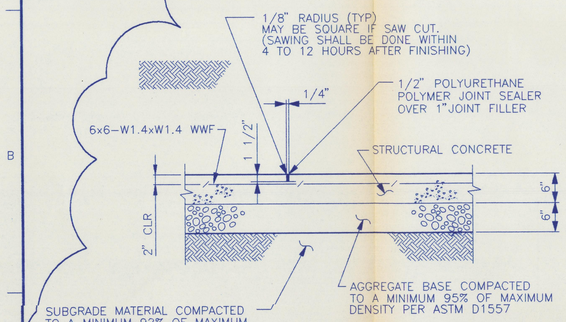


EDGE OF CONCRETE PAVING

SECTION A
SCALE: NONE

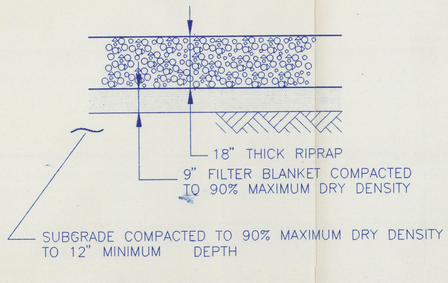
TYPICAL EXPANSION JOINT

SECTION B
SCALE: NONE



TYPICAL CONCRETE PAVEMENT SECTION

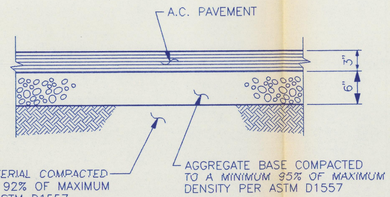
SECTION C
SCALE: NONE



NOTE:
RIPRAP SHALL BE INSTALLED PER SPECIFICATION B-595-C-A130, SECTION 02720.

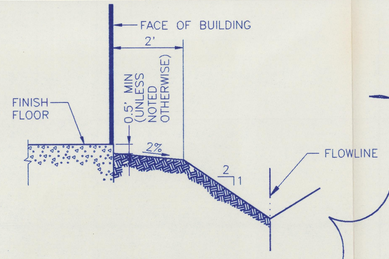
TYPICAL RIP-RAP SECTION

SECTION D
SCALE: NONE



TYPICAL ASPHALT PAVEMENT SECTION

SECTION E
SCALE: NONE



TYPICAL GRADING @ BUILDING FACE

SECTION F
SCALE: NONE

NOTES

1. SEE DRAWING H-2-117077 FOR ABBREVIATIONS, LEGEND, AND GENERAL NOTES.

HOLD NO. 248
NOTE: REFERENCE CR 0881, FAB SHOP RELOCATION

MAR 1 1 1993

QUALITY LEVEL II
SAFETY CLASS 4

REV NO.	DATE	REVISION DESCRIPTION	APPROVAL INITIALS
0	3/10/93	APPROVED FOR CONSTRUCTION	RBE HLC

DWG NO.	DRAWING TITLE
H-2-116030	FAB SHOP AND SUPPORT FACILITIES DWG INDEX

REFERENCE DRAWINGS

NEXT USED ON

CADFILE B117079A CADCODE 2B:IBM:ACD2:TO:C2:SS

ENGINEERING RELEASE
REV ____ DATE ____
ERO ____

SIGNATURE	DATE
PROJ DIR	
QA MGR	
INDEPENDENT SAFETY MGR	
PROJECT MGR	
SYSTEMS MGR	
ENGINEERING MGR	
SUPERVISOR J. Rand	3/8/93
DESIGN ENGINEER H. Chang	3/10/93
CHECKED J. Lesenbiere	3/10/93
DRAWN H. CHANG	02-25-93

U.S. DEPARTMENT OF ENERGY
Richland Field Office
DE - AC06-89RL10838

FLUOR DANIEL, INC.
ADVANCED TECHNOLOGY DIVISION

CIVIL
SECTIONS AND DETAILS

PROJECT TITLE: HANFORD WASTE VITRIFICATION PLANT

PROJECT	FLUOR CONTRACT NO.	CWBS NO.
B-595	8457	A920

SCALE	BLDG NO.	INDEX NO.
1" =40'		

CLASSIFICATION	BY	DRAWING NUMBER	SHEET	OF	REV
NONE	NOT REQD	H-2-117079	1	1	0

A920 H-2-117079 0 1 1 AFC

DISTRIBUTION CODE: 053 C3 ACAD INITIALS: HLC DATE: 02-25-93

Fri Mar 05 14:57:20 1993 P:\CADD\PAA37-H79.PLT

ABBREVIATIONS

&	AND
@	AT
AC	ALTERNATING CURRENT
AFF	ABOVE FINISH FLOOR
ALUM	ALUMINUM
ARCH	ARCHITECTURAL
BLDG	BUILDING
BOS	BOTTOM OF STEEL
℄	CENTERLINE
CLG	CEILING
COL	COLUMN
CONC	CONCRETE
CONSTR	CONSTRUCTION
CONT	CONTINUOUS
COR	CORRIDOR
CT	CERAMIC TILE
CWBS	CONTRACT WORK BREAKDOWN STRUCTURE
DBL	DOUBLE
DC	DIRECT CURRENT
DIA	DIAMETER
DN	DOWN
DOE	DEPARTMENT OF ENERGY
DWG	DRAWING
EA	EACH
EMER	EMERGENCY
EQUIP	EQUIPMENT
EXT	EXTERIOR
FAB	FABRICATION
FED-STD	FEDERAL STANDARD
FF	FINISH FLOOR
FIN	FINISH
FLR	FLOOR
GALV	GALVANIZED
GEN	GENERAL
GFE	GOVERNMENT FURNISHED EQUIPMENT
HPT	HIGH POINT
HR	HOUR
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING
LAN	LOCAL AREA NETWORK
<	LESS THAN
LPT	LOW POINT
MAX	MAXIMUM
MGR	MANAGER
MIN	MINIMUM
N	NORTH
NEC	NATIONAL ELECTRICAL CODE
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NO.	NUMBER
OC	ON CENTER
PABX	PRIVATE AUTOMATIC BRANCH EXCHANGE
RCVG	RECEIVING
REF	REFERENCE
REQD	REQUIRED
REV	REVISION
RM	ROOM
RSG	RIGID STEEL GALVANIZED
SF	SQUARE FEET
STOR	STORAGE
TOS	TOP OF STEEL
TYP	TYPICAL
UBC	UNIFORM BUILDING CODE
UFC	UNIFORM FIRE CODE
UMC	UNIFORM MECHANICAL CODE
UNO	UNLESS NOTED OTHERWISE
UPC	UNIFORM PLUMBING CODE
UPS	UNINTERRUPTABLE POWER SUPPLY
W	WEST
W/	WITH
WHSE	WAREHOUSE

GENERAL NOTES

1.0 GENERAL

1.1 BUILDING MATERIALS AND CONSTRUCTION SHALL CONFORM TO BUILDING SPECIFICATION B-595-A920-13121 AND APPLICABLE CODES.

1.2 FINISH FLOORS SHALL BE A MINIMUM OF 6" ABOVE ADJACENT FINISH GRADE. REFER TO DRAWING H-2-117078 FOR FINISHED FLOOR ELEVATIONS, BUILDING COORDINATES AND LOCATION OF PERMANENT BENCH MARKS. ALSO SEE CWBS A160 FOR APPLICABLE UTILITY POINT OF CONNECTIONS TO THE FABRICATION SHOP.

1.3 AUTOMATIC FIRE SPRINKLERS SHALL BE PROVIDED THROUGHOUT ALL BUILDINGS WITH A FIRE ALARM PANEL TO BE CONNECTED TO THE HANFORD SITE FIRE DEPARTMENT.

1.4 STRUCTURAL STEEL FRAMING SYSTEM SHOWN ON DRAWINGS REPRESENTS CONCEPTUAL DESIGN. THE SELLER SHALL SELECT TYPE OF STRUCTURAL STEEL FRAMING SYSTEM FOR FINAL DESIGN.

1.5 PAINT COLORS ARE TO BE IN ACCORDANCE WITH THE SCHEDULE BELOW.

1.6 FIRE HOSE CABINETS AND FIRE EXTINGUISHER AND CABINETS SHALL BE PROVIDED AS REQUIRED.

1.7 ALL PERSONNEL DOORS SHALL BE 3'-0" X 7'-0" WITH 1/4" THICK WIRE GLASS VISION PANEL NOT GREATER THAN 100 SQUARE INCHES IN METAL FRAMES.

2.0 FABRICATION SHOP

2.1 BUILDING FINISHES SHALL BE CONCRETE FLOOR WITH SEALER/HARDENER, PAINTED EXPOSED STRUCTURE/METAL LINER PANELS AT WALLS & UNDERSIDE OF ROOF STRUCTURE AT HIGH BAY.

2.2 OVERHEAD COILING DOORS SHALL HAVE THERMAL BARRIERS TO PREVENT CONDENSATION.

PAINT SCHEDULE

PAINT NO.	BUILDING ELEMENT	COLOR	FED-STD-595B
1	EXTERIOR ROOF, RAKE, TRIM & GUTTER	BLUE	COLOR NO. 15187
2	EXTERIOR SIDING, DOWNSPOUTS, AND INTERIOR WALL AND ROOF LINER PANELS	LIGHT GRAY	COLOR NO. 27722
3	EXTERIOR & INTERIOR METAL DOORS & FRAMES	MEDIUM GRAY	COLOR NO. 16492
4	INTERIOR COLUMNS, BEAMS, AND STRUCTURAL BRACING	LIGHT YELLOW	COLOR NO. 13618

PAINT NOTE:

1. STEEL PIPE BOLLARDS (GUARDPOSTS) SHALL BE PAINTED FED-STD-595B, COLOR NO. 13655, YELLOW.

BUILDING DATA

APPLICABLE CODES:

1988 UBC, UPC, UMC, UFC, NFPA 101, NEC (1990 NFPA 70), AND ANSI A117.1.

FABRICATION SHOP

CONSTRUCTION TYPE: II-N
OCCUPANCY: B-4
ALLOWABLE FLOOR AREA PER TABLE 5-C = 18,000 SF

SIDE YARD SEPARATION: OVER 60' ON ALL 4 SIDES
AUTOMATIC FIRE SPRINKLER SYSTEM: YES

PER UBC CHAPTER 5, SECTION 506(b)
ALLOWABLE FLOOR AREA = UNLIMITED

ACTUAL FLOOR AREA = 44,523 SF

TOTAL = 44,523 SF < UNLIMITED

REFERENCE SYMBOLS

BUILDING SECTION REFERENCE OR WALL SECTION REFERENCE — A / SK-2-XXXXX / 1 — SECTION LETTER/NUMBER; DRAWING NUMBER WHERE SECTION IS SHOWN; SHEET NUMBER

DETAIL REFERENCE — 1 — DETAIL NUMBER; DENOTE DETAIL IS DRAWN ON THE SAME SHEET AS IDENTIFICATION SYMBOL

BUILDING SECTION REFERENCE — SECTION — A / SK-2-XXXXX / 1 — SECTION LETTER/NUMBER; DRAWING NUMBER WHERE SECTION IS SHOWN; SHEET NUMBER

1 / A — COLUMN GRID

1 — PAINT NUMBER

EXIT SIGN

MAR 1 1 1993

REV NO.	DATE	REVISION DESCRIPTION	APPROVAL INITIALS
0	3/10/93	APPROVED FOR CONSTRUCTION	JLD JLD

CADFILE SK91458A — CADCODE 2B:IBM:ACD2:10.C2:SS

ENGINEERING RELEASE
REV _____ DATE _____
ERO _____

SIGNATURE	DATE
PROJ DIR	
QA MGR	
INDEPENDENT SAFETY MGR	
PROJECT MGR	
SYSTEMS MGR	
ENGINEERING MGR	
SUPERVISOR J. T. Watts	3/8/93
DESIGN ENGINEER G. Sam	3/8/93
CHECKED J. T. Watts	3/8/93
DRAWN S. SAM	11/23/92

U.S. DEPARTMENT OF ENERGY
Richland Field Office
DE - AC06-86RL10838

FLUOR DANIEL, INC.
ADVANCED TECHNOLOGY DIVISION

ARCHITECTURAL
FAB SHOP
GENERAL NOTES &
ABBREVIATIONS

PROJECT TITLE: HANFORD WASTE VITRIFICATION PLANT

PROJECT	FLUOR CONTRACT NO.	CWBS NO.
B-595	8457	A920

SCALE	BLDG NO.	INDEX NO.
NONE	18	

CLASSIFICATION	BY	DRAWING NUMBER	SHEET	OF	REV
NONE	NOT REQD	SK-2-91458	1	1	0

DWG NO.	DRAWING TITLE
H-2-116030	FAB SHOP AND SUPPORT FACILITIES DWG INDEX
H-2-117154 (CWBS A160)	CIVIL UNDERGROUND UTILITY PLAN

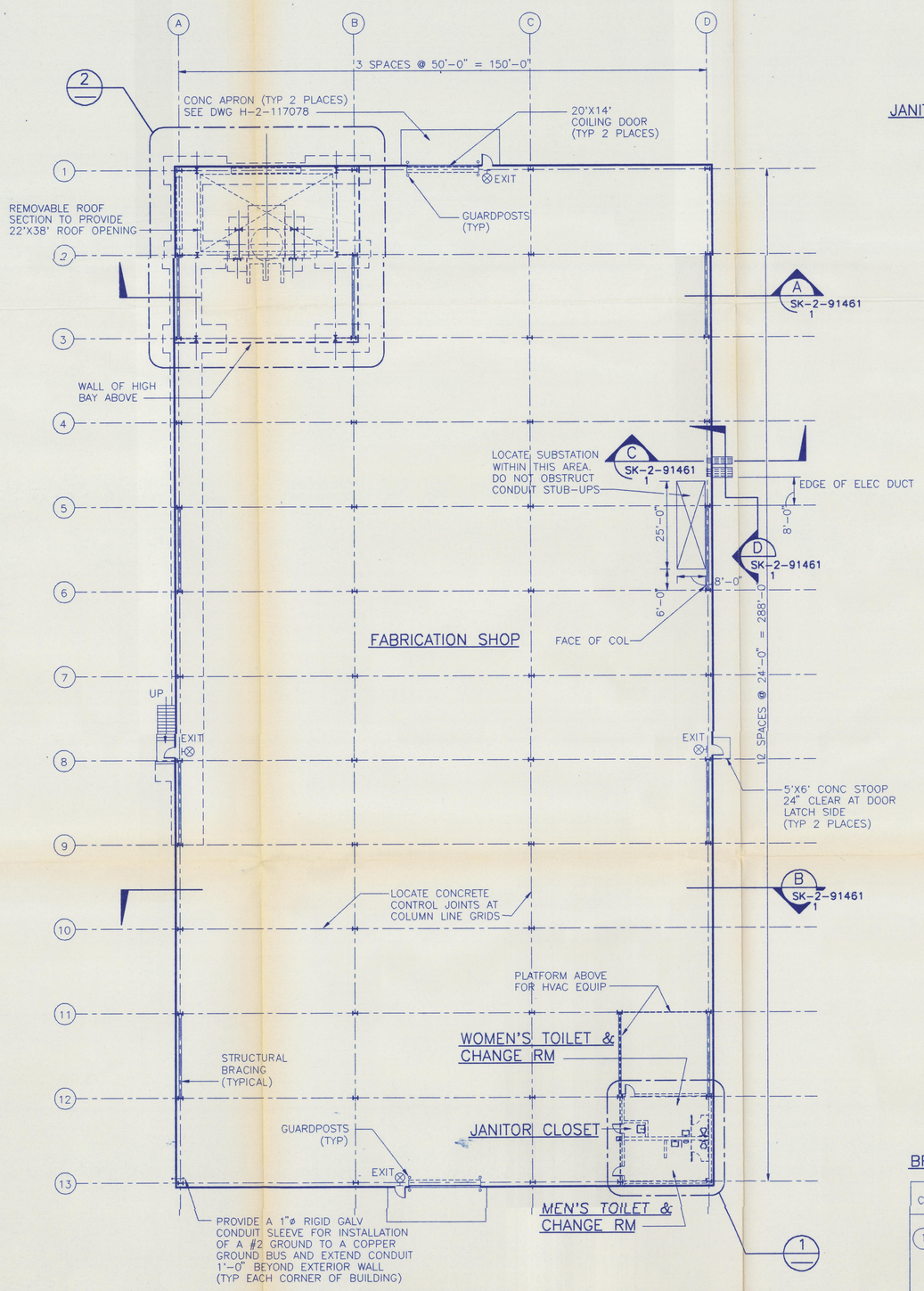
REFERENCE DRAWINGS

NEXT USED ON

920 SK-2-91458 01 1 AFC

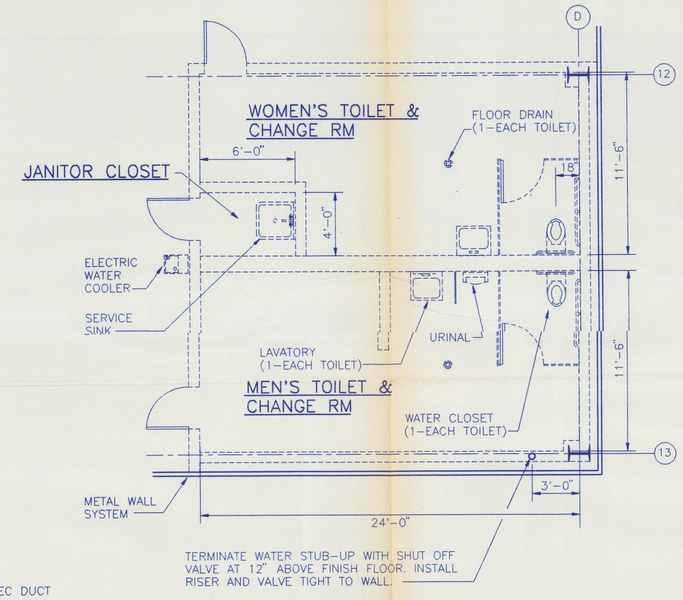
DISTRIBUTION CODE: 301 — A1 — ACAD — INITIALS: SS — DATE: 03/04/93

Mon Mar 08 17:12:41 1993 P:\CAD1 P:\PLOTS\PAA27SC1.PLT



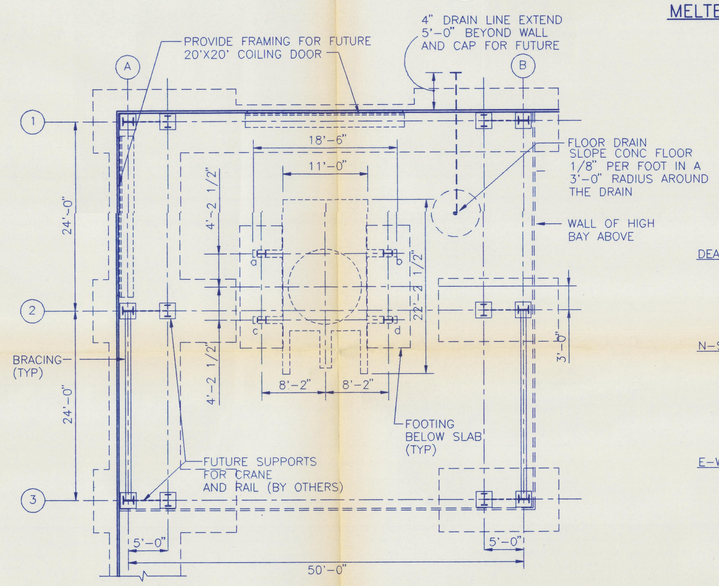
FLOOR PLAN

SCALE : 1/16"=1'-0"



ENLARGED FLOOR PLAN 1

SCALE : 1/4"=1'-0"



ENLARGED FLOOR PLAN (HIGH BAY AREA) 2

SCALE : 1/8"=1'-0"

BRIDGE CRANE SUPPORT REACTIONS AT FOUNDATION

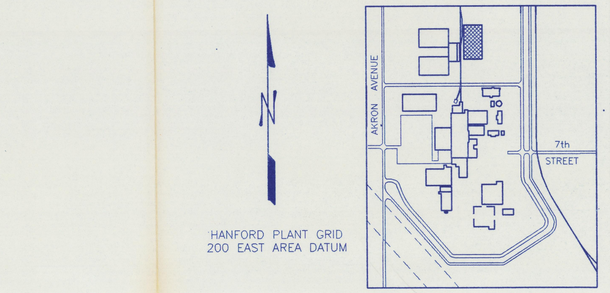
COL LINE	DEAD LOAD (KIP)			LIVE LOAD (KIP)			N-S SEISMIC LOAD (KIP)			E-W SEISMIC LOAD (KIP)		
	E-W	N-S	VERT	E-W*	N-S	VERT*	E-W	N-S	VERT	E-W	N-S	VERT
1 & 3	0	0.3	24.9	7.8	3.8	86.1±68.6	0	±1.8	±5.1	±4.7	0	±40.0
2	0	0.3	27.9	7.8	4.2	80.3±68.6	0	±2.1	0	±4.7	0	±40.0

* LIVE + IMPACT

MAXIMUM BRIDGE CRANE LOADS AT BUILDING COLUMN C1, C2, C3, D1, D2 & D3 AT ROOF DIAPHRAGM

LIVE LOAD (IMPACT) —— $H_{E-W} = 6.42^K$

E-W SEISMIC LOAD —— $H_{E-W} = 3.46^K$



KEY PLAN

SCALE: NONE

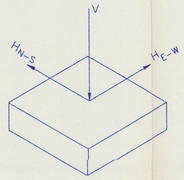
PLUMBING NOTE:

TERMINATE UNDERGROUND SANITARY SEWER ROUGH-IN WITH PLUGGED HUBS FLUSH WITH FLOOR

LEGEND:

- - - - - - INDICATE (BY OTHERS) CONSTRUCTIONS OR BUILDING ELEMENTS UNLESS NOTED OTHERWISE

MELTER SUPPORT FRAME REACTIONS



DEAD LOAD (Z DIRECTION)

$V_a = V_b = V_c = V_d = 51.85$ KIP

$H_{E-W} = 0.044$ KIP

$H_{N-S} = 0.667$ KIP

N-S SEISMIC LOAD (Y DIRECTION)

$V_a = V_b = 63.38$ KIP
$V_c = V_d = -63.38$ KIP } REVERSIBLE

$H_{E-W} = 0$

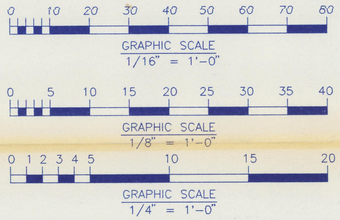
$H_{N-S} = 8.73$ KIP

E-W SEISMIC LOAD (X DIRECTION)

$V_a = V_c = 23.65$ KIP
$V_b = V_d = -23.65$ KIP } REVERSIBLE

$H_{E-W} = 8.86$ KIP

$H_{N-S} = 0$



MAR 1 1 1993

QUALITY LEVEL II
SAFETY CLASS 4

REV NO.	DATE	REVISION DESCRIPTION	APPROVAL INITIALS		
0	3/9/93	APPROVED FOR CONSTRUCTION	JLD	GS	JLD

CADFILE SK91459A CADCODE 2B:IBM:ACD2:10.C2:SS

ENGINEERING RELEASE
REV ____ DATE ____
ERO ____

SIGNATURE	DATE
PROJ DIR	
DA MGR	
INDEPENDENT SAFETY MGR	
PROJECT MGR	
SYSTEMS MGR	
ENGINEERING MGR	
SUPERVISOR J. J. Dutti	3/3/93
DESIGN ENGINEER C. Sam	12/8/92
CHECKED J. J. Dutti	3/3/93
DRAWN S. SAM	11/11/92

U.S. DEPARTMENT OF ENERGY
Richland Field Office
DE - AC06-86RL10838

FLUOR DANIEL, INC.
ADVANCED TECHNOLOGY DIVISION

ARCHITECTURAL
FAB SHOP
FLOOR PLAN

PROJECT TITLE: HANFORD WASTE VITRIFICATION PLANT

PROJECT	FLOOR CONTRACT NO.	CWBS NO.
B-595	8457	A920

SCALE	BLDG NO.	INDEX NO.
SHOWN	18	

CLASSIFICATION	BY	DRAWING NUMBER	SHEET	OF	REV
NONE	NOT REQD	SK-2-91459	1	1	0

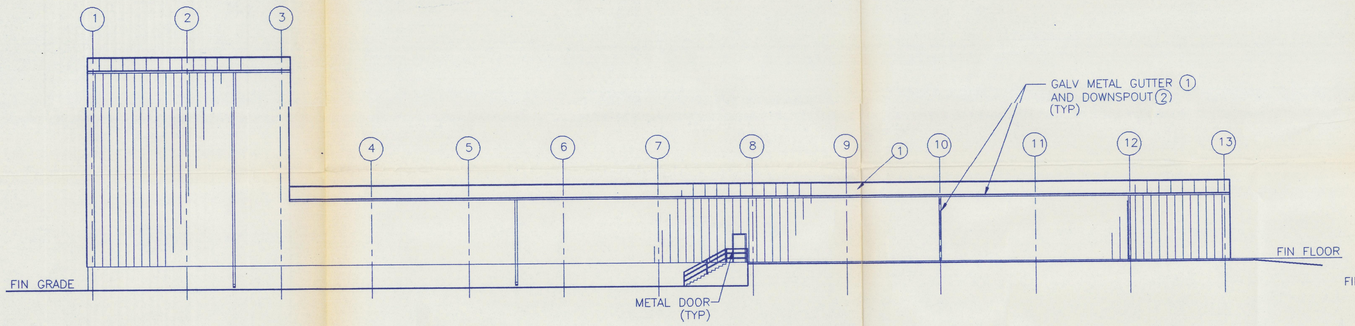
DWG NO.	DRAWING TITLE
H-2-116030	FAB SHOP AND SUPPORT FACILITIES DWG INDEX

REFERENCE DRAWINGS

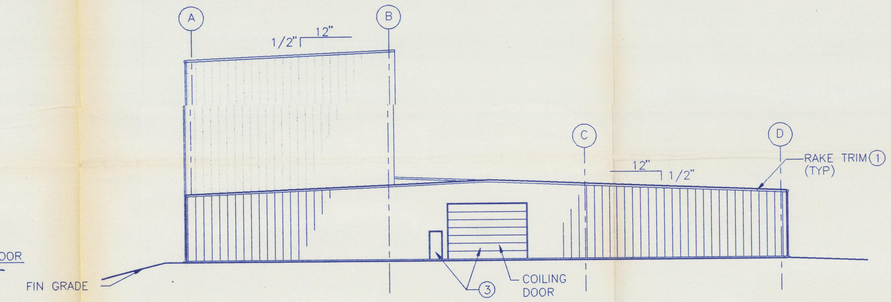
NEXT USED ON

9 2 0 SK-2-91459 0 1 1 A F C

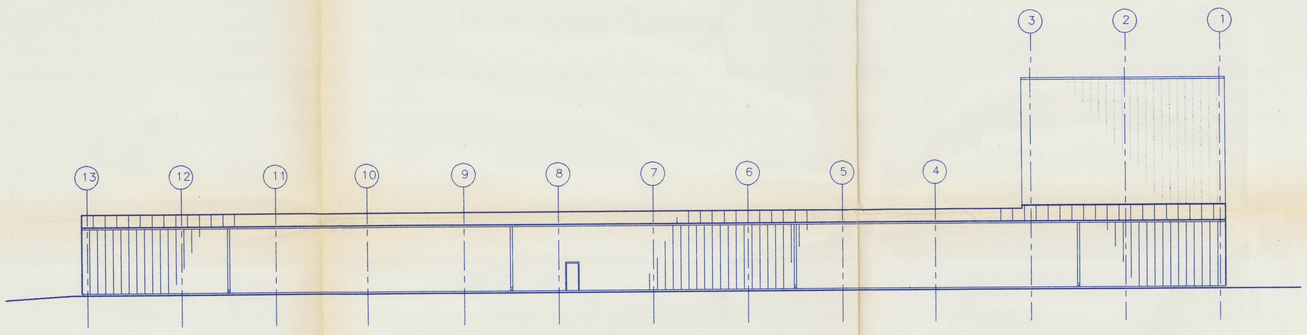
DISTRIBUTION CODE: 301 A2 ACAD INITIALS: SS DATE: 03/04/93



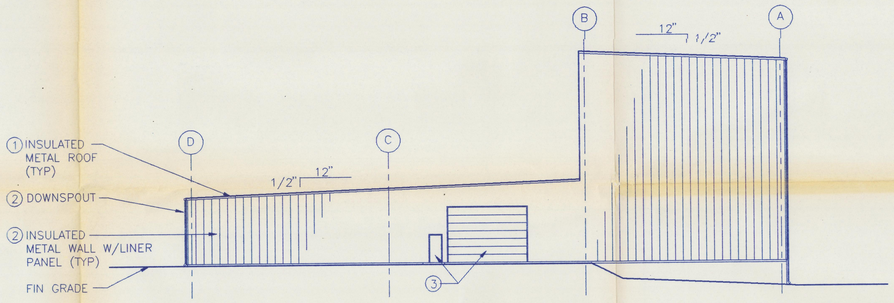
WEST ELEVATION



SOUTH ELEVATION



EAST ELEVATION



NORTH ELEVATION

0 10 20 30 40 50 60 70 80
GRAPHIC SCALE
1/16" = 1'-0"

MAR 1 1 1993

QUALITY LEVEL II
SAFETY CLASS 4

REV NO.	DATE	REVISION DESCRIPTION	APPROVAL INITIALS			
0	3/10/93	APPROVED FOR CONSTRUCTION	JLD		JLD	

CADFILE SK91460A CADCODE 2B:IBM:ACD2:10.C2:SS

ENGINEERING RELEASE
REV _____ DATE _____
ERO _____

SIGNATURE	DATE
PROJ DIR	
QA MGR	
INDEPENDENT SAFETY MGR	
PROJECT MGR	
SYSTEMS MGR	
ENGINEERING MGR	
SUPERVISOR J T Dutto	3/8/93
DESIGN ENGINEER	3/8/93
CHECKED J T Dutto	3/8/93
DRAWN S. SAM	11/11/92

U.S. DEPARTMENT OF ENERGY
Richland Field Office
DE - AC06-86RL10838

FLUOR DANIEL, INC.
ADVANCED TECHNOLOGY DIVISION

ARCHITECTURAL
FAB SHOP
EXTERIOR ELEVATIONS

PROJECT TITLE: HANFORD WASTE VITRIFICATION PLANT

PROJECT	FLUOR CONTRACT NO.	CWBS NO.
B-595	8457	A920
SCALE 1/16" = 1'-0"	BLDG NO. 18	INDEX NO.

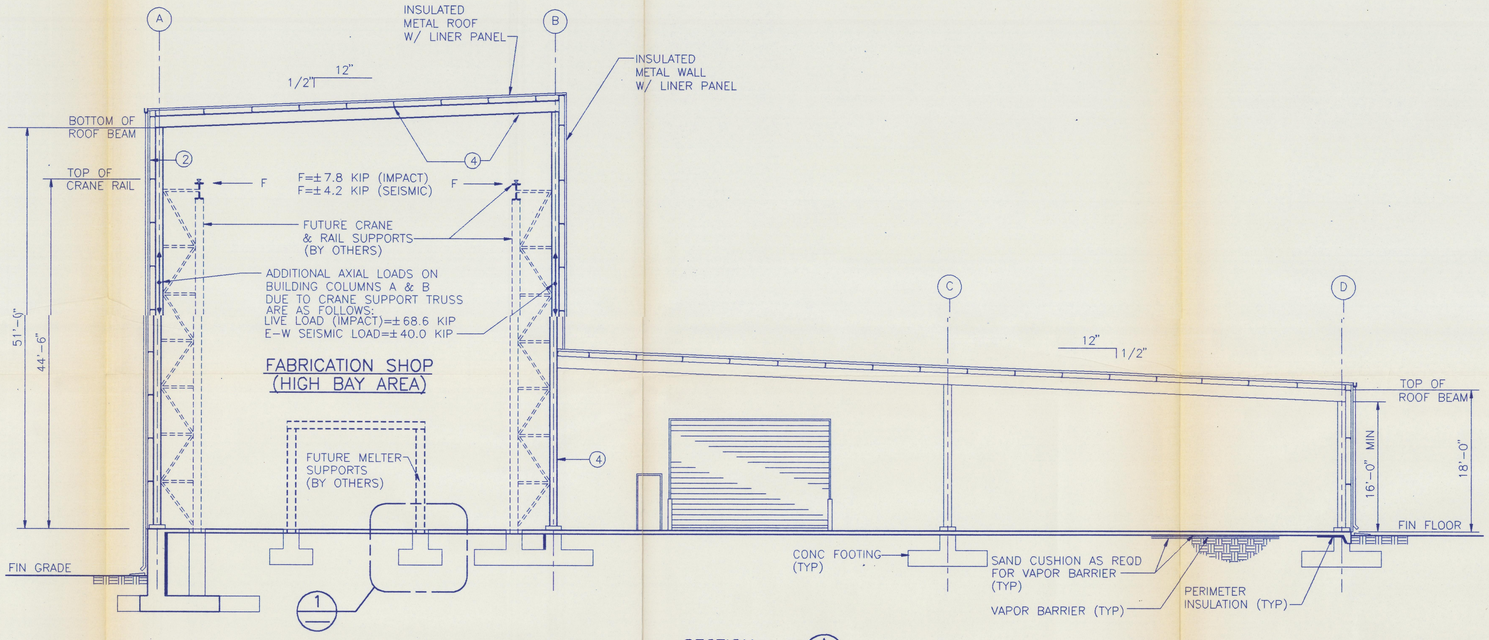
CLASSIFICATION	BY	DRAWING NUMBER	SHEET	OF	REV
NONE	NOT REQD	SK-2-91460	1	1	0

DWG NO.	DRAWING TITLE
H-2-116030	FAB SHOP AND SUPPORT FACILITIES DWG INDEX
REFERENCE DRAWINGS	
NEXT USED ON	

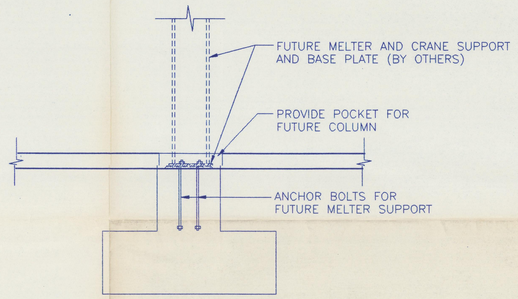
920 SK-2-91460 0 1 1 AFC

DISTRIBUTION CODE: 301 A3 ACAD INITIALS: SS DATE: 03/04/93

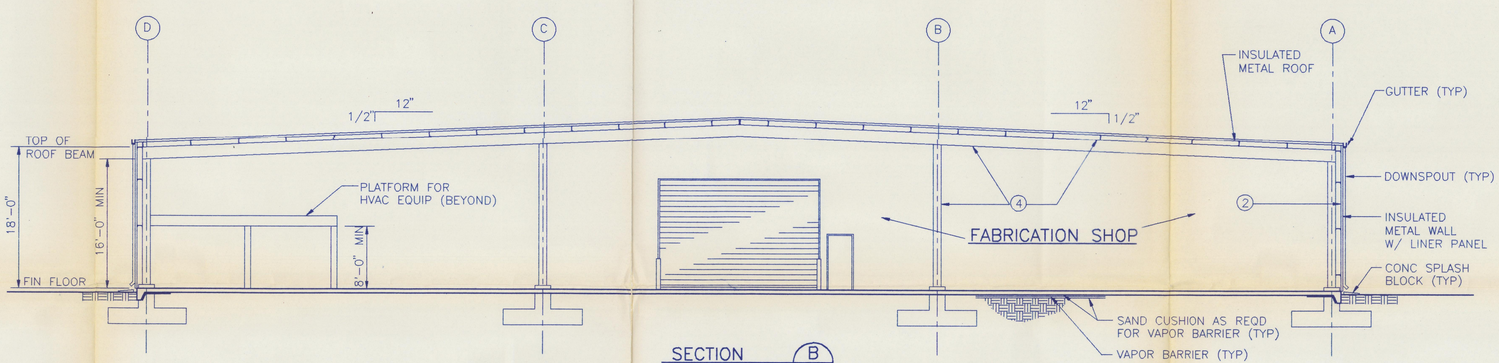
TRY MAR 04 15:58:58 1993 B:CAD2 G:\PLOTS\PAA275GC.PLT



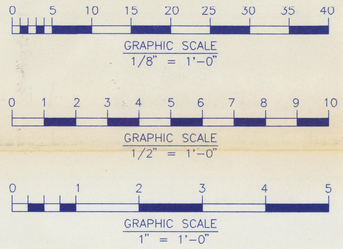
SECTION A
SCALE : 1/8"=1'-0" SK-2-91459 1



DETAIL 1
SCALE : 1/2"=1'-0"

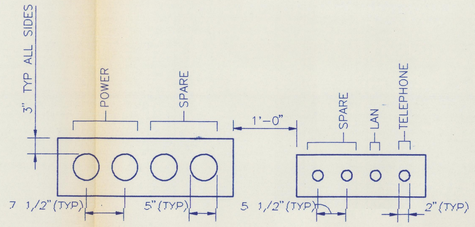


SECTION B
SCALE : 1/8"=1'-0" SK-2-91459 1

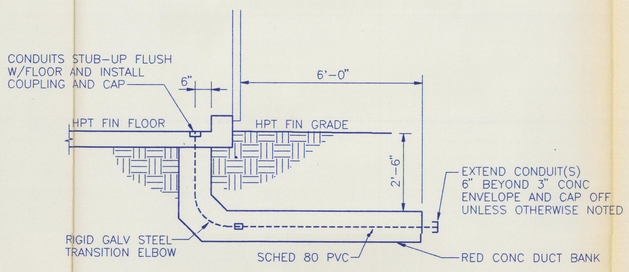


MAR 1 1 1993

QUALITY LEVEL II
SAFETY CLASS 4



SECTION D
SCALE : 1"=1'-0" SK-2-91459 1



SECTION C
SCALE : 1/2"=1'-0" SK-2-91459 1

ELECTRIC

REV NO.	DATE	REVISION DESCRIPTION	APPROVAL INITIALS		
0	3/4/93	APPROVED FOR CONSTRUCTION	JCD	SS	JCD

CADFILE SK91461A CADCODE 2B:IBM:ACD2:10.C2:SS

ENGINEERING RELEASE
REV _____ DATE _____
ERO _____

SIGNATURE	DATE
PROJ DIR	
QA MGR	
INDEPENDENT SAFETY MGR	
PROJECT MGR	
SYSTEMS MGR	
ENGINEERING MGR	
SUPERVISOR J.T. Datta	3/8/93
DESIGN ENGINEER S. Sam	
CHECKED J.T. Datta	3/8/93
DRAWN S. SAM	11/11/92

U.S. DEPARTMENT OF ENERGY
Richland Field Office
DE - AC06-86RL10838

FLUOR DANIEL, INC.
ADVANCED TECHNOLOGY DIVISION

ARCHITECTURAL
FAB SHOP
BLDG SECTIONS

PROJECT TITLE: HANFORD WASTE VITRIFICATION PLANT

PROJECT	FLUOR CONTRACT NO.	CWBS NO.
B-595	8457	A920

SCALE	BLDG NO.	INDEX NO.
SHOWN	18	

CLASSIFICATION	BY	DRAWING NUMBER	SHEET	OF	REV
NONE	NOT REQD	SK-2-91461	1	1	0

DWG NO.	DRAWING TITLE
H-2-116030	FAB SHOP AND SUPPORT FACILITIES DWG INDEX
REFERENCE DRAWINGS	
NEXT USED ON	

920 SK-2-91461 0 1 1 AFC

DISTRIBUTION CODE: 301 A4 ACAD INITIALS: SS DATE: 03/04/93

0030894

FABRICATION SHOP
A D SUPPORT FACILITIES
B-595-C-A920
REVISION 0

SPECIFICATIONS

9413202.1391

HANFORD WASTE VITRIFICATION PLANT

U.S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE

FLUOR DANIEL
ADVANCED TECHNOLOGY DIVISION
CONTRACT 8457

DOE CONTRACT NO.
DE-AC06-86RL10838

DATE 03/15/93
CONTRACT 80845734

Time: 1:56 PM

HANFORD WASTE VITRIFICATION PLANT
COORDS LISTING OF DRAWINGS FOR PKG A920

DISC	PACKAGE	DRAWING NUMBER	SHT NO.	REV	SIGNATURE DATE	DRAWING TITLE	REMARKS
05	A920	H-2-117077	1	0	03/10/93	CIVIL INFORMATION SHEET	ALL DESIGN INFORMATION ON HOLD
05	A920	H-2-117078	1	0	03/10/93	CIVIL FINISH GRADING, PAVING AND DRAINAGE PLAN	ALL DESIGN INFORMATION ON HOLD
05	A920	H-2-117079	1	0	03/10/93	CIVIL SECTIONS AND DETAILS	ALL DESIGN INFORMATION ON HOLD
30	A920	H-2-116029	1	0	03/10/93	FAB SHOP AND SUPPORT FACILITIES TITLE SHEET	SQCK AS SK-2-91456
30	A920	H-2-116030	1	0	03/10/93	FAB SHOP AND SUPPORT FACILITIES SITE PLAN AND DRAWING INDEX	SQCK AS SK-2-91457
30	A920	SK-2-91458	1	0	03/10/93	ARCHITECTURAL FAB SHOP GENERAL NOTES & ABBREVIATIONS	ALL DESIGN INFORMATION ON HOLD
30	A920	SK-2-91459	1	0	03/10/93	ARCHITECTURAL FAB SHOP FLOOR PLAN	ALL DESIGN INFORMATION ON HOLD
30	A920	SK-2-91460	1	0	03/10/93	ARCHITECTURAL FAB SHOP EXTERIOR ELEVATIONS	ALL DESIGN INFORMATION ON HOLD
30	A920	SK-2-91461	1	0	03/10/93	ARCHITECTURAL FAB SHOP BLDG SECTIONS	ALL DESIGN INFORMATION ON HOLD

TOTAL: 9

Records printed: 9

9413202.1393

DATE 03/15/93
CONTRACT 80845734

Time: 1:44 PM

HANFORD WASTE VITRIFICATION PLANT
COORDS LISTING OF SPECIFICATION FOR PKG A920

DISC	PACKAGE	SPEC NUMBER	PKG REV	SPECIFICATION TITLE	SEC REV	SECTION	SECTION TITLE	REMARKS
	A920	B-595-C-A920	0	SHOP SUPPORT FACILITIES				
30					0	01730	OPERATION AND MAINTENANCE DATA	
05					0	02100	SITE IMPROVEMENTS	
05					0	02220	EXCAVATION AND BACKFILL	
30					0	13121	FABRICATION SHOP BUILDING	
60					0	16312	13.8 KV-480Y/277 VOLT UNIT SUBSTATION	

TOTAL: 6

Records printed: 6

00/PIPING & INSTRUMENT DIAGRAMS, 05/CIVIL, 10/HVAC, 20/STRUCTURAL, 30/ARCHITECTURAL, 40/MECHANICAL, 50/PIPING, 51/FIRE PROTECTION, 60/ELECTRICAL, 70/CONTROL SYSTEMS, 90/MISCELLANEOUS

CONSTRUCTION/PROCUREMENT PACKAGE - A920
03/15/93

LIST OF SUPPORT DOCUMENTS:

SPECIFICATION SECTION	02220	EXCAVATION AND BACKFIRE
SPECIFICATION SECTION	03346	READ-MIXED CONCRETE PRODUCTION AND DELIVERY
SPECIFICATION SECTION	16640	CATHODIC PROTECTION (SACRIFICIAL ANODE)

9413202.1394

LIST OF REFERENCE DRAWINGS:

DWG NO.	REF. CWBS NO.	REF. DRAWING NO.	REV. NO.	REF. DRAWING TITLE
H-2-117077	A920	H-2-116030	0	FAB SHOP AND SUPPORT FACILITIES DWG INDEX
H-2-117078	A130	H-2-117011	1	DWG INDEX
H-2-117078	A160	H-2-117150	1A	DWG INDEX
H-2-117078	A920	H-2-116030	0	FAB SHOP AND SUPPORT FACILITIES DWG INDEX
H-2-117079	A920	H-2-116030	0	FAB SHOP AND SUPPORT FACILITIES DWG INDEX
H-2-116030	A160	H-2-117154	1	CIVIL UNDERGROUND UTILITY PLAN
SK-2-91458	A160	H-2-117154	1	CIVIL UNDERGROUND UTILITY PLAN

U.S. DEPARTMENT OF ENERGY
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.
Advanced Technology Division
Fluor Contract 8457

FABRICATION SHOP AND SUPPORT FACILIES SPECIFICATION B-595-C-A920

APPROVED FOR CONSTRUCTION

REVISION 0

ISSUE DATE 3-10-93

APPROVED BY:

Roger Charles Roman R. C. Roman	Project Package Engineer	MARCH 8, 93 Date
E R Jacobs E. R. Jacobs	Area Project Manager	3-8-93 Date
Paul J. Speidel P. J. Speidel	Engineering Project Manager	3-8-93 Date
for JLS J. L. Smets	Systems Manager	3/8/93 Date
Maurice J. Higuera for AKY A. K. Yee	Independent Safety Manager	3/8/93 Date
Barry Rittberg for JGK J. G. Kelley	Quality Assurance Manager	3/9/93 Date
for R. S. Poulter	Project Director	3/10/93 Date

MAR 1 2 1993

9413202.1395

FABRICATION SHOP AND SUPPORT FACILITIES
B-595-C-A920

TABLE OF CONTENTS
TECHNICAL SPECIFICATIONS

9413202.1396

DIVISION 1 - GENERAL REQUIREMENTS

Section	Title	Rev.
01730	Operation and Maintenance Data	0

DIVISION 2 - SITE WORK

Section	Title	
02100	Site Improvements	0
02220	Excavation and Backfill	0

DIVISION 13 - SPECIAL CONSTRUCTION

Section	Title	
13121	Fabrication Shop Building	0

DIVISION 16 - ELECTRICAL

Section	Title	
16312	13.8 kV-480Y/277 Volt Unit Substation	0

MAR 1 2 1993

U.S. DEPARTMENT OF ENERGY
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.
Advanced Technology Division
Fluor Contract 8457

SECTION 01730
OPERATION AND MAINTENANCE DATA
B-595-C-A920-01730

APPROVED FOR CONSTRUCTION

9413202.1397

REVISION 0
ISSUE DATE 3-10-93

WAPA YES ___ NO X
QUALITY LEVEL I ___ II X
SAFETY CLASS 1__ 2__ 3__ 4X

ORIGINATOR:

J. R. Morey, Specification Writer Date

CHECKER:

S. C. Sam, Architect 3/8/93 Date

MAR 1 2 1993

APPROVED BY:

J. L. Datte Architectural Lead 3/8/93 Date

SECTION 01730
OPERATION AND MAINTENANCE DATA
B-595-C-A920-01730

TABLE OF CONTENTS

PART		PAGE
PART 1	GENERAL	1
1.1	SUBMISSION OF OPERATION AND MAINTENANCE DATA	1
1.2	TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES	1
1.3	SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES	5
PART 2	PRODUCTS	6
PART 3	EXECUTION	6

9413202.1398

9413202.1399

SECTION 01730
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit operation and maintenance (O&M) data which is specifically applicable to this contract and a complete and concise depiction of the provided equipment or product. Data containing extraneous information to be sorted through to find applicable instructions will not be accepted. Present information in sufficient detail to clearly explain user O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit the following in accordance with the Vendor Drawing and Data Requirements section of the Order/ Subcontract.

1.1.1 Package Content

For each product, system, or piece of equipment requiring submission of O&M data, submit the package required in the individual technical section. Package content shall be as required in the Paragraph 1.3, "Schedule of Operations and Maintenance Data Packages."

1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.2.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation:

1.2.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.2.1.2 Operator Prestart

Include requirements to set up and prepare each system for use.

1.2.1.3 Start-Up, Shutdown, and Post-Shutdown Procedures

Include a control sequence for each of these operations.

1.2.1.4 Normal Operations

Include control diagrams with data to explain operation and control of systems and specific equipment.

1.2.1.5 Emergency Operations

Include emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.

1.2.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.

1.2.1.7 Environmental Conditions

Include a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

1.2.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1.2.2.1 Lubrication Data

Include lubrication data, other than instructions for lubrication in accordance with Paragraph 1.2.1.6, Operator Service Requirements.

1.2.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance man-hours on a daily, weekly, monthly, and annual basis.

1.2.3 Corrective Maintenance

Include manufacturer's recommendations on procedures and instructions for correcting problems and making repairs.

9413202.1400

9413202.1401

1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation numbering.

1.2.3.3 Maintenance and Repair Procedures

Include instructions and list tools required to restore product or equipment to proper condition or operating standards.

1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays.

1.2.3.6 Corrective Maintenance Man-Hours

Include manufacturer's projection of corrective maintenance man-hours. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

1.2.4 Appendices

Provide information specified in the preceding paragraphs pertinent to the maintenance or operation of the product or equipment. Include the following:

9413202.1402

1.2.4.1 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

A. Manufacturer's Standard Commercial Practice: The parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice.

B. Other Than Manufacturer's Standard Commercial Practice (MSCP): End item manufacturer may add a cross-reference to implement components' assemblies and parts requirements when implementation in manual form varies significantly from the style, format, and method of manufacturer's standard commercial practice. Use the format in the following example:

End Item Manufacturer's Alphanumeric Sequence	Actual Manufacturer's Name and MSCP	Actual Manufacturer Part No.
100001	John Doe & Co. 00000	2000002

1.2.4.2 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.

1.2.4.3 Personnel Training Requirements

Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.

1.2.4.4 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.3 **SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES**

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.3.1 Data Package

A. Operating instructions

B. Safety precautions

C. Operation prestart

D. Start-up, shutdown, and post shutdown

E. Normal operations

F. Emergency operations

G. Operator Service Requirements

H. Environmental conditions

I. Preventative maintenance

J. Lubrication data

K. Preventive maintenance plan and schedule

L. Corrective maintenance

M. Troubleshooting guides and diagnostic techniques

N. Wiring diagrams and control diagrams

O. Maintenance and repair procedures and manhour requirements

P. Removal and replacement instructions

Q. Spare parts and supply list

R. Parts identification

S. Warranty information

T. Personnel training requirements

U. Testing equipment and special tool information

9413202.1403

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION

94132021.1904

U.S. DEPARTMENT OF ENERGY
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.
Advanced Technology Division
Fluor Contract 8457

SECTION 02100
SITE IMPROVEMENTS
B-595-C-A920-02100

(HOLD NO. 251)

APPROVED FOR CONSTRUCTION

9413202.1405

REVISION 0
ISSUE DATE 3-10-93

WAPA YES ___ NO X
QUALITY LEVEL I ___ II X
SAFETY CLASS 1__ 2__ 3__ 4 X

ORIGINATOR:

Bruce R. Eisenbise 3/8/93
B. R. Eisenbise, Civil Engineer Date

CHECKER:

S. A. Runk 3/8/93
S. A. Runk, Lead Discipline Eng. Date

APPROVED BY:

MAR 1 2 1993

S. A. Runk 3/8/93
S. A. Runk, Lead Discipline Engineer Date

9413202.1406

SECTION 02100
SITE IMPROVEMENTS
B-595-C-A920-02100

TABLE OF CONTENTS

PART		PAGE
PART 1	**GENERAL**	1
1.1	SUMMARY	1
1.2	REFERENCES	1
1.3	RELATED REQUIREMENTS	6
1.4	DEFINITIONS	6
1.5	SYSTEM DESCRIPTION	6
1.6	SUBMITTALS	7
1.7	CLASSIFICATION OF SYSTEM AND COMPONENTS	9
1.8	PROJECT ON-SITE ENVIRONMENTAL CONDITIONS	9
PART 2	**PRODUCTS**	9
2.1	MATERIALS/EQUIPMENT	9
2.2	FABRICATION AND MANUFACTURE	16
PART 3	**EXECUTION**	17
3.1	PREPARATION	17
3.2	INSTALLATION, APPLICATION AND ERECTION	17
3.3	FIELD QUALITY CONTROL	26
3.4	ADJUSTMENTS	31
3.5	CLEANING	31
3.6	PROTECTION	32
3.7	DEMONSTRATION	32
3.8	SCHEDULES	32

9413202.1407

SECTION 02100
SITE IMPROVEMENTS

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Purpose

This section covers the minimum engineering and construction requirements for the site improvements which support the Fabrication Shop Building as shown on the Contract Drawings.

1.1.2 Scope

The Seller shall have full responsibility for construction, survey control, inspection and coordination of all improvements and applicable design requirements called out on the Contract Drawings and specified herein, and to ensure that all codes, specifications, standards, safety procedures and documents applicable to this section and referenced herein are totally complied with.

1.1.3 General Requirements

Seller is to construct earth fill, finish grading, new asphaltic concrete paving, concrete paving, aggregate base, rock surfacing, drainage ditches, rip rap outlet protection, drainage culvert, sanitary sewer lines, sanitary water lines, firewater lines including fire hydrants with post indicator valves, and all appurtenances as indicated on the Contract Drawings and specifications. Seller shall install sanitary water lines and firewater lines from points of connection shown on plans to tie in points at building, such points to be determined by Seller.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301	1989 Specification for Structural Concrete for Buildings
ACI 305R	1989 Hot Weather Concreting
ACI 306R	1988 Cold Weather Concreting

ACI 506.2	1990 Specification for Materials, Proportioning and Application of Shotcrete

AMERICAN SOCIETY OF MECHANICAL ENGINEERS/
AMERICAN NATIONAL STANDARD INSTITUTE (ASME/ANSI)

ASME/ANSI B16.1	1989 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
ASME/ANSI B16.5	1988 Pipe Flanges and Flanged Fittings
ANSI B16.21	1978 Nonmetallic Gaskets for Pipe Flanges
ASME B31.1	1989 Power Piping, Including Addendum "a"
ASME B31.3	1990 Chemical Plant and Petroleum Refinery Piping, Including Addenda "a" and "b"
ANSI Z53.1	1979 Safety Color Code for Marking Physical Hazards

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A36	1990 Standard Specification for Structural Steel
ASTM A53	1990 (Rev B) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A105/A105M	1990 Standard Specification for Forgings, Carbon Steel, for Piping Components
ASTM A185	1990 Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A307	1990 Standard Specification for Carbon Steel Bolts and Studs 60,000 Psi Tensile Strength
ASTM A475	1989 Standard Specification for Zinc-Coated Steel Wire Strand
ASTM A525	1991 (Rev A) Standard Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process
ASTM A536	1984 Standard Specification for Ductile Iron Castings

9413202.1408

ASTM A563	1991 Standard Specification for Carbon and Alloy Steel Nuts
ASTM A615	1990 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C31	1990(A) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C76	1989 Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
ASTM C143	1990 Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C171	1986 Standard Specification for Sheet Materials for Curing Concrete
ASTM C172	1990 Standard Practice for Sampling Fresh Mixed Concrete
ASTM C443	1990 Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM D75	1987 Standard Practice for Sampling Aggregates
ASTM D994	1982 Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
ASTM D1190	1980 Standard Specification for Concrete Joint Sealer, Hot Poured, Elastic Type
ASTM D1556	1990 Standard Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	1978 (R 1990) Standard Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using a 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop
ASTM D1751	1983 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

9413202.1409

9413202.1410

ASTM D2167	1984 (Reapproved 1990) Standard Test Method for Density and Unit Weight of Soil in Place by Rubber Balloon Method
ASTM D2419	1974 (R 1979) Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2628	1991 Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D2774	1972 (R 1983) Standard Specification for Underground Installation of Thermoplastic Pressure Piping
ASTM D2922	1981 (R 1990) Standard Test Methods for Density of Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3034	1989 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3035	1989 (Rev A) Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
ASTM D3212	1989 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3261	1990 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM F477	1990 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	1990 Structural Welding Code

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C500	1986 Gate Valves for Water and Sewerage Systems

AWWA C509	1987 Resilient-Seated Gate Valves for Water and Sewerage Systems
AWWA C651	1986 Standard for Disinfecting Water Mains, Including Addendum - January 1990

FACTORY MUTUAL (FM)

FM 1610	1978 Approval Standard Plastic Pipe and Fittings for Underground Fire Protection Service
FM Data Sheet 3-10	1981 (March) Installation and Maintenance of Private Fire Service Mains and Their Appurtenances

FEDERAL SPECIFICATIONS (FS)

FED Spec. TT-E-489H	1988 Enamel, Alkyd, Gloss, Low VOC Content
FED Spec. TT-P-645B	1990 Primer, Paint, Zinc-Molybdate, Alkyd Type

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	1987 Standard for Installation of Private Service Fire Mains and Their Appurtenances
NFPA 1963	1985 Standard for Screw Threads and Gaskets for Fire Hose Connections

PIPE FABRICATION INSTITUTE (PFI)

PFI ES-3	1990 Fabrication Tolerances

UNDERWRITERS LABORATORIES, INC. (UL)

UL 246	1987 Hydrants for Fire-Protection Service
UL 262	1988 Gate Valves for Fire-Protection Service

UNI-BELL PLASTIC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	1988 Installation of Polyvinyl Chloride (PVC) Pressure Pipe
UBPPA UNI-B-5	1982 Installation of Polyvinyl Chloride (PVC) Sewer Pipe

9413202.1411

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT)

WSDOT M41-10	1988 Standard Specifications for Road, Bridge, and Municipal Construction

1.3 **RELATED REQUIREMENTS**

Specification Section 02220	Excavation and Backfill
Specification Section 03346 B-595-A-A900-03346	Read-Mixed Concrete Production and Delivery
Specification Section 16640 B-595-C-A160-16640	Cathodic Protection (Sacrificial Anode)

1.3.1 Soils and Geotechnical Report

A soils and geotechnical report by Dames and Moore entitled "Report of Geotechnical Investigation Proposed Hanford Waste Vitrification Plant Hanford, Washington" for Kaiser Engineers, Job No. 10805-383-016, November 15, 1989, along with supplemental reports have been prepared for the construction of facilities associated with the Hanford Waste Vitrification Plant project. Copies of these reports are available for review from the Buyer for background information only.

1.4 **DEFINITIONS**

The following terms, were used in the Specifications or Contract Drawings, shall be defined as follows:

1.4.1 Existing - Improvements and site conditions shown on the Contract Drawings or Specifications, which are existing based on topographic and "as-built" data, provided by the Owner, prior to the start of any construction on the Hanford Waste Vitrification Plant project.

1.4.2 By Others - Work shown on the Contract Drawings or Specifications, which is to be constructed in other contracts prior to, in conjunction with and/or after the execution of this contract.

1.4.3 Contract Drawings - "Hanford Waste Vitrification Plant" CWBS No. A920 package.

1.5 **SYSTEM DESCRIPTION**

(Not Used)

9413202.1412

9413202.1413

1.6 SUBMITTALS

Submit the following in accordance with the Vendor Drawing and Data Requirements section of the Order/Subcontract.

1.6.1 Submittal List

SUBMITTAL ITEM	SUBMITTAL TYPE	SECTION PARAGRAPH REFERENCES
"As-Built" Drawings	Engineering Drawing	1.7.5
Sanitary Sewer - Pipe, Fittings and Cleanouts	Certificates of Compliance	2.1.1.1, 2.1.1.2
Water Valve - Pressure Test	Test Report	2.1.2.1.C
Water System - Piping, Fittings, and Valves	Certificates of Compliance	2.1.2.2, 2.1.2.3
Fire Hydrants	Certificates of Compliance	2.1.2.2.H
Aggregate Base and Crushed Rock Tests	Report	
Concrete Mix Design	Mix Design and Tests	2.1.5.1, 2.1.5.2
Concrete Admixture Materials	Certificates of Compliance	2.1.5.1, 2.1.5.2
Reinforcement Materials	Certificates of Compliance	2.1.5.4
Expansion Joint Materials	Certificates of Compliance	2.1.5.5
Joint Sealant Materials	Certificates of Compliance	2.1.5.6
Asphalt Concrete Materials	Certificates of Compliance	2.1.6.10
Asphalt Concrete Mix Design	Report	2.1.6.11
Reinforced Concrete Pipe	Certificates of Compliance	2.1.9.1
Soil Moisture Density Relationship	Report (1)	3.2.1.4.A
Flange Bolt Torque Procedure	Procedure	3.2.15.4
Earthwork Field Density Test	Report (1)	3.3.2
Aggregate Base and Rock Surfacing Field Sampling and Testing	Report (1)	3.3.3.1
Aggregate Base Field Density Test	Report (1)	3.3.3.2
Asphalt Concrete Field Density Test	Report (1)	3.3.4.1
Concrete Slump Tests	Report (1)	3.3.5.4
Concrete Air Content Tests	Report (1)	3.3.5.5

SUBMITTAL ITEM	SUBMITTAL TYPE	SECTION PARAGRAPH REFERENCES
Concrete Compression Tests	Report [1]	3.3.5.8
Water System Hydrostatic Pressure Test Procedure	Procedure	3.3.7.1.F
Water System Pressure Test	Report	3.3.7.5
Firewater Test Plan	Procedure	3.3.7.7
Sanitary Sewer Test	Report	3.3.9
Sanitary Water Cleaning Report	Report	3.4.2.2

[1] Tests and submittals by Buyer

1.6.2 Product Data

Submit catalog cuts for fittings, joints, couplings, valves or other data published by the manufacturer, to demonstrate conformance to the specification requirements, catalog figure numbers alone will not be acceptable.

1.6.3 Test Requirements

1.6.3.1 Factory Acceptance Tests (FAT)

Documentation for all tests and certifications shall conform to the requirements of PART 2 PRODUCTS of this specification section.

1.6.3.2 Field Testing

Documentation for all tests and certifications shall conform to the requirements of PART 3 EXECUTION of this specification section.

1.6.3.3 Certificates of Compliance

Certificates of compliance attesting that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise. Production control tests shall have been performed at the intervals or frequency specified in the referenced publication. Other tests shall have been performed within three years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

9413202.1414

1.6.4 "As Built" Drawings

Prepare and submit "As Built" construction survey records which will include: Underground utility routing and utility interface location and elevations, grading contours and control elevations, and other field revisions or modification to the Contract Drawings. The drawings, calculations and specifications shall be prepared and stamped by professional engineers registered in the State of Washington.

1.6.5 Any modifications and/or deviations from the grading and drainage as shown on the Contract Drawings will require the Seller to prepare and submit a change request for the Buyer's written approval prior to implementing the change request.

1.7 **CLASSIFICATION OF SYSTEM AND COMPONENTS**

(Not Used)

1.8 **PROJECT ON-SITE ENVIRONMENTAL CONDITIONS**

(Not Used)

PART 2 PRODUCTS

2.1 **MATERIALS/EQUIPMENT**

2.1.1 Sanitary Sewer Materials

2.1.1.1 PVC Sewer Pipe and Fittings

PVC sewer pipe and fittings shall conform to ASTM D3034 and minimum wall thickness for SDR 35 in Table 1. Joints shall conform to ASTM D3212 and gaskets shall conform to ASTM F477.

2.1.1.2 Sewer Cleanout

Sewer cleanout risers shall be the same diameter and material as the sewer pipe laterals. Two 45-degree elbows shall connect the riser to the lateral and the top of the cleanout shall have a cast-iron frame and cover with the letter "S" cast into the cover.

2.1.2 Water System Materials

2.1.2.1 General Requirements for Fire and Sanitary Water System Piping Materials

All pressure piping components, fabrication, erection, and testing except as otherwise qualified herein, shall be in accordance with

9413202.1415

the requirements of ASME B31.1 for sanitary water systems and NFPA 24 for firewater systems.

A. Test water requirements shall be potable grade.

B. Pressure test blinds shall be plain 1/4 inch thick carbon steel test blanks made from ASTM A36/A36M plate with 1/16 inch thick nonasbestos gaskets shall be used for blanking raised face flanges for sizes up to 12 inch NPS.

C. All gate valves shall have a backseat bushing that allows the valve to be repacked under pressure. All valves shall be pressure tested by the manufacturer in accordance with the national standard or code governing the valve design. A pressure test report shall be submitted.

D. Nonmetallic components or parts (i.e., gaskets, stem packing, seals, etc.) shall not contain asbestos.

2.1.2.2 Firewater System Materials

A. 4" - 12" pipe seamless Polyethylene (PE) conforming to ASTM 3035, PE 3408. Rated for 200 psig @ 73°F. To be joined by butt fusion connections. FM approved as conforming to FM 1610, and so labeled. Plexco PE-3408 Class 200 or equal. Where FM approved pipe and/or fittings are not available due to size and/or type of component, the material and pressure rating shall be the same as specified herein (excluding FM approval) with the additional requirement that the Standard Dimension Ratio (SDR) shall not be greater than SDR 9.

B. 4" - 12" fittings (ells, tees, caps, reducers, and flange adapters) Polyethylene (PE) conforming to ASTM D3261, PE 3408, Rated for 200 psig @ 73°F. To be joined by butt fusion connections. FM approved as conforming to FM 1610, and so labeled. Plexco PE-3408 Class 200 or equal.

C. 4" - 12" gate valves Class 150 flat face flanged, ductile iron, Factory Mutual approved or UL labeled as conforming to UL 262, with UL labeled adjustable post indicators. American Darling CRS-82 with post indicator or equal. The height of valve indicator posts and extension stems for each location shall be determined by the Seller based on actual jobsite valve bury depths.

D. Painting

Painting for post indicators shall conform to the requirements indicated in Paragraph 2.1.2.2.J.

9413202.1416

9413202.1417

E. Thrust Blocks

Thrust blocks for firewater systems shall conform to NFPA 24 Section 8-6.2.7, Table A-8.6.2.8 and Paragraph 2.1.6.2 herein.

F. Branch Construction

Use reducing tees within the manufacturer's size range. Use reducing tees and reducers where reducing tees are not within the manufacturer's size range.

G. 4" - 12" flanges Class 150 lap joint type and flat-face blind flanges, carbon steel ASTM A105/A105M, ASME/ ANSI B16.5.

H. 4" - 12" gaskets Class 150 ring type, red rubber 1/8 inch thick, ANSI B16.21. Sepco No. 20 or equal.

I. Bolts

Galvanized machine bolt, heavy hex head, ASTM A307 Grade B, with one galvanized heavy hex nut, ASTM A563, Grade A.

J. Fire Hydrants

Dry barrel type with ductile iron base and barrel, Factory Mutual approved or UL labeled as conforming to UL 246, 6 inch Class 125 flat face flanged inlet, with two 2-1/2 inch hose connections, one 4-1/2 inch pumper connection, all with NFPA 1963 national standard hose threads, all capped with chain attached caps. Standard 1-1/2 inch point to flat pentagon operating nuts, rotating counter clockwise to open. Furnish each hydrant with an operating wrench. Paint one coat primer to FED SPEC TT-P-645B, and two coats finish red enamel to FED SPEC TT-E-489H, Class A. American Darling B62B-BB or equal. The lower barrel height of fire hydrants for each location shall be determined by the Seller based on actual jobsite fire hydrant bury depths. The top or head of the fire hydrants shall be painted with green enamel and a sign reading RAW WATER - DO NOT DRINK (3 inch high lettering) shall be mounted on the hydrants.

K. Thread Compound

For Flange Bolt - Never-Seez Regular Grade or equal.

2.1.2.3 Sanitary Water System Materials

A. 3/4" - 12" pipe seamless Polyethylene (PE) conforming to ASTM D3035, SDR 11, PE 3408. Rated for 160 psig @ 73°F. To

be joined by butt fusion connections. Phillips Driscopipe 8600 or equal.

B. 3/4" - 12" fittings (ells, tees, caps, reducers, and flange adapters) seamless molded Polyethylene (PE) conforming to ASTM D3261, PE 3408, SDR 9.3 or 11. Rated for 160 psig @ 73°F. To be joined by butt fusion connections. Phillips Driscopipe 8600 or equal. Fabricated fittings rated for 160 psig or greater @ 73°F, and made from PE 3408 pipe are acceptable substitutes where seamless molded fittings are not available due to size and/or type of fitting.

C. 2" - 3" gate valves Class 150 ductile iron flanged gate valve, nonrising stem, conforming to AWWA C500, with asbestos-free packing material, bronze gate, and standard AWWA operating nut. American Darling CRS-52 or equal.

D. 4" - 12" gate valves Class 150 ductile iron flanged gate valve, nonrising stem, conforming to AWWA C509, with asbestos-free packing material, bronze gate, and standard AWWA operating nut. American Darling CRS-82 or equal.

E. Branch Construction

Use reducing tees within the manufacturer's size range. Use reducing tees and reducers where not within the manufacturer's size range.

F. Flanges

3/4" - 12" Class 150 back-up type, convoluted design, ductile iron ASTM A536 Grade 60/40/12 to 60/40/18, to mate with ANSI B16.1 flanges. Improved Piping Products or equal. (Use as back-up flange with polyethylene Flange Adapter.)

3/4" - 12" Class 150 flat-face blind flange, carbon steel ASTM A105/A105M, ASME/ANSI B16.5.

G. Gaskets

Class 150 ring type, red rubber, 1/8 inch thick, ANSI B16.21. Sepco No. 20 or equal.

H. Bolts

Galvanized machine bolt, heavy hex head, ASTM A307 Grade B, with one galvanized heavy hex nut. ASTM A563, Grade A.

9413202.1418

9413202.1419

I. Thread Compound

For Flange Bolt - Never-Seez Regular Grade or equal.

2.1.3 Utility Bedding Materials

2.1.3.1 Bedding materials shall conform to either the provisions of Paragraph 2.1.1.2 or 2.1.1.3, Specification B-595-C-A920-02220.

2.1.3.2 Buried warning and identification tape shall conform to the provision of Paragraph 2.1.5, Specification B-595-C-A920-02220.

2.1.4 General Fill Material

Materials used to construct general fill sections shall be in accordance with Paragraph 2.1.1.1, Specification B-595-C-A920-02220.

2.1.5 Aggregate Base and Rock Surfacing Materials

2.1.5.1 Aggregate base course material shall conform to the provisions of Paragraph 2.1.2, Specification B-595-C-A920-02220.

2.1.5.2 Rock surfacing material shall conform to the provision of Paragraph 2.1.3, Specification B-595-C-A920-02220.

2.1.5.3 Gravel

Gravel used for fire hydrant drains shall conform to the provisions of Paragraph 2.1.1.3, Specification B-595-C-A920-02220.

2.1.5.4 Conformance testing shall comply with the provision of Paragraph 2.1.4, Specification B-595-C-A920-02220.

A new sample shall be taken and tested whenever the source of the material is changed or the tests show unacceptable deficiencies or variations from specified requirements.

2.1.6 Concrete Materials

2.1.6.1 Structural concrete for foundations, pavement and drainage structures including inlets, and headwalls shall be Mix Design Class ST2 per Specification B-595-A-A900-03346.

2.1.6.2 Nonstructural concrete for firewater system thrust blocks shall be Mix Design Class M per Specification B-595-A-A900-03346.

2.1.6.3 Reinforcement

A. Reinforcing steel shall conform to ASTM A615, Grade 60, deformed steel bars.

B. Welded wire fabric shall conform to ASTM A185, fabricated in flat sheets.

2.1.6.4 Preformed Expansion joint fillers shall conform to ASTM D994, D1751, or D2628 (Tex-Mastic Asphalt by J&P Petroleum Products, Inc., Sonoflex by Sonneborn of Rexnord Chemical Products, Inc., or an approved equal).

2.1.6.5 Poured joint sealant shall conform to ASTM D1190 (Eucolastic by Euclid Chemical Corporation, Hotpour by J&P Petroleum Products, Inc., or an approved equal).

2.1.7 Asphalt Concrete Materials

2.1.7.1 Asphalt Cement: WSDOT M41-10, Section 9-02.1(4), Viscosity Grade AR-4000W

2.1.7.2 Aggregate for Asphaltic Concrete Paving: WSDOT M41-10, Section 9-03.8(3)B, Class B

2.1.7.3 Blending Sand: WSDOT M41-10, Section 9-03.8(4)

2.1.7.4 Mineral Filler: WSDOT M41-10, Section 9-03.8(5)

2.1.7.5 Prime Coat: WSDOT M41-10, Section 9-02.1(2), MC-250

2.1.7.6 Tack Coat: WSDOT M41-10, Section 9-02.1(6), CRS-1

2.1.7.7 Coal Tar Pitch Emulsion: WSDOT M41-10, Section 9-02.1(9)

2.1.7.8 Aggregates for Coal Tar Pitch Seal: WSDOT M41-10, Section 9-03.7

2.1.7.9 Conformance Testing: WSDOT M41-10, Section 9-03.8(2). All tests shall be performed in accordance to the procedures specified in WSDOT M41-10, Section 9-03.15.

2.1.7.10 Asphalt Paving Mix

The proportions of materials for the mix design shall be in accordance with WSDOT M41-10, Section 9-03.8(6), Class B except that the asphalt percentage of total mixture shall not be less than 4.5 percent nor more than 7.5 percent. Recycled asphalt materials shall not be used in the asphalt pavement mix.

2.1.8 Rock Rip Rap Materials

Rock rip rap shall be classified as Hand Placed Rip Rap conforming to WSDOT M41-10 Section 9-13.2 and shall be constructed over filter blanket material conforming to WSDOT M41-10 Section 9-03.4(2) 1/4 inch to 0 inch material gradation.

9413202.1420

9413202.1421

2.1.9 Storm Drain System Materials

2.1.9.1 Reinforced Concrete Pipe (RCP)

A. RCP Class and Wall shall be based on Seller design of Fabrication Shop and shall also conform to the requirements of ASTM C76.

B. Joint material for RCP shall be rubber gasket conforming to the requirements of ASTM C443 or "tongue and groove" type filled with cement mortar.

2.1.9.2 Pipe Bedding and Backfill

A. Bedding materials shall be gravel conforming to the requirements of WSDOT M41-10 Section 9-03.12(3).

B. Backfill shall conform to the provisions of Paragraph 2.1.3.

2.1.10 Post Barricades

Posts shall be concrete filled 4 inch diameter, Schedule 40, conforming to the provisions of ASTM A53.

A. Paint the posts in accordance with colors defined in ANSI Z53.1.

B. Provide and install at the top of each post 2 - 3 inch bands of No. 3270 silver adhesive-coated reflective sheeting, "Scotchlite," as manufactured by 3M Company or equal. Band shall be located as indicated on the Contract Drawings.

2.1.11 Capillary Water Barrier Materials (Beneath Building Floor Slabs)

2.1.11.1 Granular fill for capillary water barriers, where required by Seller's design, shall be a clean, coarse grained crushed stone, uncrushed gravel, or crushed gravel conforming to the following gradation: 90 to 100 percent passing the 3/4 inch sieve and zero to five percent passing the No. 4 sieve, and with a sand equivalent of not less than 50 when tested in accordance with ASTM D2419.

2.1.11.2 Filter material for capillary water barrier shall conform to the provisions for Class 2 fine aggregate of WSDOT M41-10, Section 9-03.1(2).

9413202.1422

2.2 FABRICATION AND MANUFACTURE

2.2.1 Water System Piping Fabrication

2.2.1.1 Shop Assembly

A. Welding

Bonding and welding for nonmetallic piping shall be in accordance with ASME B31.3.

B. Flanges

Flange face vertical - bolt holes to straddle vertical centerline.

Flange face horizontal - bolt holes to straddle the normal piping layout grid lines.

2.2.1.2 Fabrication Dimensional Tolerances

Piping fabrication tolerances shall be in accordance with PFI ES-3.

2.2.2 Water System Packaging and Shipping

2.2.2.1 Preparation for shipment shall conform to the manufacturer's standard, and as a minimum shall provide protection against corrosion and damage from normal handling and storage.

2.2.2.2 Minimum preparation shall include the following:

A. Flange faces shall be protected with a wood, metal or plastic flange protector. A nonmetallic gasket shall be furnished and placed between the flanges and the protector when a metallic flange protector is used.

B. All pipe ends shall be protected by means of a plastic or metallic plug or cap.

C. Valves shall be prepared for shipment in such a manner to avoid damage or atmospheric corrosion to the inside or outside surface, or parts, during storage or while in transit. Gate valves shall be shipped in the closed position.

9413202.1423

PART 3 EXECUTION

3.1 PREPARATION

Preparation shall be in conformance with the provisions of Paragraph 3.1, Specification B-595-C-STD-02220.

3.2 INSTALLATION, APPLICATION AND ERECTION

3.2.1 Grading

3.2.1.1 General

A. Grading shall be performed to the lines and grades indicated on the Contract Drawings.

B. All areas covered by the project, including cut and fill sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations.

C. Tolerances

Subgrade elevations for pavement areas, rock surface areas, and trapezoidal drainage ditches shall not vary by more than plus or minus 0.10 feet above or below the elevations shown on the Contract Drawings.

3.2.1.2 Unsuitable Fill Materials

Cut materials, as determined by the Buyer, due to presence of vegetation, excessive moisture, refuse or other deleterious substances, shall be unsuitable for use as fill. Material which has been determined to be unsuitable for fill material, or material which has been disturbed by the Seller's operations or softened by exposure to the elements and water and surplus material shall be disposed of as directed by the Buyer.

3.2.1.3 Suitable General Fill Materials

A. Cut materials determined to be suitable for fill in accordance with Paragraph 2.1.1.1, Specification B-595-C-A920-02220, shall be transported to and placed in fill areas. Where sufficient material is not available from cut sections, the Seller shall obtain fill material from a source designated by the Buyer.

B. Cuts which are carried below the depths indicated, without specific instructions from the Buyer, shall be properly

filled and compacted to the required elevation by the Seller.

C. Cuts for the trapezoidal drainage ditches shall be made to the cross sections and grades indicated on the Contract Drawings. All roots, rock, and foreign matter in the sides and bottom of the ditch shall be removed or trimmed to conform to the slope, grade, and shape of the section indicated on the Contract Drawings. Care shall be taken not to excavate the ditch below the grades indicated. Over excavation shall be corrected as indicated in Paragraph 3.2.1.3.B.

D. In cut areas, the grade beneath the pavement areas shall be over-excavated to a depth of at least 12 inches below the required elevation. The exposed surface shall be scarified to a minimum depth of 6 inches, moisture conditioned and compacted in accordance with Paragraph 3.2.1.5. The excavation shall then be backfilled in accordance with Paragraph 3.2.1.4.D and compacted in accordance with Paragraph 3.2.1.5. Any areas failing to meet compaction requirements shall be recompacted and retested. If required compaction cannot be obtained, the material shall be removed, replaced, recompacted and tested.

E. In order to achieve a compacted surface at cut areas the Seller shall make an initial cut slightly higher than the finished elevation. The cut shall be scarified and compacted in accordance with Paragraph 3.2.1.5, then the final grading shall be performed to the required elevation.

3.2.1.4 General Fill

A. Before placing general fill material, the existing grade shall be scarified to depth of not less than 6 inches, moisture conditioned and compacted to requirements specified in Paragraph 3.2.1.5.

B. Ground surfaces which are sloped more than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped or broken up in such a manner that the fill will bond with the existing surface.

C. Fill and embankments shall be constructed to the lines and grades indicated on the Contract Drawings. The completed fill shall conform to the typical sections indicated or meet the particular requirements specified on the Contract Drawings.

D. In general, fill material shall be placed in maximum loose lifts of 8 inches and be compacted per Paragraph 3.2.1.5.

9413202.1424

Each lift shall be completed, compacted and tested before the overlaying lift is placed.

E. Fill material shall be moisture conditioned to within plus or minus 2 percent of its optimum moisture content as determined in Paragraph 3.2.1.5.A. Disking may be required to obtain the required moisture content since water applied at the surface may not penetrate the full depth of the lift.

3.2.1.5 Compaction

A. The moisture density relationship shall be determined by the Buyer for each type of fill material used in accordance with ASTM D1557. The optimum moisture content for the onsite soil is estimated to be 10 percent.

B. Existing surface and fills for general grading shall be compacted to 90 percent of the maximum dry density as determined by ASTM D1557. The top 12 inches below the required roadway and pavement subgrade elevation shall be compacted to 92 percent of its maximum dry density. Where a fill depth is shallow, existing materials shall be removed and recompacted to provide a minimum of 12 inches of compacted fill below the required subgrade elevation.

C. Fill and cut areas under building slabs and foundations shall be compacted to 95 percent of the maximum dry density as determined by ASTM D1557, to a distance of 5 feet beyond the building footprint limit.

3.2.2 Excavation and Backfill for Foundations, Slabs at Grade, Appurtenances, and Utility Trenches

3.2.2.1 Excavation - General

A. General excavation requirements shall conform to the provisions of Paragraph 3.2.1.1, Specification B-595-C-A920-02220.

B. Material excavated for the installation of underground utilities which have been determined suitable for backfill may be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but no closer than 2 feet.

C. Surplus material and material determined to be unsuitable for backfill or general fill shall be disposed in an area designated by the Buyer.

9413202.1425

D. Tolerances

Excavation and backfill tolerances shall conform to the provisions of Paragraph 3.2.3, Specification B-595-C-A920-02220.

3.2.2.2 Excavation for Foundations and Slabs at Grade

A. Requirements specified in Paragraph 3.2.2.1 herein and Paragraph 3.2.1.2, Specification B-595-C-A920-02220, shall apply. Additional requirements shall be as specified below.

B. For building foundations and floor slabs excavate the entire area to bottom of foundations and compact the exposed surface in accordance with Paragraph 3.2.1.4 prior to construction of foundations and backfilling.

C. The excavation shall extend a sufficient distance from concrete walls and footings to allow the placement and removal of forms and inspection except where the concrete is to be deposited directly against excavated surfaces or shoring.

3.2.2.3 Excavation for Appurtenances

A. Requirements specified in Paragraph 3.2.2.1 herein and Paragraph 3.2.1.3, Specification B-595-C-A920-02220 shall apply. Additional requirements shall be as specified hereinafter.

B. Excavations for sewer cleanouts, water system valves, fire hydrants and other appurtenances shall be of sufficient width and depth to install these items as shown on the Contract Drawings.

3.2.2.4 Excavation for Utility Trenches

A. Requirements specified in Paragraph 3.2.2.1 herein and Paragraph 3.2.1.4, Specification B-595-C-A920-02220 shall apply. Additional requirements shall be as specified below.

B. Backfill overexcavations with thoroughly tamped bedding materials per Paragraph 2.1.3.5. Whenever unsuitable soil as defined in Paragraph 3.2.1.2.A that is incapable of properly supporting the utility is encountered in the bottom of the trench, remove such soil to the depth required and replace to the proper grade with bedding materials per Paragraph 2.1.3.5.

9413202.1426

C. Pipe bedding shall be rounded so that at least the bottom quadrant of the pipe shall rest firmly for the full length of the barrel as proper pipe jointing operations will permit.

3.2.2.5 Dewatering

A. Requirements specified in Paragraph 3.2.1.6, Specification B-595-C-A920-02220 shall apply in addition to the following:

B. Obtain approval from the Buyer for discharge of water removed by any means.

3.2.2.6 Backfilling - General

A. Backfill material shall meet the requirements specified in Paragraph 2.1.4 herein and Paragraph 3.2.2.1, Specification B-595-C-A920-02220.

B. Backfill material shall be placed in maximum loose lifts of 8 inches and compacted in accordance with Paragraph 3.2.2.9.B.

C. After the backfilling and compaction operations have been completed, place rock surfacing and compact in accordance with Paragraph 3.2.5.5.

3.2.2.7 Backfilling for Foundations, Slabs at Grade and Appurtenances

A. Requirements specified in Paragraph 3.2.2.6 herein and Paragraph 3.2.2.2, Specification B-595-C-A920-02220 shall apply.

B. Proof roll all surfaces beneath slabs at grade.

C. Place capillary water barrier materials under building floor slabs as required by the Seller's design compacting in accordance with the requirements for crushed rock surfacing of Paragraph 3.2.5.5.

3.2.2.8 Backfilling of Utility Trenches

A. Requirements specified in Paragraph 3.2.2.6 herein and Paragraph 3.2.2.3, Specification B-595-C-A920-02220 shall apply. Additional requirements shall be as specified below.

B. Place buried warning and identification tape conforming to Paragraph 2.1.3.2 to identify the presence of underground

9413202.1427

utilities at a depth of 18 inches below finished grade or as shown on the Contract Drawings.

3.2.2.9 Compaction of Backfill

Compaction of backfill shall be in accordance with Paragraph 3.2.2.4, Specification B-595-C-A920-02220.

3.2.3 Sanitary Sewer

3.2.3.1 Earthwork

Earthwork requirements for excavation and backfill, including bedding for pipe trenches shall be in accordance with Paragraph 3.2.2.

3.2.3.2 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper equipment for lowering sections of pipe into trenches. Lay pipe with the bell ends in the upgrade direction. Adjust spigots in bells to provide a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. At the end of each work day, close open ends of pipe temporarily.

3.2.3.3 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with the requirements of UBPPA UNI-B-5 and Contract Drawings. Joints with gaskets shall be made in accordance with the requirements of UBPPA UNI-B-3 for assembly of joints. Joints to other pipe materials shall be in accordance with the recommendations of the plastic pipe manufacturer.

3.2.4 Storm Drain

3.2.4.1 Earthwork

Earthwork requirements for excavation and backfill, including bedding for pipe trenches shall be in accordance with Paragraph 3.2.2.

3.2.4.2 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper equipment for lowering sections of pipe into trenches. Lay pipe in accordance with WSDOT M41-10 Paragraph 7-02.3(1).

9413202.1428

3.2.4.3 Installation of RCP

Install pipe and fittings in accordance with the requirements of WSDOT M41-10, Paragraphs 7-02.3(1) and 7-02.3(1)A and Contract Drawings. Joints shall be made in accordance with the requirements of WSDOT M41-10, either Paragraph 7-02.3(1)A1 or 7-02.3(1)A2 for assembly of joints. Joints to other pipe materials shall be in accordance with the recommendations of the manufacturer.

3.2.4.4 Rock Rip Rap

Install filter blanket and rock riprap, conforming to Paragraph 2.1.8, in accordance with WSDOT M41-10, Sections 8-15.3(7) and 8-15.3(3).

3.2.5 Aggregate Base and Rock Surfacing

3.2.5.1 Do not install any materials when the surface temperature is below 35°F or when rainfall or other weather conditions will detrimentally affect the quality of the finished product.

3.2.5.2 Do not install any materials when the underlying subgrade contains frozen materials.

3.2.5.3 Spread the aggregate base course material and rock surfacing in layers over the prepared subgrade to achieve a total compacted thickness as shown on the Contract Drawings. When a compacted layer of 6 inches or less is specified, the material may be placed in a single layer; when a compacted thickness of more than 6 inches is required, no layer shall exceed 6 inches nor be less than 3 inches when compacted.

3.2.5.4 Level and contour rock surfaces to the elevations and gradients shown on the Contract Drawings.

3.2.5.5 Compact each layer of the aggregate base course material to not less than 95 percent of its maximum dry density determined in accordance with Paragraph 2.1.4.3. Add water as required to obtain the specified compaction. If excess water is apparent, remove material and aerate to reduce moisture content. Each layer of crushed rock surfacing shall be compacted by at least two passes of a vibratory compactor approved by Buyer.

3.2.5.6 Final elevations at the roads shall not vary by more than 0.02 feet above nor more than 0.02 feet below the elevations indicated on the Contract Drawings. Elsewhere the final elevations shall be within plus or minus 0.10 feet from the elevations indicated on the Contract Drawings.

9413202.1429

9413202.1430

3.2.6 Asphaltic Concrete Paving

3.2.6.1 Prime coat and tack coat shall not be placed when the ground temperature is lower than 50°F.

3.2.6.2 Asphaltic concrete paving shall not be placed on any wet surface or when the average surface temperature is less than 35°F or when weather conditions otherwise prevent the proper handling or finishing of the bituminous mixtures.

3.2.6.3 Asphaltic concrete paving shall be installed in accordance with WSDOT M41-10, Section 5-04.3 except that the following portions shall not apply.

Section 5-04.3(5)C, 5-04.3(5)D, 5-04.3(15), 5-04.3(17) through 5-04.3(21).

3.2.7 Seal Coat

3.2.7.1 The seal coat shall only be installed in dry weather and only when the ambient temperature is 60°F or above.

3.2.7.2 The seal coat shall consist of a coal tar pitch emulsion seal coat installed in accordance with WSDOT M41-10, Section 5-03 except that Sections 5-03.4 and 5-03.5 shall not apply.

3.2.8 Site Concrete

3.2.8.1 Site concrete for drainage structures, and nonstructural concrete per Paragraph 2.1.5, shall be constructed in accordance with the Contract Drawings and this specification section.

3.2.8.2 Concrete formwork, finishing, placing, curing and protection shall be in conformance with ACI 301.

A. Concrete placement in temperatures below 40°F shall conform to the provisions of ACI 306R.

B. Concrete placement in temperatures above 90°F shall conform to the provisions of ACI 305R.

3.2.9 Post Barricades

3.2.9.1 Post barricades for fire hydrants and post indicators for gate valves shall be installed at the locations indicated on the Contract Drawings.

3.2.9.2 Posts shall be set plumb.

9413202.1431

3.2.10 Capillary Water Barriers (Beneath Building Floor Slabs)

3.2.10.1 Granular materials per Paragraph 2.1.13, where required by Seller's design, shall be placed on compacted building pad grades in accordance with Paragraph 3.2.5.5.

3.2.10.2 Granular water barrier materials shall be placed in 4 inch maximum lifts, and compacted with a minimum of two passes with a hand-operated plate type vibratory compactor or "proof-rolled" with a minimum of two roller passes.

3.2.10.3 Earthwork

Earthwork requirements for excavation and backfill shall be in accordance with Paragraph 3.2.2.

3.2.11 Water Systems

3.2.11.1 Earthwork

Earthwork requirements for excavation and backfill shall be in accordance with Paragraph 3.2.2 and the recommendations of ASTM D2774, and FM Data Sheet 3-10.

3.2.11.2 (Not Used)

3.2.11.3 All piping shall be routed in accordance with the Contract Drawings.

3.2.11.4 All flange bolts shall be lubricated with anti-seize compound of as specified in Paragraphs 2.1.2.2.I and 2.1.2.3.H before tightening. Bolt torque procedures shall be in accordance with the gasket manufacturer's recommendations. Misalignment shall not be corrected by pulling up cocked flanged joints. The Seller shall submit gasket manufacturer's suggested bolt torque procedures including recommended torques and alignment procedures.

3.2.11.5 Piping shall be examined before and after erection to ensure that all foreign matter has been removed from interior surfaces as well as the bore of the piping.

3.2.11.6 Installation of nonmetallic piping shall conform to the recommendations of ASTM D2774. Installation of underground fire water mains shall conform to FM Data Sheet 3-10.

3.2.11.7 Seller shall protect polyethylene piping from overheating due to sunlight as required during installation.

3.2.11.8 The Seller shall provide the necessary materials and install locking devices (with padlock and two keys) for valves that are to

be L.O. (locked open) or L.C. (locked closed). All locks shall be common keyed for a given size valve.

3.2.11.9 Fitting make-up is not dimensioned on the drawings.

3.2.11.10 All buried valves and buried portions of hydrants shall be protected per Specification B-595-C-A160-16640.

3.2.11.11 Thrust blocks shall be placed at all turns, branch connections, and risers.

3.2.11.12 Fire hydrants shall be installed with the hydrant bury placed on a concrete block and the hydrant's drain outlet surrounded with gravel drainage material conforming to the requirements of Paragraph 2.1.4.3.

9413202.1432

3.3 **FIELD QUALITY CONTROL**

3.3.1 General

3.3.1.1 The Buyer shall be responsible for field tests required per Paragraphs 3.3.2, 3.3.3, 3.3.4, and 3.3.5 to determine that the work is performed in accordance with this specification and the Contract Drawings. The Seller shall support and coordinate its work with Buyer's testing activities.

3.3.1.2 The Seller shall be responsible for field tests required per Paragraphs 3.3.6 and 3.3.7 to determine that the work is performed in accordance with this specification and the Contract Drawings. The Buyer's representative shall be given two (2) working days prior notification, at the time and date of any testing to be performed.

3.3.2 Earthwork

Field density tests shall be performed in accordance with Paragraph 3.3.2 and 3.3.3, Specification B-595-C-A920-02220.

3.3.3 Aggregate Base

3.3.3.1 For each type of aggregate base course material, random samples shall be taken for each 3000 square feet of compacted lift, but not less than one random sample per day. Take samples in accordance with ASTM D75. Tests are not required for the crushed rock surfacing.

Each sample shall be placed in a clean container, securely fastened to prevent loss of material and tagged with the following information:

9413202.1433

Sample No.:
Date:
Name of Sampler:
Type of material sampled:
Location where sample was taken:

3.3.3.2 Test each sample without delay. Make gradation tests for each sample in accordance with the procedures specified in WSDOT M41-10 Section 9-03.15 for a Sieve Analysis of Fine and Course Aggregates. Materials not meeting specified gradation requirements shall be removed and replaced by the Seller.

3.3.3.3 Field density tests shall be performed in accordance with ASTM D1556 or ASTM D2922. For each type of material one test shall be performed for each 3000 square feet of compacted lift, but not less than one test per day. When tests are performed by the Nuclear Method per ASTM D2922 at least 20 percent of the tests shall be with ASTM D1556.

3.3.4 Asphaltic Concrete Pavement

3.3.4.1 Field density tests shall be performed in accordance with WSDOT M41-10, Section 5-04.3(10)B.

3.3.5 Concrete Testing

3.3.5.1 Sampling and testing of concrete shall be in accordance with ACI 301, Chapter 16, except as modified by the supplemental requirements herein.

3.3.5.2 The responsibilities and duties of the Seller are as defined in ACI 301, Section 16.7.

3.3.5.3 Concrete test samples shall be taken at or near the point of final deposit.

3.3.5.4 Concrete slump tests shall meet the requirements of ASTM C143. Perform a slump test concurrently with the preparation of molded test cylinders.

3.3.5.5 Concrete air content tests shall meet the requirements of ASTM C17 or C231. Perform air content tests concurrently with the preparation of molded test cylinders.

3.3.5.6 Molded cylinders for compression tests shall be prepared in sets of three meeting the requirements of ASTM C31. Composite samples shall be secured in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis. Curing shall meet the requirements of ASTM C31 for the standard 7 day and 28 day tests.

9413202.1434

3.3.5.7 The minimum sampling frequency shall be one set for each 100 cubic yards or fraction thereof per day for each mix design.

3.3.5.8 Compression testing of cylinders shall meet the requirements of ASTM C39. Test each set of three cylinders as follows:

A. One cylinder at 7 days.

B. The remaining cylinders at 28 days.

C. The acceptance test results shall be the average of the two specimens tested at 28 days per ACI 301, Paragraph 16.3.4.3. Acceptance of concrete shall be per ACI 301, Paragraph 17.2.

3.3.6 Water Systems

3.3.6.1 Pressure Tests

A. The minimum test pressure is the lowest allowable test pressure gauge reading (the calculated test pressure plus the additional pressure resulting from the static head of the test fluid above the test gauge).

B. The maximum test pressure shall be the greater of:

1.1 times (1.1x) the minimum test pressure

20 psi greater than the minimum test pressure.

C. Prior to initial operation, all installed piping shall be tested except where otherwise qualified by this specification.

D. The Buyer's Representative shall be given two working days prior to notification of the time and date of any testing to be performed.

E. The Seller shall be responsible for installing vents and drains required for testing purposes. All vents and drains installed for the purpose of testing, flushing, or purging shall be plugged and seal welded after test completion.

F. The Seller shall prepare and submit a hydrostatic test procedure for Buyer approval, including test diagrams, and test report format.

3.3.6.2 Pressure Testing of Piping

A. All pressure testing shall be per ASME B31.1 for sanitary water systems and NFPA 24 for firewater systems.

B. The alternate initial service tests as allowed in ASME B31.1 shall not be utilized.

3.3.6.3 Limits of Pressure Test

The Seller shall install temporary flanges and blind flanges at the A120 package boundaries for test purposes. After test completion and approval, these flanges shall be removed and the piping welded to the existing system.

3.3.6.4 Test Preparation for Pressure Piping

A. Temporary test blinds shall be installed between flanges where necessary to isolate piping systems, vessels, and equipment. However, where permanent operational blinds are installed, they may be used for pressure testing. Temporary test blinds shall be removed after successful completion and acceptance of tests.

B. All joints, including welds, are to be left exposed for examination during the test.

C. Pressure test gauges shall be calibrated at 90 day intervals or following damage to the gauge (i.e., dropping, over-pressurizing, etc.). The calibration shall be made using a dead weight tester with calibration records traceable to the National Institute of Standards and Technology. Gauge shall be tagged with the dates of the last and next calibrations. The date of gauge calibration shall be recorded by the Seller. In the event that a pressure gauge is found during calibration to be reading higher than the actual pressure, all tests made with that gauge since the last time it was calibrated shall be considered nonconforming and will require retesting if it cannot be determined that the test pressure utilized was sufficiently high to conform to the required minimum pressure.

D. The Seller shall take necessary precautions to prevent plastic piping from bowing in trenches as a result of expansion and/or internal pressure, during hydrotesting.

E. The Seller shall furnish the pumps, gauges, measuring devices, temporary plug valves, and other miscellaneous equipment necessary for testing.

F. The test fluid media, pressure, minimum duration and acceptance criteria shall be in accordance with the applicable code or standard referenced in Paragraph 3.3.7.2.A. The following additional requirements shall be included:

9413202.1435

9413202.1436

1) The test pressure shall be applied and maintained for at least five minutes prior to start of minimum test duration to assure that the pressure has equalized.

2) Systems required to be pressure tested per ASME B31.1 shall have the test pressure maintained for a time sufficient to examine all joints and connections for leakage, but in any case not less than ten minutes. The acceptance criteria for these systems is zero leakage.

3) If unacceptable leaks are found, then

   a. their locations shall be marked;

   b. the test pressure shall be gradually released;

   c. the piping shall be drained;

   d. appropriate repairs or replacement shall be made;

   e. and the pressure testing shall be repeated until acceptable results have been achieved.

3.3.6.5 Test Records

The Seller shall prepare and submit to the Buyer in accordance with Paragraph 1.7.1 test reports for all piping systems requiring tests. The test reports shall contain, as a minimum, the following data:

A. Job Title and Contract Number

B. Date of Test

C. Contract Drawing and Line Numbers Identification of Piping Systems

D. Type of Test, i.e., Hydrostatic, Pneumatic

E. Pressure Applied, Material Temperature, and Length of Time at Test Pressure

F. Test Results

G. Test by

H. Signature of Seller Test Supervisor

I. Comments, if any

J. Gauge Identification and Dates of Last and Next Calibration

K. Signature or Stamp of the Buyer's Representative

3.3.6.6 System Component Acceptance Test

After completion of the Hydrostatic and Pneumatic tests and at such times as the Buyer may direct, an acceptance test shall be performed for approval and acceptance. The test shall be performed in the presence of the Buyer's representative and shall consist of the following:

All valves in the system shall be fully opened and then fully closed to ensure proper operation of valve mechanism.

3.3.6.7 Firewater Systems are designed to withstand Safety Class 1 Design Basis Earthquake (DBE) conditions. Therefore, the Seller shall develop and implement a plan to check and verify that all Firewater Systems (FWX) are erected and tested in accordance with this specification and the Contract Drawings. The plan shall address, but not be limited to backfill, bedding, fusion, pipelines and workmanship.

3.3.7 Sanitary Sewer Test

Sanitary sewer laterals shall be tested from the manhole point of connection shown on the Contract Drawings to the pipe joint nearest the building. Test methods shall conform to WSDOT, Sections 7-17.3(4) A, B, E, and F.

3.4 **ADJUSTMENTS**

(Not Used

3.5 **CLEANING**

3.5.1 General

Upon completion of work, the Seller shall remove all waste and surplus material resulting from his operations and leave the site clean.

3.5.2 Water Systems

3.5.2.1 Disinfection

All lines in sanitary water service (Service Code SWX) shall be disinfected in accordance with AWWA C651.

9413202.1437

3.5.2.2 Cleaning Reports

All visual examinations and disinfections shall be documented in a test report to be submitted to the Buyer.

3.6 **PROTECTION**

Measures shall be taken to protect existing facilities such as benchmarks, aboveground electrical, underground utilities, roadway pavement and other items identified on the Contract Drawings and by the Buyer. All material shall be adequately protected and stored. Plastic pipes, joints and gasket material shall be stored in shade and out of direct sunlight. Do not store material directly on ground.

3.7 **DEMONSTRATION**

(Not Used)

3.8 **SCHEDULES**

(Not Used)

END OF SECTION

9413202.1438

U.S. DEPARTMENT OF ENERGY
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.
Advanced Technology Division
Fluor Contract 8457

SECTION 02220
EXCAVATION AND BACKFILL
B-595-C-A920-02220

(HOLD NO. 232)

APPROVED FOR CONSTRUCTION

9413202.1439

REVISION 0
ISSUE DATE 3-10-93

WAPA YES ___ NO X
QUALITY LEVEL I ___ II X
SAFETY CLASS 1__ 2__ 3__ 4 X

ORIGINATOR:

B. R. Eisenbise 3/8/93
B. R. Eisenbise, Civil Engineer Date

CHECKER:

S. A. Runk 3/8/93
S. A. Runk, Lead Disc. Engineer Date

APPROVED BY:

MAR 1 2 1993

S. A. Runk
S. A. Runk Lead Discipline Engineer

3/8/93
Date

3/5/93 7:24am
106\VOL5...\SPECS\A920\02220-0.

9413202.1440

SECTION 02220
EXCAVATION AND BACKFILL
ADDENDUM

This addendum modifies the above indicated Section by addition, deletion, and /or revision for the purpose of conveying the package specific requirements of the HWVP project. The type of modification shall be defined, and indicated in subsequent text, as follows:

- (Addition) - Indicates the following statements(s) is/are added to the referenced text.
- (Deletion) - Indicates the following statement(s) is/are deleted from the referenced text.
- (Revisions) - Indicates the following statement(s) is/are revision(s) to the referenced text.

PART 1 GENERAL

1.1 (Deletion) Delete "basement slab and walls and drilled foundation" from the paragraph.

(Addition) Add "storm drainage facilities and asphalt paving."

PART 3 EXECUTION

3.1.1.2	(Deletion)	Delete "basement slabs and walls and drilled foundations."
	(Addition)	Add "storm drainage facilities, asphalt paving, slopes and areas to receive rock surfacing."
3.1.2.4	(Addition)	Add "storm drainage facilities."
3.1.2.5	(Deletion)	Delete "Refer to Contract Drawings for additional restrictions on backfilling operations against concrete walls."
3.2.11.B.	(Addition)	Add "storm drainage facilities."
3.2.1.2	(Revision)	Revise title to read "Excavations for Foundations."
3.2.1.2.B.	(Deletion)	Delete slabs, walls and appurtenances.
3.2.1.3.B.	(Deletion)	Delete "precast manholes, flange boxes and other" from the first paragraph. Delete the second paragraph, "The depth of the excavation shall be

		sufficient to allow the placement of a minimum of 6 inches of compacted sand below the bottom of the precast manholes and flange boxes."
3.2.1.4	(Revision)	Revise title to read "Excavation for Utility Trenches and Storm Drainage Facilities."
3.2.1.4.B.	(Addition)	Add "storm drainage facilities" to the first sentence.
3.2.1.5	(Deletion)	Delete paragraph.
3.2.2.3.C.	(Deletion)	Delete paragraph.
3.2.2.3.F.	(Deletion)	Delete "direct burial wires, and conduit" from first sentence.
3.2.2.3.G.	(Deletion)	Delete paragraph.

9413202.1441

U.S. DEPARTMENT OF ENERGY
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.
Advanced Technology Division
Fluor Contract 8457

SECTION 02220
EXCAVATION AND BACKFILL
(B-595-C-B210A-02220)

"APPROVED FOR CONSTRUCTION"

REVISION NO. 0
ISSUE DATE 11-12-92

WAPA YES ___ NO X
QUALITY LEVEL I ___ II X
SAFETY CLASS 1___ 2___ 3___ 4 X

ORIGINATOR:

M. S. Whitten 11/11/92
M. S. Whitten, Structural Engineer Date

CHECKER:

G. Kuilanoff 11/11/92
G. Kuilanoff, Structural Engineer Date

APPROVED BY:

RPKumar
R. P. Kumar Lead Discipline Engineer

11/11/92
Date

11/10/92 5:31pm
106\VOL5...\SPECS\B210A022.200

9413202.1442

SECTION 02220
EXCAVATION AND BACKFILL
B-595-STD-02220

TABLE OF CONTENTS

PART		PAGE
PART 1	**GENERAL**	1
1.1	SUMMARY	1
1.2	REFERENCES	1
1.3	RELATED REQUIREMENTS	2
1.4	DEFINITIONS	2
1.5	SYSTEM DESCRIPTION	2
1.6	SUBMITTALS	3
1.7	CLASSIFICATION OF SYSTEM AND COMPONENTS	3
1.8	PROJECT OR SITE ENVIRONMENTAL CONDITIONS	3
PART 2	**PRODUCTS**	3
2.1	MATERIALS AND EQUIPMENT	3
2.2	FABRICATION AND MANUFACTURE	5
PART 3	**EXECUTION**	6
3.1	PREPARATION	6
3.2	INSTALLATION, APPLICATION AND ERECTION	7
3.3	FIELD QUALITY CONTROL	11
3.4	ADJUSTMENTS	12
3.5	CLEANING	12
3.6	PROTECTION	12
3.7	DEMONSTRATION	12
3.8	SCHEDULES	12

9413202.1443

9413202.1444

SECTION 02220
EXCAVATION AND BACKFILL

PART 1 GENERAL

1.1 SUMMARY

This section covers the technical requirements for excavation, backfill and compaction of onsite materials, imported fill, aggregate base course or rock surfacing for the installation of foundations, basement slab and walls, drilled foundations, slabs at grade, underground utilities and appurtenances as shown on the Contract Drawings.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D75	1987 Standard Practice for Sampling Aggregates
ASTM D422	1963-E1 (R 1990) Standard Test Method for Particle-Size Analysis of Soils
ASTM D1140	1954-E1 (R 1990) Standard Test Method for Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve
ASTM D1556	1990 Standard Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D1557	1978 Standard Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound (4.54 kg) Rammer and 18 Inch (457 mm) Drop
ASTM D2103	1986 Standard Specification for Polyethylene Film and Sheeting
ASTM D2167	1984 (R 1990) Standard Test Method for Density and Unit Weight of Soil In-Place by the Rubber Balloon Method
ASTM D2774	1972 (R 1983) Standard Specification for Underground Installation of Thermoplastic Pressure Piping

9413202.1445

ASTM D2922	1981 (R 1990) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D4397 EA-84	1984 (R 1989) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D4718	1987 Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles

FACTORY MUTUAL (FM)

Data Sheet 3-10	March 1981 Installation and Maintenance of Private Fire Service Mains and Their Appurtenances

WASHINGTON ADMINISTRATIVE CODE (WAC)

WAC	1990 Washington Administrative Code Chapter 296-155, Section 650-664. Excavation, Trenching and Shoring

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

M41-10	1991 Standard Specifications for Road, Bridge, and Municipal Construction
M46-01	1989 Materials Branch Laboratory Manual

1.3 **RELATED REQUIREMENTS**

(Not Used)

1.4 **DEFINITIONS**

1.4.1 "Organic material" when referenced shall include vegetation or trash which will deteriorate and promote undesirable settlement.

1.4.2 References to "free from organic material" shall mean less than 5 percent by volume, with individual pieces less than 1/2 inch in maximum dimension.

1.5 **SYSTEM DESCRIPTION**

(Not Used)

1.6 **SUBMITTALS**

Submit the following in accordance with the Vendor Drawing and Data Requirements section of the Order/Subcontract.

1.6.1 Documentation providing the backfill characterization, as specified in Paragraph 2.1.1.4 and 2.1.4 and the moisture density relationships specified in Paragraph 3.2.2.4.A, for each type of soil used for backfill.

1.6.2 Documentation of field density tests, as specified in Paragraph 3.3, including the location and depth of each sample tested.

1.7 **CLASSIFICATION OF SYSTEM AND COMPONENTS**

(Not Used)

1.8 **PROJECT OR SITE ENVIRONMENTAL CONDITIONS**

(Not Used)

PART 2 PRODUCTS

2.1 **MATERIALS AND EQUIPMENT**

2.1.1 Backfill Materials

2.1.1.1 Backfill materials shall be the originally excavated onsite material unless such material is determined to be unsuitable due to presence of organic material, excessive moisture, or other deleterious substances. Rocks which would be retained on a 3 inch (3") screen shall not be used in the fill material.

2.1.1.2 Imported sand used for backfill shall be a natural sand, graded from fine to coarse, not lumpy or frozen, with 100 percent passing a No. 4 sieve and 0 to 5 percent passing a No. 200 sieve. The sand shall be free from organic material, slag, cinders, ashes, and other refuse.

2.1.1.3 Imported fine gravel used for backfill shall be a natural gravel having particles with 100 percent passing a 3/4 inch sieve, 25 to 80 percent passing a 1/4 inch sieve and 0 to 5 percent passing a No. 200 sieve. The gravel shall be free from organic material, slag, cinders, ashes, and other refuse.

2.1.1.4 Imported fill materials utilized for backfill shall be properly characterized and verified utilizing grain-size distribution (ASTM D422 and D1140).

9413202.1496

9413202.1447

2.1.1.5 Bedding materials shall conform to either the provisions of Paragraph 2.1.1.2 or 2.1.1.3 herein.

2.1.1.6 Notwithstanding the above requirements, gradation and particle size of imported granular fill material shall be controlled such that the laboratory and field testing required under Paragraphs 3.2.2.4.A and 3.3 herein can be performed in accordance with the specified ASTM or WSDOT test method.

2.1.2 Aggregate Base Course

Aggregate base course shall conform to M41-10, Section 9-03.10, Aggregate for Gravel Base and the additional gradation requirements of Table 1 herein.

2.1.3 Rock Surfacing

Material for the rock surfacing shall consist of crushed, processed or naturally occuring pit-run gravel. The material shall be free from organic material and shall conform to the gradation requirements provided in Table 1 herein and as approved by the Buyer.

TABLE 1

GRADATION REQUIREMENTS

SIEVE DESIGNATION	PERCENT PASSING BY WEIGHT	
	Aggregate Base Course	Rock Surfacing
1-1/2 inch square	100	100
3/4 inch square	50-85	-
1/4 inch square	35-65	50 max.
No. 4 mesh	25-45	-
No. 40 mesh	10-25	-
No. 200 mesh	0 to 10 max.	0 to 10 max.

2.1.4 For the material provided per Paragraph 2.1.2 and 2.1.3, one sample from the source material shall be taken in accordance with ASTM D75 prior to use.

2.1.4.1 The sample shall then be tested to demonstrate conformance to the specified requirements. Testing shall be performed in accordance with the procedures specified in M41-10, Section 9-03.20, Test Methods for Aggregates.

2.1.4.2 Test procedures in M41-10, Section 9-03.20 for aggregate base course, shall be WSDOT 102, WSDOT 104, WSDOT 111 and WSDOT 611 provided in M46-01.

2.1.4.3 Test procedures in M41-10, Section 9-03.20 for rock surfacing, shall be WSDOT 102, WSDOT 104, and WSDOT 111 provided in M46-01.

2.1.5 Buried Warning and Identification Tape

Tape shall be an alkali-resistant polyethylene plastic tape manufactured specifically for warning and identification of buried utility lines, and shall be provided in rolls, 6 inches wide with minimum thickness of 0.004 inch and shall have a minimum strength of 1750 psi lengthwise and 150 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core of the tape shall be encased in a protective jacket provided with other means to protect it from corrosion. The tape shall be as specified in Table 2 below and shall be imprinted in bold black letters continuously and repeatedly over entire tape length.

TABLE 2

TAPE COLOR

Yellow:	Electric
Red:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Security and Fire Communications
Blue:	Water Systems (raw, sanitary, and fire)
Green:	Sewer and Drainage Systems

Warning and identification shall be "CAUTION BURIED (Intended Service) LINE BELOW" or similar wording. Code and letter coloring shall be permanent, unaffected by moisture and other substances contained in trench backfill material.

2.1.6 Vapor Barriers (Water Vapor Retarders)

Polyethylene sheet for vapor barrier shall be 6 mil in thickness conforming to ASTM D2103 or ASTM D4397 EA-84.

2.2 **FABRICATION AND MANUFACTURE**

(Not Used)

9413202.1448

9413202.1449

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Prior to Excavation

3.1.1.1 Obtain permission to excavate from the Buyer.

3.1.1.2 Determine the lines, grades and elevations for the installation of foundations, basement slab and walls, drilled foundations, slabs at grade, underground utilities and appurtenances as shown on the Contract Drawings.

3.1.1.3 Supply and set stakes to provide strict and accurate vertical and horizontal control of the work from monuments and benchmarks provided by the Buyer. Provisions shall be taken to protect the monuments and benchmarks from damage.

3.1.2 Prior to Backfilling

3.1.2.1 All excavations shall be free of standing water, ice, frozen material or organic material, and the subgrade shall not contain frozen material, prior to placing backfill.

3.1.2.2 All exposed and excavated horizontal surfaces within a building and structure footprint shall be compacted to not less than 95 percent of its maximum dry density as determined in Paragraph 3.2.2.4.A. The horizontal surfaces of existing excavations need not be recompacted unless the subgrade is found not to be in conformance with the above requirements.

3.1.2.3 At locations beneath foundations, slabs at grade and appurtenances do not begin backfill operations until after the subgrade has been inspected, tested and approved by the Buyer.

3.1.2.4 Backfilling operations over or adjacent to foundations and behind walls shall not begin until the concrete work has been inspected, tested and accepted by the Buyer.

3.1.2.5 Backfilling operations over foundations may not begin until the concrete has cured for at least 7 days and the forms have been removed. In addition, do not backfill against concrete walls until the walls have reached their specified 28 day compressive strength as demonstrated by compression testing of molded concrete cylinders. Refer to Contract Drawings for additional restrictions on backfilling operations against concrete walls.

3.1.2.6 Backfilling operations for utility trenches shall not begin until the installed utilities have undergone all required tests and inspections, and the required as-builts have been obtained, except as specified elsewhere.

3.1.2.7 Prior to placement of aggregate base course and rock surfacing, inspect and verify that the underlying subgrade has been properly compacted per Paragraph 3.2.2.4.B and graded.

3.2 INSTALLATION, APPLICATION AND ERECTION

3.2.1 Excavation

3.2.1.1 General

A. All excavations shall be in accordance with Washington Administrative Code (WAC), Chapter 296-155, Section 650-664, "Excavation, Trenching and Shoring" and other applicable federal, state and local safety regulations. The side slopes below elevation 698.0 shall be 1.5 horizontal to 1 vertical and above elevation 698.0 shall be 2 horizontal to 1 vertical.

B. Excavations shall be by the open-cut method. Precautions shall be taken not to damage the existing underground utilities.

C. An imaginary 45° line extending downward and outward from the bottom corner of any existing foundation shall not intersect any intended excavation for adjacent foundations or utilities, unless noted otherwise on the Contract Drawings or approved by the Buyer. Seller shall support in place, shore or otherwise protect existing underground utilities or structures from damage due to Seller's operations.

D. When freezing temperatures are expected, do not excavate to the full depth indicated on the Contract Drawings unless the bottom of the excavation is adequately protected from frost.

E. Excess excavated material meeting the requirements of Paragraph 2.1.1 shall be stockpiled at a location designated by the Buyer for later use as backfill material. Material determined to be unsuitable for backfill shall be disposed of in an area designated by the Buyer.

3.2.1.2 Excavation for Foundations and Slabs at Grade

A. Requirements specified in Paragraph 3.2.1.1 herein shall apply. Additional requirements shall be as specified below.

B. The excavation shall be made to the size and depth required to install the foundations, slabs, walls and appurtenances to the lines and elevations shown on the Contract drawings.

9413202.1450

9413202.1451

3.2.1.3 Excavation for Appurtenances

A. Requirements specified in Paragraph 3.2.1.1 herein shall apply. Additional requirements shall be as specified hereinafter.

B. Excavations for precast manholes, flange boxes and other appurtenances shall be of sufficient width and depth to install these items as shown on the Contract Drawings.

The depth of the excavation shall be sufficient to allow the placement of a minimum of 6 inches of compacted sand below the bottom of the precast manholes and flange boxes.

C. Compact the bottom of the excavation in accordance with Paragraph 3.1.2.2.

3.2.1.4 Excavation for Utility trenches

A. Requirements specified in paragraph 3.2.1.1 herein shall apply. Additional requirements shall be as specified below.

B. Excavate trenches to widths and depths required to install the utilities as shown on Contract Drawings. Accurately grade the bottoms of trenches to provide uniform bearing and support for underground utilities and compact in accordance with Paragraph 3.1.2.2, except where it is necessary to excavate holes for bell or for proper sealing of joints. Excavate pipe trenches to at least 3 inches below the bottom of pipe elevation.

3.2.1.5 Drilled Pier Foundations

Drill holes for piers to the diameter and depth shown on the Contract Drawings. Bottom of the holes shall be level and free of loose material. Provide casing as required to prevent caving or sloughing during construction. Holes shall not be out of plumb by more than 1-1/2 inches in full depth.

3.2.1.6 Dewatering

Excavate in such a manner that the work area will be effectively drained. Drainage shall be by gravity whenever possible; utilize additional means when necessary, including pumping and bailing.

9413202.1452

3.2.2 Backfilling

3.2.2.1 General

A. Backfill material shall meet the requirements specified in Paragraph 2.1.1.1 unless noted otherwise in this specification section or on the Contract Drawings.

B. Jetting of backfill is not permitted.

C. Backfill material shall be moisture conditioned to within plus or minus 2 percent points optimum moisture content as determined in Paragraph 3.2.2.4.A. Scarifying or other methods may be required to obtain the required moisture content since water applied to the surface may not penetrate the full depth of the lift.

D. Do not operate heavy equipment for spreading and compacting backfill within 5 feet of below-grade walls. The fill within this 5 foot strip shall meet the requirements of Paragraph 2.1.1.3 and shall be placed in maximum loose lifts of 6 inches and be compacted with a vibrating plate compactor, or drum compactor with a total static weight not exceeding 3000 pounds.

E. Backfill shall be placed to the lines and contours matching the adjacent grade and as shown on the Contract Drawings.

3.2.2.2 Backfilling for Foundations, Slabs at Grade and Appurtenances

A. Requirements specified in Paragraph 3.2.2.1 herein shall apply.

B. Backfill material shall be placed in maximum loose lifts of 8 inches and compacted in accordance with Paragraph 3.2.2.4.

C. Place sand conforming to Paragraph 2.1.1.2 under all precast manholes and flange boxes. A minimum thickness of 6 inches, compacted to 95 percent of its maximum dry density as determined in Paragraph 3.2.2.4.A, shall be placed.

3.2.2.3 Backfilling of Utility Trenches

A. Requirements specified in Paragraph 3.2.2.1 herein shall apply. Additional requirements shall be as specified below.

B. Where utilities are coated for protection against corrosion, perform backfilling and tamping in such a manner that the coating will not be damaged. Damaged coatings shall be repaired or replaced by Seller.

9413202.1453

C. Direct burial cables shall be bedded in a cushion of sand conforming to Paragraph 2.1.1.2, not less than 3 inches on all sides. Direct burial conduit shall be buried directly in backfill material conforming to Paragraph 2.1.1.1. Other utilities shall be bedded in 3 inches of bedding materials conforming to Paragraph 2.1.1.5.

D. When pressure testing of underground pipe is required the trench shall not be backfilled to more than 2 feet above the top of pipe until the pressure tests have been performed. The joints and couplings shall be left uncovered during the pressure test. Upon the satisfactory completion of the test backfill operations may resume.

E. Deposit backfill material in the trench for its full width on each side of the underground utilities and appurtenances simultaneously. Use special care in placing initial layers of the backfill, so as to avoid damage or movement of the utility.

F. From the top of the bedding material to a depth of not less than two feet over sewers, direct burial wires, conduit, and underground piping; and not less than one foot over other utilities, backfill shall be placed in maximum loose lifts of 6 inches and compacted in accordance with Paragraph 3.2.2.4B. Compaction shall be achieved through the use of hand tamping or a power operated hand vibrating compactor such as a vibrating plate compactor or drum compactor with a total static weight not exceeding 3000 pounds.

G. Place markers and wood boards or concrete protection over underground electrical utilities as shown on the Contract Drawings.

Place buried warning and identification tape conforming to Paragraph 2.1.5 over the centerline of the underground utility at a depth of 12 inches below finished grade or as shown on the Contract Drawings.

H. Place the remainder of the backfill material in maximum loose lifts of 8 inches and compact in accordance with Paragraph 3.2.2.4.B.

I. Backfilling for plastic pipe shall conform to the requirements of ASTM D2774 for sanitary water line and FM Data Sheet 3-10 for fire water lines.

9413202.1454

3.2.2.4 Compaction of Backfill

A. Determine the moisture density relationship in accordance with ASTM D1557 for each type of soil used for backfill. Corrections to adjust the laboratory maximum dry density and optimum moisture content for soil with oversize particles shall be made in accordance with ASTM D4718. Onsite soil with more than 30 percent of the material retained on a 3/4-inch sieve shall be tested in accordance with WSDOT 606 provided in M46-01.

B. Compact each lift to not less than 95 percent of its maximum dry density as determined in Paragraph 3.2.2.4.A. Aggregate base course shall be compacted to not less than 95 percent of its maximum dry density. Each layer of rock surfacing shall be compacted by at least two passes of a vibratory compactor approved by the Buyer.

C. Compaction requirements shall be as identified here or as otherwise shown on the Contract Drawings.

3.2.3 Tolerances

All excavation and backfill shall be made to the dimensions and elevations shown on the Contract Drawings plus or minus 1 inch.

3.2.4 Vapor Barriers

Install polyethylene sheets for vapor barrier in continuous sheets, lapping joints 6" minimum. Cross section shall be sand cushion conforming to Paragraph 2.1.1.2, over polyethylene sheet over aggregate base conforming to Paragraph 2.1.2, as shown on the Contract Drawings.

3.3 **FIELD QUALITY CONTROL**

3.3.1 The Buyer shall ensure specified field tests are performed independently from the work being carried out to verify the work is accomplished in accordance with this specification section and the Contract Drawings. The Seller shall coordinate the work performed with specified testing activities.

3.3.2 Field density tests shall be performed in accordance with ASTM D1556, ASTM D2167 or ASTM D2922. When tests are performed by the Nuclear Method per ASTM D2922, at least 20 percent of the tests shall be performed in accordance with ASTM D1556 or ASTM D2167 methods.

3.3.3 Field density tests are required for each method of compaction utilized and for each type of fill material used.

9413202.1455

3.3.4 The minimum number of field density tests shall be as follows:

A. Below foundations, underground structures and slabs at grade; one test, per lift, per 1500 square feet of area with a minimum of one test at each installation; one test, per 1500 square feet of area for exposed and excavated horizontal surfaces.

B. Over and adjacent to foundations, underground structures and slabs at grade; one test, per lift, per 3000 square feet of area with a minimum of one test at each installation; one test per 3000 square feet of area for exposed and excavated horizontal surfaces.

C. One test per lift per day.

D. One test per lift per 3000 square feet of area for aggregate base course.

E. One test per lift per 200 lineal feet for trenches.

F. No tests are required for rock surfacing.

3.3.5 Any areas failing to meet compaction requirements shall be recompacted and retested. If required compaction cannot be obtained, the material shall be removed, replaced, recompacted and tested.

3.4 **ADJUSTMENTS**

(Not Used)

3.5 **CLEANING**

(Not Used)

3.6 **PROTECTION**

(Not Used)

3.7 **DEMONSTRATION**

(Not Used)

3.8 **SCHEDULES**

(Not Used)

END OF SECTION

U.S. DEPARTMENT OF ENERGY
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.
Advanced Technology Division
Fluor Contract 8457

SECTION 13121
FABRICATION SHOP BUILDING
B-595-C-A920-13121

APPROVED FOR CONSTRUCTION

9413202.1456

REVISION 0
ISSUE DATE 3-10-93

WAPA YES ___ NO X
QUALITY LEVEL I ___ II X
SAFETY CLASS 1__ 2__ 3__ 4X

ORIGINATOR:

J. L. Datte 3/8/93
J. L. Datte, Architectural Lead Date

CHECKER:

S. Sam 3/8/93
S. C. Sam, Architect Date

APPROVED BY:

MAR 1 2 1993

J. L. Datte
J. L. Datte Lead Discipline Engineer

3/8/93
Date

3/5/93 12:04pm
106\VOL5...\SPECS\A920\13121-0.

SECTION 13121
FABRICATION SHOP BUILDING
B-595-C-A920-13121

TABLE OF CONTENTS

PART		PAGE
PART 1 GENERAL		1
1.1	SUMMARY	1
1.2	REFERENCES	2
1.3	RELATED REQUIREMENTS	16
1.4	DESIGN CRITERIA	16
1.5	SUBMITTALS	37
PART 2 PRODUCTS		38
2.1	GENERAL	38
2.2	SITEWORK	39
2.3	CONCRETE	39
2.4	MASONRY	40
2.5	METALS	40
2.6	WOOD AND PLASTICS	41
2.7	THERMAL AND MOISTURE PROTECTION	41
2.8	DOORS	46
2.9	FINISHES	52
2.10	SPECIALTIES	53
2.11	EQUIPMENT	53
2.12	FURNISHINGS	53
2.13	SPECIAL CONSTRUCTION	54
2.14	CONVEYING SYSTEMS	54
2.15	MECHANICAL	54
2.16	ELECTRICAL	61
PART 3 EXECUTION		68

9413202.1457

ATTACHMENTS

ATTACHMENT	TITLE
A	MAXIMUM ALLOWABLE VOLTAGE DROP IN CABLE
B	CONDUIT, CABLE TRAY AND WIRE IDENTIFICATION
C	STANDARD SPECIFICATION FOR IDENTIFICATION OF PIPING SYSTEMS
D	(NOT USED)
E	PREPARATION AND CONTROL OF ENGINEERING AND FABRICATION DRAWINGS
F	(NOT USED)
G	(NOT USED)
H	GENERAL HVAC REQUIREMENTS
J	(NOT USED)
K	ENERGY CONSERVATION
L	MECHANICAL INSULATION/FIRE PROTECTION
M	PLUMBING/SERVICE PIPING
N	HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS
P	REFRIGERATION
Q	CONTROLS
R	(NOT USED)
S	(NOT USED)
T	HEALTH AND SAFETY
U	FIRE PROTECTION
V	QUALITY ASSURANCE

9413202.1458

9413202.1459

SECTION 13121
FABRICATION SHOP BUILDING

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Purpose

The specifications and drawings cover the minimum requirements for designing and constructing a pre-engineered, prefabricated, steel framed, metal clad, one story Fabrication Shop Building including foundations, structural system, all interior construction, electrical, plumbing, HVAC, and fire sprinkler systems; and to establish a level of quality and performance for design, material, durability, and workmanship.

1.1.2 Scope

This specification is not intended to specify all details of design and construction. The Seller has full responsibility for the design, engineering, erection, and complete and total construction of the building and foundations, and to ensure that all codes, specifications, standards, and documents applicable to this performance specification and referenced herein are complied with in total.

1.1.3 General Requirements

The Seller is to design and construct a new, one story, pre-engineered, prefabricated, steel framed, metal building to be located in the 200 East Area of the Hanford Project, north of Richland, Washington.

The building will be erected upon a reinforced concrete foundation. The first floor concrete-slab-on-grade shall be placed on a free-draining aggregate base overlying a compacted subgrade. The building envelope will comprise metal siding and a metal roof. Roof and walls will be insulated, and will have liner panels (except the low roof). Motorized, overhead coiling doors are typically 14 feet high by 20 feet wide. Personnel doors are typically 7 feet high metal flush doors. Plumbing is only under slab rough-in.

Foundations for the future Melter Support and Bridge Crane Support shall be included. Overall design shall be such so as to allow the future improvements to be incorporated by the Owner.

9413202.1460

1.1.4 Soils and Geotechnical Report

A soils and geotechnical report prepared by Dames and Moore entitled:

"Report of Geotechnical Investigation Proposed Hanford Waste Vitrification Plant Hanford, Washington" for Kaiser Engineers, Job No. 10805-383-016, November 15, 1989, along with supplemental reports dated July 28, 1990 and July 24, 1991 has been prepared for the construction of facilities associated with the Hanford Waste Vitrification Plant project. Copies of these reports are available for review from the Buyer for background information only.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 210	1981 Standard for Unitary Air Conditioning Equipment
ARI 410	1987 Forced-Circulation Air Cooling and Air-Heating Coils
ARI 430	1989 Control Station Air Handling Units
ARI 460	1987 Remote Mechanical Draft Air Cooled Refrigerant Condensers
ARI 520	1990 Positive Displacement Refrigeration Compressors, Compressor Units and Condensing Units
ARI 850	1984 Standard for Commercial and Industrial Air Filter Equipment
ARI 1010	1984 Drinking Fountains and Self-Contained, Mechanically-Refrigerated Drinking Water Coolers

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA Publication 99	1986 Standards Handbook
AMCA Standard 201	1973 AMCA Fan Application Manual - Fans and Systems

AMCA Standard 210	1974 Laboratory Methods of Testing Fans for Rating Purposes
AMCA Publication 261	Directory of Products Licensed to Bear the AMCA Certified Rating Seal
AMCA Standard 300	1985 (Rev. 1987) Reverberant Room Method for Sound Testing of Fans
AMCA Standard 500	1989 Test Methods for Louvers, Dampers and Shutters

AMERICAN CONCRETE INSTITUTE (ACI)

ANSI/ACI 318/318R	1989 Building Code Requirements for Reinforced Concrete and Commentary

AMERICAN CONFERENCE OF GOVERNMENT INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH	1988 TLVs: Threshold Limit Values

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC M016	1989 Manual for Steel Construction Ninth Edition

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A13.1	1981 Rev. 85 Scheme for the Identification of Piping Systems
ANSI A117.1	1986 Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped
ANSI/BHMA A156.1-156.21	1984-1990 Miscellaneous Hardware Specifications
ANSI C2	1990 National Electrical Safety Code
ANSI C78.1C	1978 Fluorescent Lamps (1985 Supplement)
ANSI C78.380	1984 Standard for Electric Lamps - High-Intensity Discharge Lamps - Method of Designation
ANSI C78.41	1987 Standard for Electric Lamps - Low Pressure Sodium Lamps
ANSI C82.1	1985 Standard for Ballasts for Fluorescent Lamps - Specifications

9413202.1461

9413202.1462

ANSI C82.2	1984 Standard for Fluorescent Lamp Ballasts - Methods of Measurement
ANSI C82.4	1985 Standard for Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type)
ANSI C82.9	1988 Standard for High-Intensity Discharge and Low Pressure Sodium Lamps, Ballasts and Transformers - Definitions
ANSI C84.1	1989 Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hertz)
ANSI N45.2.2	1978 Packaging, Shipping, Receiving, Storage and Handling of Item for Nuclear Power Plants
ANSI Y14.1	1980 Drawing Sheet Size and Format
ANSI Y14.2M	1979 Line Conventions and Lettering
ANSI 14.36	1978 Surface Texture Symbols
ANSI Y32.2	1975 (See IEEE 315 and 315A)
ANSI Y32.2.4	1949 (Revised 1988) Graphical Symbols for Heating, Ventilating, and Air Conditioning
ANSI Y32.2.6	1950 (Revised 1984) Graphical Symbols for Heat-Power Apparatus
ANSI Y32.4	1977 (Revised 1987) Graphic Symbols for Plumbing Fixtures for Diagrams Used in Architecture and Building Construction
ANSI Y32.9	1972 (Revised 1988) Graphic Symbols for Electrical Wiring and Layout Diagrams Used in Architecture and Building Construction
ANSI Z9.2	The Design and Operation of Local Exhaust Systems
ANSI Z97.1	1989 Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

ANSI Z358.1	1990 Emergency Eyewash and Shower Equipment
ANSI/SDI-100	(See also SDI-100) 1985 Standard Steel Doors and Frames
ANSI/ISA S5.1	1984 Instrumentation Symbols and Definitions
ANSI/ISA S5.2	1976 Binary Logic Diagrams for Process Operations
ANSI/ISA S5.5	1982 Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Control Systems
ANSI 242	1986 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
ANSI/IEEE 730	1984 Standard Instrumentation, Logic and Control Systems
ANSI/IEEE 828	1983 Standard for Software Configuration
ANSI/IEEE 983	1986 Guide for Software Quality Assurance
ANSI/IEEE 1012	1986 Standard for Software Verification and Validation Plans

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A36	1989 Standard Specification for Structural Steel
ASTM A53	1990 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A74	1987 Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A105/A105M	1990 Standard Specification for Forgings, Carbon Steel, for Piping Components
ASTM A153	1982 (R 1987) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

9413202.1463

9413202.1464

ASTM A185	1990 Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A307	1990 Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A325	1990 Standard Specification for High-Strength Bolts for Structural Steel Joints
ASTM A446	1989 Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
ASTM A500	1989 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A525	1990 General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A526/A526M	1990 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM A527/A527M	1990 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock Forming Quality
ASTM A563	1990 Standard Specification for Carbon and Alloy Steel Nuts
ASTM A615	1990 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM B1	1985 Standard Specification for Hard-Drawn Copper Wire
ASTM B8	1986 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft
ASTM B32	1989 Standard Specification for Solder Metal

9413202.1465

ASTM B88	1989 (Rev. A) Standard Specification for Seamless Copper Water Tube
ASTM C564	1988 Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C578	1987 (Rev. A) Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation
ASTM C665	1988 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C920	1987 Standard Specification for Elastomeric Joint Sealants
ASTM C1036	1990 Standard Specification for Flat Glass
ASTM D1557	1978 Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound (4.54 kg) Hammer and 18 Inch (457 mm) Drop
ASTM D2000	1990 Standard Classification System for Rubber Products in Automotive Applications
ASTM D2103	1986 Standard Specification for Polyethylene Film and Sheeting
ASTM D4397 EA-84	1984 (R 1989) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM G46	1976 Standard Practice for Examination and Evaluation of Pitting and Corrosion

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-88	1988 Edition (Published 1990) Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS (ASHRAE)

ASHRAE Handbook	1987 ASHRAE Handbook HVAC Systems and Application
ASHRAE Handbook	1989 ASHRAE Handbook Fundamentals (Inch-Pound Edition)
ASHRAE Handbook	1988 ASHRAE Handbook Equipment; Errata 1989 Additions and Corrections, 1990 Additions and Corrections, 1991
ASHRAE Handbook	1990 ASHRAE Handbook Refrigeration Systems and Applications, I-P Edition, Additions and Corrections, 1991
ASHRAE Manual	1983 Design of Smoke Control Systems for Buildings
ASHRAE Manual	1984 Simplified Energy Analysis Using the Modified Bin Method
ASHRAE 15	1989 Safety Code for Mechanical Refrigeration
ASHRAE 20	1970 Method of Testing for Rating Remote Mechanical - Draft Air Cooled Refrigerant Condensers
ASHRAE 24	1989 Method of Testing for Rating Liquid Coolers
ASHRAE 51	1985 Laboratory Methods of Testing Fans for Rating (AMCA Standard 210-85)
ASHRAE 52	1976 ASHRAE Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASHRAE 55	1981 Thermal Environmental Conditions for Human Occupancy
ASHRAE 62	1989 Ventilation for Acceptable Indoor Air Quality
ASHRAE 90.1	1989 Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

9413202.1499

ASHRAE GRP 158	1979 Development of Heating and Cooling Load Calculations Manual

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME	1989 Boiler and Pressure Vessel Codes, Section VIII Rules for Construction of Pressure Vessels
ASME B16 SERIES	Pipework and Fittings ASME B16.1-89 to ASME B16.47-90
ASME B31.1	1989 Power Piping Addenda B31.1A - 1989
ASME B16.22	1980 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME Y1.1	1989 Abbreviations for Use on Drawings and in Text

AMERICAN SOCIETY OF PLUMBING ENGINEERS (ASPE)

1988 Data Book

AMERICAN WATERWORKS ASSOCIATION, INC. (AWWA)

AWWA C651	1986 Standard for Disinfecting Water Mains

AMERICAN WELDING SOCIETY (AWS)

D1.1	1990 Structural Welding Code

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC	1989 Volume A National Standard for Testing and Balancing HVAC Systems

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION, INC. (BHMA)

(See ANSI/BHMA 156.1-156.21)

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	1985 Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems
CISPI 310	1985 Patented Joints for Use in Connection with Hubless Cast Iron Sanitary Systems

9413202.1467

9413202.1468

CODE OF FEDERAL REGULATIONS (CFR)

10 CFR 435	Code of Federal Regulations, Title 10, Part 435
10 CFR 436	Code of Federal Regulations, Title 10, Part 436
29 CFR 1910	Code of Federal Regulations Title 29 Particularly Chapter XVII, Part 1910, Subpart 132, 133, 134

FEDERAL SPECIFICATIONS (FS)

FS-HH-I-545	(Superseded by ASTM C1071 E1)
FS-HH-I-551	(Superseded by ASTM C552)
FS-HH-I-558	1976 Insulation Blocks, Boards, Blankets, Felt, Sleeving (Pipe and Tube Covering) and Pipe Fitting Covering, Thermal (Mineral Fiber Industrial Type) [Rev. B, Amendment 3]

FEDERAL STANDARDS (FED-STD)

FED-STD 595B	1989 Colors Used in Government Procurement

ILLUMINATING ENGINEERING SOCIETY (IES)

IES Handbook	1987 Illuminating Engineering Society Handbook

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

UPC	1988 Uniform Plumbing Code

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

UBC	1988 Uniform Building Code
UFC	1988 Uniform Fire Code
UMC	1988 Uniform Mechanical Code

9413202.1469

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 142	1982 Recommended Practice for Grounding of Industrial and Commercial Power Systems
IEEE 315	1975 (Revised 1989) Graphic Symbols for Electrical and Electronics Diagrams (Including Reference Designation Class Designation Letters)
IEEE 315A	1986 Supplement to Graphic Symbols for Electrical and Electronics Diagrams
IEEE 837	1989 Qualifying Permanent Connections Used in Substation Grounding

NATIONAL BUREAU OF STANDARDS (NBS)

NBS Handbook 135	1987 Life Cycle Costing Manual for the Federal Energy Management Program

NATIONAL ELECTRICAL MANUFACTURING ASSOCIATION (NEMA)

NEMA 250	1985 Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA PB-1	1990 Panelboards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	1988 Portable Fire Extinguishers
NFPA 11	1988 Standard for Low Expansion Foam and Combined Agent Systems
NFPA 11A	1988 Standard for Medium and High Expansion Foam Systems
NFPA 12	1989 Standard on Carbon Dioxide Extinguishing Systems
NFPA 13	1991 Installation of Sprinkler Systems
NFPA 15	1990 Standard for Water Spray Fixed Systems for Fire Protection
NFPA 16	1991 Standard on Deluge Foam-Water Sprinkler and Foam-Water Spray Systems

NFPA 16A	1988 Recommended Practice for the Installation of Closed-Head Foam-Water Sprinkler Systems
NFPA 17	1990 Dry Chemical Extinguishing Systems
NFPA 20	1990 Standard for the Installation of Centrifugal Fire Pumps
NFPA 22	1987 Standard for Water Tanks for Private Fire Protection
NFPA 24	1987 Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 45	1991 Standard on Fire Protection for Laboratories Using Chemicals
NFPA 70	1990 National Electrical Code (NEC)
NFPA 71	1989 Standard for the Installation, Maintenance, and Use of Signaling Systems for Central Station Service
NFPA 72	1990 Standard for the Installation, Maintenance, and Use of Protective Signaling Systems (Revision and Consolidation of 72A, 72B, 72C, 72D, and 72F)
NFPA 72E	1990 Standard on Automatic Fire Detectors
NFPA 72G	1989 Guide for the Installation, Maintenance, and Use of Notification Appliances for Protective Signaling Systems
NFPA 72H	1988 Guide for Testing Procedures for Local, Auxiliary, Remote Station, and Proprietary Signaling Systems
NFPA 78	1989 Standard for Lightning Protection Code
NFPA 90A	1989 Standard for the Installation of Air Conditioning and Ventilation Systems
NFPA 90B	1989 Standard for the Installation of Warm Air Heating and Air Conditioning and Ventilation Systems

9413202.1470

9413202.1471

NFPA 91	1990 Standard for the Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying
NFPA 96	1991 Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooling Equipment
NFPA 101	1988 Code for Safety to Life from Fire in Buildings and Structures
NFPA 255	1990 Standard Method of Test of Surface Burning Characteristics of Building Materials
NFPA 1410	1988 Training Standard on Initial Fire Attack
NFPA Vol. 1-16	Volumes 1 Through 16, Primarily Volume 9 as Specified in HPS

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA	1990 OSHA Technical Manual Chapter 3 - Heat Stress
OSHA 2201	1970 General Industry Safety and Health Standard, Revised 1988 and 1991

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA	1983 HVAC Systems Testing, Adjusting and Balancing (First Edition)
SMACNA	1987 Architectural Sheet Metal Manual, 4th Edition
SMACNA	1990 HVAC Systems Duct Design (Third Edition)
SMACNA	1985 HVAC Duct Construction Standards, Metal and Flexible, First Edition
SMACNA	1985 HVAC Air Duct Leakage Test Manual
SMACNA	1978 Energy Recovery Equipment and Systems Manual
SMACNA	1984 Energy Conservation Guide Lines

9413202.1472

SMACNA	1986 Fire, Smoke, and Radiation Damper Installation Guide for HVAC Systems
SMACNA	1975 Accepted Industry Practice for Industrial Duct Construction
SMACNA	1983 HVAC Systems Testing, Adjusting and Balancing
SMACNA	1991 Seismic Restraints

STEEL DECK INSTITUTE (SDI)

SDI	1990 Steel Deck Institute Diaphragm Design Manual, 2nd Edition
SDI	1989 Design Manual for Composite Decks, Form Decks and Roof Decks, Publication No. 27

STEEL DOOR INSTITUTE (SDI)

(See also ANSI/SDI-100)

SDI-100	1985 Standard Steel Doors and Frames

THERMAL INSULATION MANUFACTURERS ASSOCIATION (TIMA)

TIMA T302A	1988 TIMA Energy Saving Guide (Recommended Thickness for Pipe and Equipment Insulation)

UNDERWRITERS LABORATORIES (UL)

UL 44	1983 Rubber-Insulated Wires and Cables, 12th Edition, January 29, 1990, Bulletin July 6, 1990, Bulletin July 10, 1990
UL 50	1990 Cabinets and Boxes
UL 67	1988 Panelboards
UL 96	1988 Standard for Safety Lightning Protection Components
UL 96A	1990 Standard for Safety Installation Requirements for Lightning Protection Systems
UL 489	1986 Molded Case Circuit Breakers and Circuit Breaker Enclosures

9413202.1473

UL 723	1983 UL Standard for Safety Test for Surface Burning Characteristics of Building Materials Sixth Edition; April 28, 1987
UL 900	1987 Safety Standard for Air Filter Units
UL 924	1990 Emergency Lighting and Power Equipment, 6th Edition
UL 935	1984 Standard for Safety Fluorescent Lamp Ballasts 7th Edition
UL 943	1990 Ground Fault Circuit Interrupters, 2nd Edition
UL 1029	1990 High-Intensity-Discharge Lamp Ballasts
UL 1242	1983 Standard for Safety Intermediate Metal Conduit 7th Edition
UL 1561	1991 Dry-Type General Purpose and Power Transformers
UL 1570	1988 Standard for Safety Fluorescent Lighting Fixture 3rd Edition
UL 1572	1984 High Intensity Discharge Lighting Fixtures, Second Edition, May 30, 1990, Errata - August 1990

U.S. DEPARTMENT OF ENERGY - HEADQUARTERS (DOE)
Telephone: (202) 586-9642

DOE Order 5480.7	1980 Fire Protection, Revised 1987 (Attachment U)
DOE Order 6430.1A	1989 General Design Criteria:
	Section 0110-5 (Attachment T) - Health and Safety
	Section 0110-12 (Attachment K) - Energy Conservation
	Section 0140 (Attachment V) - Quality Assurance
	Section 1300-3.2 (Attachment R) - Safety Class Items

Section 1525 (Attachment L) - Mechanical Insulation

Section 1530 (Attachment L) - Fire Protection

Section 1540 (Attachment M) - Plumbing/ Service Piping

Section 1550 (Attachment N) - Heating, Ventilating and Air Conditioning Systems

Section 1565 (Attachment P) - Refrigeration

Section 1595 (Attachment Q) - Controls

U.S. DEPARTMENTS OF THE ARMY AND THE AIR FORCE

AFM 88-29	Engineering Weather Data
TM-5-815-2 (AFM 88-36)	Energy Monitoring and Control Systems

U.S. NAVAL FACILITIES ENGINEERING COMMAND

NCEL UG-0010	User Guide for Single Building Controllers

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5-88 (plus supplements)	1988 Grading Rules for Western Lumber

1.3 **RELATED REQUIREMENTS**

Specification Section 01730 Operation and Maintenance Data

1.4 **DESIGN CRITERIA**

1.4.1 Architectural

The Architectural design of the building shall meet the following criteria:

1.4.1.1 Codes and Specifications

A. Uniform Building Code (UBC)

B. NFPA 101

C. Uniform Fire Code (UFC)

D. 29 CFR Part 1910 (Subpart D) for Handrails, Stair Treads and Ladders

E. ANSI A117.1

1.4.1.2 Design Criteria

A. Thermal Resistance Value (R-Value)

Roof	R-18.52 (Minimum)
Walls	R-12.5 (Minimum)
Floors (Perimeter)	R-6 (Minimum) Vertical insulation for at least 24 inches of foundation or R = 13 (minimum) horizontal insulation for at least 36 inches on underside of slab on grade (see Section 2.7.2.1 of this specification for more construction details)

The whole building(s) shall comply with ASHRAE Standard 90.1 and the above minima. However, individual values may have to be increased to accommodate other items like doors that do not comply with the prescriptive design approach. Also use heating degree-days method to determine the minimum values, which may supersede the above minimum values.

B. Wall Assembly

Siding assemblies shall be designed to resist the wind loading as specified in Paragraph 1.4.2.2. Inward and outward design wind pressures shall be determined from ASCE 7-88.

C. Roof Assembly

Roofing, insulation and liner shall be designed to resist an uplift due to wind suction pressure as specified in Paragraph 1.4.2.2.

D. Floors, walls, roof, and doors in the Fab Shop Building shall be insulated and have vapor barriers (except doors) on warm side of the insulation to prevent condensation internally, externally, or within the construction in all weather and internal design conditions.

E. The building shall be designed to eliminate mobility barriers, making the building accessible to and usable by the physically handicapped; conforming to ANSI Standard A117.1.

9413202.1475

9413202.1476

1.4.2 Structural

Structural engineering and design of the building shall meet the following requirements:

1.4.2.1 Codes and Specifications

The following codes, standards and specifications shall be used for the purposes listed below. Modifications applicable to this project are described below.

A. UBC

Earthquake Loads
Impact Loads
Rain Loads (Ponding)
Building Design
Concrete Anchorage

B. ASCE 7-88 (Formerly ANSI A58.1-82)

Dead Loads
Live Loads
Snow Loads
Wind Loads

C. ACI 318

Concrete Design

D. AISC - Manual for Steel Construction (Ninth Edition)

Steel Design
Steel Fabrication
Steel Erection

E. SDI - Diaphragm Design Manual and Manual for Composite Decks, Form Decks and Roof Decks

Floor and Roof Deck Design

1.4.2.2 Design Loads

Loads and forces used for design shall be as defined in ASCE 7-88, UBC Chapter 23, and as specified below. The buildings are classified as Category I per ASCE 7-88, Table 1 for purpose of determining wind and snow loads.

The unit weights of materials and construction assemblies for buildings and other structures shall be those given in ASCE 7-88. Where unit weights are neither established in that standard nor

9413202.1477

determined by test or analysis, the weights shall be determined from data in manufacturers' drawings or catalogs.

A. Snow Loads

Ground snow load shall be 15 psf. Minimum snow load on roofs shall be 20 psf. The effects of snow drifts shall be considered.

B. Wind Loads

Basic wind speed at standard height of 33 feet shall be 70 mph. The wind loads shall be based on terrain Exposure "C".

C. Earthquake Loads

Building and structures, components and equipment supports and anchorage shall be designed to resist earthquake forces calculated in accordance with UBC Chapter 23 utilizing the following site specific information:

Seismic Zone	= 2B
Importance Factor I	= 1.0
Site Coefficient S	= 1.2

D. Minimum Design Live Loads (on slab)

1) Shops - 200 psf plus 60,000 lbs all terrain crane with four rubber tires (spacing 8'-6" out to out).

2) Floor in high bay - HS20-Truck Load

3) Mock-up equipment laydown area - such as the future Melter Supports and future Bridge Crane Supports, see Architectural Sketch SK-2-91458 through SK-2-91461.

E. Bridge crane loads in the high-bay area, operation of 30 ton crane.

1.4.2.3 Load Combinations

Loads shall be combined in accordance with UBC and ASCE 7-88 Section 2.3 when using allowable stress design and Section 2.4 when using strength design method.

1.4.2.4 Foundations

Foundation design shall meet the requirements of the UBC and the soil parameters given herein.

9413202.1478

1.4.2.4.1 Soil Properties

The soil bulk density may be assumed as 110 pcf and angle of internal friction equal to 35 degrees.

1.4.2.4.2 Water Table

The water table is about 310 feet below-grade and, therefore, will not be a consideration.

1.4.2.4.3 Frost Depth

The design frost depth is 30 inches below finished grade.

1.4.2.4.4 Foundation Depth

The minimum depth to the bottom of foundations will be 2'-6" below finished grade.

1.4.2.4.5 Minimum Footing Size

Minimum footing width shall be 2 feet 6 inches. The footings will be sized to provide a minimum stability ratio against overturning and sliding of 1.5 for all lateral load conditions.

1.4.2.4.6 Allowable Soil Bearing

The allowable net soil bearing pressure shall not exceed 2.5 ksf, except a 33 percent increase is permitted when considering wind or seismic load.

1.4.2.4.7 Settlements

The settlements will be elastic in nature, and will occur essentially simultaneous with the application of loads. No long term settlements are anticipated.

The estimated elastic settlement of footings for 2.5 ksf net bearing pressure is expected not to exceed 1/2 inch. To prevent differential settlement, size building footings to provide uniform bearing pressure.

1.4.2.4.8 Lateral Earth Pressure

Lateral earth pressure against yielding walls shall be determined using the coefficient of active earth pressure, (Ka) equal to 0.27. For rigid (unyielding) walls the at-rest earth pressure coefficient, (Ko) equal to 0.43 shall be used. Lateral pressure due to surcharge loads where occurring shall also be considered. Yielding walls are those where displacement at top exceeds 0.001 times the wall height.

9413202.1479

1.4.2.4.9 Lateral Force Resistance

Lateral loads may be resisted by a combination of passive pressure and friction. The coefficient of passive earth pressure, (Kp) is equal to 2.5. The coefficient of friction (μ) between soil and footing may be taken as 0.42. One-half of the passive resistance shall be used when combining with friction to determine resistance. The upper 1 foot of soil shall be neglected when determining passive resistance.

1.4.2.4.10 Excavation and Backfill

The excavated soil or imported granular fill material approved by the Buyer may be used as structural backfill around foundations and under floor slab. Backfill shall be compacted to 95 percent of its maximum density as determined by ASTM D1557 methods.

1.4.3 Heating, Ventilating and Air Conditioning

1.4.3.1 General

The design and installation of the heating, ventilating and air conditioning system shall be in accordance with DOE 6430.1A modified as shown in Attachments; Section 0110-12: Energy Conservation (Attachment K), Section 1525: Mechanical Insulation (Attachment L), Section 1530: Fire Protection (Attachment L), Section 1540: Plumbing/Service Piping (Attachment M), Section 1550: Heating, Ventilating and Air Conditioning Systems (Attachment N), Section 1565: Refrigeration (Attachment P), and Section 1595: Controls (Attachment Q), Section 0110-5: Health and Safety (Attachment T), and Section 0140: Quality Assurance (Attachment V).

The design, equipment and materials used together with the installation shall be on the basis of a 20 year life expectancy.

Attention is drawn to the following documents listed below but are not limited to these. The Seller is strongly advised to read these and all related publications. No excuses will be accepted due to lack of knowledge of these on state, federal and industry standards.

ASHRAE Handbook: 1987 ASHRAE Handbook HVAC Systems and Application

ASHRAE Handbook: 1989 ASHRAE Handbook Fundamentals (Inch Pound Edition)

ASHRAE Handbook: 1990 ASHRAE Handbook Refrigeration Systems and Applications, I-P Edition, Additions and Corrections, 1991

ASHRAE 55

ASHRAE 90.1

ASHRAE GRP 158

ASHRAE 62

OSHA Technical Manual, Chapter 3 - Heat Stress

SMACNA: 1978 Energy Recovery Equipment and Systems Manual

SMACNA: 1985 HVAC Duct Construction Standards - Metal and Flexible, First Edition

SMACNA: 1990 HVAC Systems Duct Design (Third Edition)

OSHA 2201 General Industry Safety and Health

1.4.3.2 HVAC System Design Criteria

1.4.3.2.1 Geographical Site Design Conditions

Location	Hanford, Washington
Altitude	714 feet above sea level
Latitude	46° North
Longitude	119° West

1.4.3.2.2 Attachments K, L, M, N, P, and Q (Sections 0110-12, 1525, 1530, 1540, 1550, 1565 and 1595, respectively) General Design Criteria.

1.4.3.2.3 Outdoor Design Conditions

	Type of Area	Winter	Summer
1)	Fabrication Shop and High Bay Computerize (melter) area	9°F db	101°F db and 68°F wb
2)	Offices, change rooms, restrooms (future)	9°F db	101°F db and 68°F wb
3)	Extreme weather conditions	-27°F db	115°F db and 75°F wb
4)	Outdoor summer dry bulb daily range		30°F

9413202.1480

	Type of Area	Winter	Summer
5)	Wind velocity - winter and summer	15 mph for 'U' value calculations	
6)	Average infiltration wind velocity	25 mph (0.3 inches differential pressure)	
7)	Ground temperature at 10 feet below grade	55°F	55°F

1.4.3.2.4 Indoor Design Conditions

	Type of Area	Summer	Winter	R.H.
1)	Fabrication Shop	85°F Max	65°F Min	Not Controlled
2)	Offices	78°F	72°F	50% RH at maximum summer design conditions. RH not controlled in winter.
3)	Change rooms	78°F	75°F	50% RH at maximum summer design conditions. RH not controlled in winter.
4)	Rest (toilet) rooms	78°F	70°F	Not Controlled
5)	High bay (melter) area	85°F Max	60°F Min	40% to 60%

and ANSI N45.2.2 storage requirements Class A

1.4.3.2.5 Anticipated Occupant Densities and Degree of Activity, and Internal Electrical Equipment Tools Load

1) Occupant densities and degree of activity as recommended by ASHRAE Standards and Manuals to suit areas or as specified in Architectural sections of this specification and as indicated below:

9413202.1481

9413202.1482

a. Employees (20 Total)

Supervisor	1
Fab. Spec./Eng.	1
Planner/Scheduler	1
Material Coord.	1
Tool Room Attendant	1
Boiler Makers	2
Pipe Fitters	4
Millwrights	2
Electrician	2
Welders	2
Sign Painter	1
Insulator	2
Quality Control	1

2) Electrical Equipment Tools

Pedestal grinders	2ea	12"
Pedestal grinder	1ea	6"
Power hack saws	1ea	
Band saw	1ea	
Drill press	2ea	(one of the drill press shall have 2 1/2" capacity)
Pipe Bender	1ea	(to handle largest size of jumper in HWVP.)
Pipe Threader	1ea	(1/8" to 2")
Air Compressor . . . . . (outside building)	1ea	(125 CFM at 110 lbs sq. in.)
Hydraulic Press	1ea	(100 ton)
Welders	2ea	(Miller gold Stars)
Masonry Saw	1ea	

1.4.3.2.6 Ventilation Air

The minimum outside air to be delivered relatively equally to all areas shall be to ASHRAE Standard 62 plus make-up air required for industrial ventilation in the building. Ventilation requirements will also comply with OSHA standards particularly OSHA 2201 General Industry Safety and Health Standard (29 CFR 1910) Subpart G, H and L and OSHA Technical Manual Chapter 3 - Heat Stress during extreme weather conditions.

9413202.1483

1.4.3.2.7 Infiltration

Infiltration for heating and cooling loads shall be calculated according to the methods provided by ASHRAE Publication GRP 158 and ASHRAE Handbook Fundamental and ASHRAE 90.1 and the recommendations of the manufacturers of the building materials, plus the building construction methods used.

1.4.3.2.8 Thermal Transmission Values ('U' Values)

The building construction shall be to ASHRAE Standard 90.1 and Table 8A-27 for energy usage compliance but shall be superseded by the annual heating degree-days method for determining the minimum thermal resistance. See Paragraph 1.4.1.2 of this specification.

1.4.3.2.9 Air Circulation

A. The air circulation shall be designed to limit the thermal stratification to less than 7°F from floor to the underside of the roof in the Fabrication Shop and 10°F from floor to the underside of roof in the High Bay (melter) area. Space unit heaters shall be located as high as possible to provide maximum working space in the Fabrication Shop and 15'-0" in the melter area and circulate air during the winter months even when the heating elements are not in use. This is required as an economy feature and also to minimize hot air stratification.

B. An absolute minimum air circulation rate of 1.0 cfm/SF shall be provided in the Fabrication Shop area. The air circulation rate in the High Bay (melter) area shall be increased to at least 5.0 cfm/SF. However, it is the designer's responsibility to provide sufficient air circulations to minimize temperature imbalance between the various working levels particularly in the High Bay (melter) area. Economizers and heaters shall be located at approximately 15'-0" above the floor in the High Bay (melter) area with inlet ducts extended to within 12 inches of the roof to suck down hot stratified air and blow it to floor level (both summer and winter). If a centralized air handling system is used in the melter area, then the return air shall also be taken from a high-level location to suck down hot stratified air. Supply air will be distributed at various heights and sides of the centrally located melter to provide even and controlled air temperature distribution. All areas shall be heated and cooled with no dead spots.

1.4.3.2.10 Safety Factor

A minimum of 10 percent safety factor shall be added to the calculated design total cooling requirements. A minimum of

20 percent safety factor shall be added to the calculated design total heating requirement.

1.4.3.2.11 Noise and Vibration Levels

A. Shall comply with 1987 ASHRAE HVAC Systems and Application Handbook (table, 2 pg. 52.4, table, 27 pg. 52.31) requirements.

B. Figure 5, Page 52.3 1987 ASHRAE HVAC Systems and Application Handbook will be used for Room Criterion Calculations.

C. If air handling equipment is located on top of the offices, then suitable construction methods shall be used to prevent noise and vibration being transmitted to the office and wash room areas.

9413202.1484

1.4.3.2.12 Energy Conservation

The building envelope shall meet with the minimum prescriptive energy conservation requirements of ASHRAE Standard 90.1 and Table 8A-27 and the criteria in Sections 0110-12.3 and 0110-12.4 (Attachment K).

The Life Cycle Cost (LCC) Analysis shall be performed to determine the most economical HVAC system according to the procedures described in Section 0110-12.7 and 0110-12.8 (Attachment K). The HVAC system to be used shall also comply with all the other details of this specification.

The systems shall be zoned to save energy costs for different occupied areas.

The control diagrams shall use ANSI/ISA, S5.1, S5.2, and S5.5 Symbols and Definitions, plus ANSI/IEEE 730, 828, 983 and 1012, Standards for Software.

1.4.3.2.13 Fire and Smoke

Systems shall be designed to be started and stopped as required by Local/State/National Codes and requirements and Sections 1530 and 1595-6.5 (Attachments L and Q, respectively). Provision shall be made for automatic smoke ventilation in the event of fire as necessary to comply with Local/State/National requirements and Section 1595-6.5 (Attachment Q) and NFPA 90A and NFPA 90B.

Fire and smoke dampers and barriers shall be provided where necessary to comply with Local/State and NFPA 90A and NFPA 90B requirements.

9413202.1485

1.4.3.2.14 Operating Times/Frost Protection/Maximum Summer Conditions

The areas/rooms shall be designed to operate at the following times: Frost thermostats shall be provided where necessary to protect the systems and all services within the buildings from frost damage. All air cooling systems must operate with outside temperatures up to 110°F and down to -20°F. All outside water carrying pipes shall be electrically trace heated and insulated. Other pipes shall be electrically trace heated where necessary.

The areas/rooms shall operate at the following times:

Type of Area	Time Operated
Fabrication Shop	Two - 8 hour shifts
Offices, restrooms, change rooms	Two - 8 hour shifts
High Bay (melter) area	Three - 8 hour shifts

1.4.3.2.15 Filtration Requirements (Disposable)

Supply air will be filtered with units rated at 25 percent to 35 (minimum) percent efficiencies (atmospheric dust spot) in accordance with ASHRAE 52. Outside intake air inlets will be located above grade (see Attachment H, Paragraph 3.0) to minimize dust loading to the filters.

The Design Engineer shall calculate both the particulate and volatile levels in all indoor areas to meet the minimum requirements of ASHRAE 62, ACGIH and OSHA. These calculations may indicate that higher particulate efficiencies than the minimum stated above and also the use of filters and activated carbon filters to remove volatile gases are both necessary. Sand storms occur in Hanford, Washington and consideration should be given to installing inertia prefilters to lengthen the life of the higher efficiency filters.

1.4.3.2.16 Equipment Location

Air cooling systems equipment (like adiabatic washers) or air conditioning equipment shall be located at ground level on concrete pads outside the building or inside areas which are easily/safely accessible. Space unit heaters shall be located as high as possible to optimize space requirements and economize on energy usage.

1.4.3.2.17 Condensation/Moisture Control

Condensation within any building structure or building material shall be prevented at all internal and external temperature and humidity conditions by the use of 'water vapor retarders and

sufficient insulation.' Reference and calculations to determine this condition shall be based on the methods detailed in ASHRAE Handbook (Fundamentals) Chapters 20, 21 and 22. Moisture migration to or from humidity controlled areas shall be controlled by the use of water vapor retarders and sealing strips.

Thermal bridging which will cause condensation within or on the surface of any building structure or building component shall be prevented at all internal and external temperature and humidity conditions by the design and construction methods used by the Seller. Reference and calculations to determine this (these) condition(s) shall be based on the methods detailed in ASHRAE Handbook (Fundamentals) Chapters 20, 21 and 22.

All the above calculations will be required to be reviewed by the Buyer before construction starts.

1.4.3.2.18 Industrial Ventilation

The industrial ventilation system(s) shall be designed as specified in ACGIH Industrial Ventilation Manual and comply with NFPA 91. The industrial ventilation systems shall have air filtration in compliance with the State of Washington air quality requirements. Metal chips from lathes and drills etc. will be collected manually.

1.4.3.2.19 Access and Working Space

Provide access to and working space about HVAC equipment to permit safe operation and maintenance of such equipment.

1.4.4 Electrical

The electrical design shall include all applicable elements as defined in this document for the following systems:

A. Lighting, interior and exterior

B. Grounding

C. Electrical distribution

D. Telephone

E. Public Address

F. Lightning Protection

9413202.1989

9413202.1487

1.4.4.1 Access and Working Space

Provide access to and working space about electrical equipment to permit safe operation and maintenance of such equipment. Article 110 of NFPA 70 shall be used to determine the minimum access and working space.

1.4.4.2 Energy Conservation

1.4.4.2.1 Electrical distribution systems shall be designed to conserve energy and comply with ASHRAE Standard 90.1. Provide energy efficient electrical equipment on a life cycle cost analysis basis and select equipment locations to minimize electrical system energy losses.

1.4.4.2.2 Energy conservation measures shall include:

A. Use of high efficiency light sources

B. Use of high power factor ballasts in accordance with ANSI C82.9 or ANSI C82.1

C. Power factor correction for electric motors of 20 HP or larger.

1.4.4.3 Spare Capacity

Electrical distribution switchboard and panelboards shall be sized such that their main bus will be 75 percent loaded after calculation of their design load in accordance with the NFPA 70. Electrical distribution panels shall be provided with 20 percent spare circuit breakers for future load.

1.4.4.4 General Design Considerations

The electrical design shall conform to the requirements of:

A.	ANSI C2	National Electrical Safety Code
B.	NFPA 70	National Electrical Code

1.4.4.5 System Voltage Levels

The following voltage levels shall be utilized as indicated:

System Voltage	Applications
13.8 kV, 3 phase, 3 wire, 60 Hz	Incoming power source
480V, 3 phase, 4 wire, 60 Hz	Power distribution and utilization

408Y/277V, 3 phase, 4 wire, 60 Hz	General lighting, task lighting and special purpose power receptacles
208Y/120V, 3 phase, 4 wire, 60 Hz	Convenience receptacles

System and equipment voltage ratings shall comply with ANSI C84.1.

1.4.4.6 System Voltage Drop Criteria

The allowable voltage drop in the cables during normal operation shall not exceed the values on Attachment "A".

In all cases involving motor starting, the voltage at the motor terminals must be sufficient to ensure proper breakaway and acceleration of the motor. In general, the allowable voltage drop at motor terminals shall not exceed 15 percent.

1.4.4.7 Basis for Selection of Equipment and Feeder Ratings

1.4.4.7.1 Voltage levels, insulation levels, continuous current ratings, interrupting capacities and circuit protection shall be selected and coordinated in accordance with the recommendations of the National Electrical Code and this specification.

1.4.4.7.2 Feeders to distribution transformers and lighting and distribution panelboards shall be sized to match the rating of the associated equipment.

1.4.4.7.3 Equipment short circuit ratings shall be coordinated to the available fault duty at the Fabrication Shop service entrance.

1.4.4.7.4 Fault current rating of electrical equipment shall be selected to exceed the available fault current, at that point by a minimum of 20 percent, as determined by short circuit calculations performed in accordance with ANSI Standard 242. For purposes of calculation, the available fault duty shall be taken as the three phase RMS symmetrical short-circuit current available at the substation transformer secondary terminals with an infinite or unlimited primary power source.

1.4.4.8 Electrical System Protection

1.4.4.8.1 Protective devices such as circuit breakers, fuses, breaker trip units and overload devices, shall be selected and applied to minimize damage to the electrical system and to limit the extent and duration of service interruptions due to overload or fault conditions.

9413202.1488

1.4.4.8.2 A coordination and selectivity study shall be performed to coordinate upstream and downstream overcurrent protection devices so that the protective device closest to the fault will selectively trip to isolate the fault. The coordination and selectivity study shall make use of time versus current curves on standard log-log paper to illustrate coordination of the selected protective devices. The coordination and selectivity study shall include breaker curves and set-point, fuse curves, cable damage curves, transformer inrush and damage points, motor inrush and overload curves and ground fault curves. The coordination and selectivity study shall begin with the overcurrent protection device at the 13.8 kV load interrupter switch and continue downstream to the branch circuit protective devices.

1.4.4.9 Environmental and Operating Conditions

1.4.4.9.1 Electrical equipment and material shall be suitable for continuous operation at the following ambient temperatures:

Area	Design Ambient Temperature Range
Outdoors	110°F maximum, -20°F minimum
Indoors - general	104°F maximum

1.4.4.9.2 Electrical enclosures shall be in accordance with NEMA 250 and UL 50, and shall be suitable for the environmental conditions encountered:

1.4.4.10 Equipment and Material Quality

1.4.4.10.1 Electrical equipment and materials when applicable shall be specified to be UL tested, with the UL label attached.

1.4.4.10.2 Electrical equipment, components and materials shall be new, readily available and of proven design for the intended application.

1.4.4.10.3 When two or more components of the same specifications are required, the components shall be identical, same manufacturer and catalog number.

1.4.4.11 Equipment Identification

1.4.4.11.1 Major items of electrical equipment shall be identified by equipment numbers. Equipment to be so numbered includes:

A. Disconnect Switches

B. Transformers

9413202.1499

C. Distribution Panels

D. Lighting Panels

E. Motor Control Enclosure

1.4.4.11.2 The electrical equipment numbering system shall be as follows:

XX - 32 B - X XX X

- X — Designation for similar or standby (1 alpha)
- XX — Sequential equipment number (2 digits)
- X — Prime equipment number (1 digit)
- B — Subsystem designation (1 alpha)
- 32 — System designation (2 digits)
- XX — Equipment category (2 alpha)

Equipment Category

DA - AC Distribution Panel	MT - Motor
DD - Disconnect Switch	SB - Switchboard
LX - Lighting Panel	XT - Transformer

1.4.4.11.3 Equipment and device nameplates shall be made of laminated plastic and shall have black lettering on white background. Nameplates shall be permanently attached to equipment with screws.

1.4.4.11.4 Indicating Lights

Indicating lights for control stations shall be provided with color caps as follows:

A. Green - Circuit breaker open, Contactor open

B. Red - Circuit breaker closed, Contactor closed

C. Amber - Control Switch in "Auto" position

1.4.4.12 Conduit and Wire Identification

1.4.4.12.1 See Attachment "B" for conduit and wire identification on construction drawings and in the field.

1.4.4.12.2 Conduit and cable schedules shall be prepared for the following systems:

9413202.1490

A. Power and control

B. Instrumentation

C. Communications (Home runs only)

For the following systems, conduit and wire shall be identified on the drawings, but shall not be listed in the conduit and cable schedules:

A. Instrumentation (Except home runs)

B. Communications (Except home runs)

C. Fire Alarm

D. Lighting

1.4.4.12.3 Power, control and instrumentation circuits shall be physically labeled at their source and termination points.

1.4.4.12.4 Conductors for 208Y/120 volt, three-phase systems shall be color coded as follows:

A. Grounded neutral - White

B. Grounding conductor - Green or bare

C. Phase "A" conductor - Black

D. Phase "B" conductor - Red

E. Phase "C" conductor - Blue

1.4.4.12.5 Conductors for 480Y/277 volt, three-phase systems shall be color coded as follows:

A. Grounded neutral - Gray

B. Grounding conductor - Green or bare

C. Phase "A" conductor - Brown

D. Phase "B" conductor - Orange

E. Phase "C" conductor - Yellow

1.4.4.12.6 Lighting fixture wire shall be color coded as follows:

A. Grounded conductor - White insulation or white braid

9413202.1491

B. Ungrounded conductor - Black insulation or white braid with black tracer

1.4.4.12.7 Insulated conductors intended solely for grounding purposes will be identified by a continuous green color insulation.

1.4.4.12.8 Grounded neutral conductors No. 2 AWG and smaller shall have white or gray insulation. Grounded conductors larger than No. 2 AWG shall also have white or gray insulation or shall be identified at all terminal and junction points and splices by wrapping with white or gray, self-adhesive, vinyl plastic electrical tape.

1.4.4.12.9 Control wiring conductors shall have black insulation. Multi-conductor control cables shall have individual conductors numbered for identification, e.g., 1, 2, 3, etc.

1.4.4.12.10 Color coding and identification of wiring supplied by equipment Vendors shall be the Vendor's standard.

1.4.4.12.11 Color coding and identification of fire alarm system wiring shall be as follows:

Red	-	Initiating device, input to Fire Alarm Panel.
Violet Purple	-	Alarm device, output from Fire Alarm Panel.
Blue	-	Output from Fire Alarm Panel to devices other than alarms.
Yellow	-	Supervisory device, input to Fire Alarm Panel.
Orange	-	Wiring between Fire Alarm Panel and Radio Fire Alarm Repeater to indicate panel status.
Black	-	Incoming power (phase/line) to the Fire Alarm Panel, Radio Fire Alarm Repeater or indicating light.
White	-	Incoming power (neutral) to the Fire Alarm Panel, Radio Fire Alarm Repeater or indicating light.
Green/Bare	-	Ground wire.
Brown	-	Battery wiring.

1.4.4.13 Drawings

1.4.4.13.1 Drawings shall be prepared using standard symbols in accordance with ANSI Y32.9 for plan drawings and ANSI Y32.2 for single line diagrams, elementary diagrams and connection diagrams.

9413202.1492

9413202.1493

1.4.4.13.2 The following categories of electrical drawings shall be prepared:

A. One-Line Diagrams.

B. Grounding.

C. Lightning Protection.

D. Power.

E. Lighting.

F. Instrumentation.

G. Elementary Diagrams.

H. Connection Diagrams.

I. Communications.

J. Legend, Symbols and General Notes.

K. Standard Assemblies.

L. Conduit Schedules.

M. Circuit Schedules.

1.4.4.14 Calculations and Analyses

The following calculations and analyses shall be performed by Seller during the design phase of the project:

A. Building and system load analysis

B. System short circuit

C. Equipment heat dissipation

D. Voltage drop

E. Illumination levels

1.4.4.15 Electrical Power Systems

1.4.4.15.1 Incoming Power

Seller shall provide and install indoor 13.8 Kv - 480Y/277 Volt unit substation comprising of primary disconnect switch, dry type transformer and low voltage distribution switchboard per Section 16312. The 13.8 kV incoming power shall be routed via underground

conduit. Conduit to be used for cable entrance to the building shall be shown on the Seller's drawings and shall be located by dimension and elevation.

1.4.4.15.2 480Y/277 Volt Power Distribution System

A. 480Y/277 volt power distribution shall originate at the 480Y/277 volt switchboard. Power shall be distributed from the switchboard via distribution circuit breakers and feeders to lighting panels, distribution transformers, 480 volt power distribution panels and other individual 480 volt and 277 volt loads as determined during design development.

1.4.4.15.3 208Y/120 Volt Power Distribution System

A. 208Y/120 volt power distribution shall originate at the secondary side of the individual 480-208Y/120 volt power distribution transformers. 208Y/120 volt power shall be distributed from panelboards via circuit breakers and branch circuits to convenience outlets.

1.4.4.16 Telephone System

Seller shall provide and locate inside the Fabrication Shop a telephone box with backboard sized to accommodate 15 future phone lines. Seller shall run a two (2) inch conduit from the telephone box to one of the two inch conduits which are stubbed out and capped as shown on the Contract Drawings.

1.4.5 Plumbing Systems

The plumbing systems design shall conform or meet the following criteria:

1.4.5.1 Codes and Regulations

A. All fixtures, equipment, materials shall be in conformance to the Uniform Plumbing Code.

1.4.6 Fire Protection Requirements

The Fabrication Shop building shall be fully sprinklered with an automatic wet pipe system in accordance with the requirements of NFPA 13. All sprinkler systems are required to be hydraulically designed. The sprinkler contractor shall verify pressure and flow requirements, and provide connection to the underground fire water system shown on the drawings.

The Fabrication Shop building shall be designed to meet the most restrictive requirements for life safety in accordance with the

9413202.1494

9413202.1495

requirements of DOE Orders 6430.1A (Attachment L), 5480.7 (Attachment U) and NFPA 101.

A fire alarm system shall be provided to monitor the alarm and supervisory signals from the wet pipe sprinkler system and transmit any other necessary signals required by NFPA 72 to the site's Radio Master Box system. All fire alarm equipment shall be in accordance with the requirements of NFPA 72 and 70.

A fire alarm panel shall be provided, installed, and wired in accordance with the requirements of NFPA 70, NFPA 72, NFPA 13, and the Contract Drawings. The fire alarm panel shall include all of the following features:

A. Local alarms for the automatic sprinkler waterflow pressure switch.

B. Trouble signals for all devices and circuits as required by NFPA 13 and NFPA 72.

C. Emergency battery backup for system operation.

D. Electrical supervision of all circuits as required by NFPA 72.

E. Output contacts and terminals for connection to the Hanford Radio Master Box System, including waterflow alarm, trouble, and supervisory signals.

Fire extinguishers shall be provided in accordance with NFPA 10.

1.5 SUBMITTALS

Submit the following in accordance with the Vendor Drawing and Data Requirements section of the Order/Subcontract:

1.5.1 Drawings, Calculations, and Specifications

Prepare and submit to Buyer for review by the Engineer (Fluor Daniel) engineering/construction drawings, calculations, and construction specifications (CSI format) for the following:

Architectural
Structural
HVAC/Mechanical
Electrical
Fire Protection
Plumbing

9413202.1496

The structural design drawings shall indicate the design criteria, the structural materials and their strengths with applicable materials standards, the design loads including loads that can occur during construction, and the allowable foundation loads that were used in the design.

1.5.2 Qualifications

The drawings, calculations and specifications shall be prepared and stamped by professional architects/engineers registered in the State of Washington. Fabrication drawings, e.g., rebar details do not need to be stamped.

1.5.3 Manufacturer's Literature

Material and equipment data shall be submitted for all items to be incorporated in the Work, including manufacturer's catalog cuts, specifications, performance characteristics and other descriptive data in sufficient detail to verify compliance with contract requirements.

1.5.4 Installation, Operating, and Maintenance Instructions

Detailed installation, operating, and maintenance instructions shall be submitted in accordance with Specification Section 01730, Operation and Maintenance Data.

PART 2 PRODUCTS

2.1 GENERAL

2.1.1 Scope

Whenever possible throughout this specification, the minimum acceptable quality of workmanship and materials has been defined by reference to recognized industry or government standard, or description of required attributes and performance.

2.1.2 Proprietary Names

Wherever proprietary names are used to identify products of a particular manufacturer, they are used for the purpose of establishing minimum acceptable standards of quality of materials, finish, or workmanship, and are not intended to exclude from consideration comparable products of other manufacturers. Products of other manufacturers will be permitted, subject to authorization by the Buyer.

9413202.1497

2.1.3 "Or Equal"

Where the phrase "or equal" occurs in the specifications, the use of alternative material which is of equal quality and of the required characteristics for the purpose intended will be permitted, subject to authorization by the Buyer.

2.1.4 Colors

Where not otherwise specifically indicated on the drawings or in the specifications, colors, patterns, and textures shall be selected by the Buyer from manufacturer's standard samples.

2.1.5 Galvanic Corrosion

Where permanent contact by dissimilar metals cannot be avoided, the metals at the contact area will be painted with zinc chromate followed by one coat of a non-leaded paint (such as aluminum paint) or of a heavy bodied bituminous paint. When the dissimilar metals cannot be painted, a strip of plastic, neoprene, or a similar insulator will be used in place of paint.

2.2 **SITEWORK**

2.2.1 Concrete Splashblocks

Prefabricated, reinforced, precast concrete splashblocks shall be installed at all downspout discharge points. Concrete compressive strength shall be 3,000 psi at 28 days. Steel reinforcing shall conform to ASTM A615, Grade 60, Number 4. The upper surface of the splashblock shall have an indentation which slopes downwards towards, and has sidewalls flared outward towards the discharge end. The rear end wall shall be at least three inches higher than the minimum thickness of the splashblock. Side and rear walls shall be at least one inch thick.

2.3 **CONCRETE**

2.3.1 Design Concrete Compressive Strength at 28 Days

f'_c = 4000 psi

2.3.2 Concrete Reinforcement

2.3.2.1 Reinforcing Steel

ASTM A615, Grade 60

2.3.2.2 Welded Wire Fabric

ASTM A185

2.3.3 Cast-in-Place Anchors and Inserts

2.3.3.1 Anchor Bolts

ASTM A307, Type C

2.3.4 Grout

Non-shrink cement based

2.3.5 Concrete Sealer/Hardener

A dry shake, non-metallic surface hardener using size-graded hard quartz aggregate of natural configuration. The aggregate shall have 0.0 percent absorption. The plasticizer and water reducing admixture used as components of the product shall be formulated, manufactured, and processed by the dry shake manufacturer. A monomolecular film evaporative retardant shall be manufactured by the manufacturer of the surface hardener. Application rate shall be 1.0 pound per square foot. ["Mastercron" by Master Builders, Inc., Cleveland, Ohio] or equal.

2.4 **MASONRY**

(Not Used)

2.5 **METALS**

2.5.1 Structural Steel Framing

2.5.1.1 Structural Steel

ASTM A36

2.5.1.2 Structural Pipe

ASTM A53, Type E or S, Grade B

2.5.1.3 Structural Tubing

ASTM A500, Grade B

2.5.1.4 High Strength Bolts

ASTM A325

2.5.1.5 Unfinished Bolts

ASTM A307

9413202.1498

2.5.1.6 Nuts

ASTM A563

2.5.1.7 Welding Electrodes

E70XX in accordance with AWS D1.1

2.6 **WOOD AND PLASTICS**

2.6.1 Rough Carpentry

2.6.1.1 Nonstress Graded Members

Blocking and other nonstress graded members shall conform to WWPA G-5-88 "Grading Rules for Western Lumber" published by the Western Wood Products Association. Provide Douglas Fir, Utility Grade. Members used in exterior applications shall be pressure treated with salt preservatives.

2.7 **THERMAL AND MOISTURE PROTECTION**

2.7.1 Vapor Barriers (Water Vapor Retarders)

6 mil polyethylene sheet conforming to ASTM D2103 or ASTM D4397 EA-84. Install in continuous sheets, lapping joints 6" minimum and shall be placed on top of granular fill.

2.7.2 Insulation

2.7.2.1 Perimeter Insulation

Extruded, rigid, cellular thermal insulation with closed cells and integral high density skin, complying with ASTM C578, 5-year aged R-values of 6 (min) at 75°F; Type IV, 1.6 pcf density, 25 psi compressive strength, 0.3 percent water absorption. Adhesive, fasteners, and protection board as recommended by the insulation manufacturer.

2.7.2.2 Wall and Roof Insulation

Fiberglass wool batts, foil-faced; conforming to ASTM C665, Type III, Class B. Thickness as required to meet R-values stipulated in 1.4.1.2.

2.7.3 Preformed Metal Roofing and Siding

2.7.3.1 Material

9415202.1499

Steel conforming to ASTM A446 Grade A with minimum yield strength of 33,000 psi and thickness not less than 22 gauge; galvanized in conformance to ASTM A525 Class G-90 (1.25 oz.).

2.7.3.2 Profile

Smooth surface exterior wall panels in 12 inch modules with 1-1/2 inch deep interlocking ribs and concealed fasteners. Oil-canning shall be kept to an absolute minimum.

V-ribbed exterior roof panels in 12 inch modules with 1-1/2 inch deep interlocking ribs and concealed fasteners. Oil-canning shall be kept to an absolute minimum.

Interior liner panels in 24 inch modules with one intermediate groove/rib, 1-1/2 inch deep interlocking ribs and concealed fasteners. Oil-canning shall be kept to an absolute minimum.

2.7.3.3 Factory Applied Finish

Exterior wall and roof panels will receive 0.8 mil polyvinylidene fluoride (PVF_2), Kynar-500, 70 percent resin finish coat applied over a 0.2 mil baked-on epoxy base primer to a total film thickness of 1.0 mil. Color as indicated on the drawings.

Interior liner panels shall be shop primed and painted in accordance with the paint schedule.

2.7.3.4 Subgirts

May be hat or zee shaped from galvanized steel in 18 or 16 gauge. Subgirts shall be located at each structural support and at intermediate locations as required to meet design loads.

2.7.3.5 Flashing

Shall be formed from the same material and in the same finish as the attached wall panel.

2.7.3.6 Fasteners

Shall be electrolytically compatible self-tapping #14B or self-drilling #12 for sheet-to-support as required by the support thickness, and #14 self-tapping AB point or lap self-drilling fasteners for sheet-to-sheet attachment. For subgirt attachment, pre-drill hole for either fastener.

2.7.3.7 Closures

Shall be made from closed cell pre-molded neoprene or polyethylene foam or metal.

9413202.1500

2.7.3.8 Dissimilar Metals

Preformed metal siding system will not include dissimilar or electrolytically incompatible metals.

2.7.3.9 Sealant

Low modulus, one-component, moisture curing, modified polyurethane joint sealant conforming to ASTM C920 and suitable for gun application.

[DYMONIC by Tremco, Cleveland, Ohio] or equal

2.7.3.10 Sealant Tape

Void filling, 100 percent solids butyl based extruded sealant tape.

[MBT-35 by Tremco, Cleveland, Ohio] or equal

2.7.4 Sheet Metal Flashing and Trim

2.7.4.1 Sheet metal flashing and trim shall conform to the Architectural Sheet Metal Manual published by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

2.7.4.2 Galvanized Steel

Galvanized steel sheet shall conform to ASTM A526, regular coating, designation Z90. Minimum thickness as recommended by SMACNA.

2.7.4.3 Fasteners

Shall be the same metal or a metal compatible with the materials joined.

2.7.4.4 Solder Materials

Solder and flux shall meet ASTM B32. Solder shall have lead content less than 0.2 percent.

2.7.4.5 Sealing Compound

Fast cure, non-sag, two component polyurethane sealant conforming to ASTM C920 and suitable for gun application.

[FC-2 by Tremco, Cleveland, Ohio]

9413202.1501

9413202.1502

2.7.4.6 Gutters

Gutter design shall be in accordance with the Architectural Sheet Metal Manual, Plate 1, and Plate 2, Style F.

Gutters shall be pitched to drain at not more than 1/16 inch per foot.

Gutter supports shall be in accordance with the Architectural Sheet Metal Manual, Plate 20, Figure A.

Outlet tubes with flanges shall be riveted and soldered to gutters; tubes shall be extended 3 inches (min) into downspouts.

A downspout strainer shall be inserted into each outlet tube.

Gutter expansion joints shall be provided at a spacing of not more than 32 feet on center in accordance with the Architectural Sheet Metal Manual, Plate 6.

2.7.4.7 Downspouts

Downspouts shall be provided on outside walls from gutters.

Downspouts shall be joined to the gutters at outlet tubes and joined to each other by telescoping end joints 1-1/2 inches (min) into the lower section.

Downspout hangers shall be fabricated from the same material as downspouts. One hanger will be provided at the top and bottom of each downspout section.

Elbows shall be installed where downspouts terminate on splashblocks.

Downspouts shall conform to the Architectural Sheet Metal Manual, Plate 32, Figure B; Plate 33, Figure E; and Plate 35, Figure G.

2.7.5 Sealants

2.7.5.1 Quality

Sealants shall conform to ASTM C920.

2.7.5.2 Grade

As recommended by manufacturer for particular condition of installation (location, joint shape, ambient temperature, and similar conditions) to achieve the best possible overall performance.

9413202.1503

2.7.5.3 Joint Fillers

Flexible, compressible, closed-cell polyethylene of no less than 100 psi compression deflection (25 percent), except provide higher compression deflection strength as necessary to withstand installation forces and provide proper support for sealants. Surface water absorption of not more than 0.1 pounds per square foot.

2.7.5.4 Backer Rod

Compressible rod stock of polyethylene foam, butyl rubber foam, neoprene foam, or other flexible, permanent, durable, nonabsorbent material, 33 percent to 50 percent larger than joint as recommended for compatibility with sealant by sealant manufacturer.

2.7.5.5 Bond-Breaker Tape

Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back of joint. Provide self-adhesive tape where applicable.

2.7.5.6 Sealant Types and Schedule

Sealant types referenced are products of Tremco, Cleveland, Ohio.

2.7.5.6.1 Exterior Locations

Horizontal surfaces: Multi-component epoxidized polyurethane; Type M, Grade NS, Class 25. [DYMERIC]

Perimeter of exterior openings: Low modulus, one-component, moisture curing, modified polyurethane; Type S, Grade NS, Class 25. [DYMONIC]

All other exterior building applications except as otherwise noted: Low modulus, high performance, one-part, moisture curing, architectural grade, silicone sealant; Type S, Grade NS, Class 25. [SPECTREM 1]

2.7.5.6.2 Interior Locations

All interior locations: Medium modulus, neutral cure, high performance silicone sealant; Type S, Grade NS, Class 25. [SPECTREM 2]

2.7.5.7 Colors

As selected from manufacturer's standard samples.

9413202.1504

2.8 **DOORS**

2.8.1 Metal Doors and Frames

Shall conform to requirements of ANSI/SDI-100.

2.8.1.1 Steel Doors - Exterior

Grade II - Heavy Duty; Model 3 - Seamless, hollow steel construction, insulated, thermal break.

2.8.1.2 Steel Frames - Exterior

Welded type with corners mitered and ground smooth.

2.8.1.3 Related Items

Frame anchors, floor anchors, and other items shall conform to requirements of ANSI/SDI-100.

2.8.1.4 Finish

Shop primed in accordance with ANSI/SDI-100; field finished in accordance with Finish Schedule, Paragraph 2.9.1.3.

2.8.2 Overhead Coiling Doors

Designed and reinforced to withstand wind loading specified in 1.4.2.2.

2.8.2.1 Construction

Interlocking cold-rolled slats shall be fabricated from steel sheets conforming to ASTM A446, Grade A; and galvanized in accordance with ASTM A525, G90. Slats to be continuous without splices for the width of the door. Profile to be flat with a depth not less than 0.625 inch, a center-to-center width not more than 2.75 inches, and not less than 0.0478 inch uncoated thickness.

2.8.2.2 Bottom Bar

Pair of angles not less than 2" by 2" by 0.188 inches; ASTM A36 steel, galvanized in accordance with ASTM A525, G90.

2.8.2.3 Wind Locks

Cast steel, galvanized in accordance with ASTM A525, G90. Provided on every other curtain slat.

9413202.1505

2.8.2.4 Insulation

Polyurethane foam in slats. Provide thermal break.

2.8.2.5 Weatherstripping

Minimum 1/8 inch thick neoprene rubber conforming to ASTM D2000.

2.8.2.6 Hardware

Jamb guides and door operating equipment supports shall be fabricated from ASTM A36 steel shapes galvanized in accordance with ASTM A525, G90. Fasteners shall conform to ASTM A307, Grade A, galvanized per ASTM A153, Table 1.

Locks and latches, lifting handles, and other hardware items shall be galvanized steel. Cylinders shall conform to Paragraph 2.8.3.7.

2.8.2.7 Counterbalancing Mechanism

Adjustable, steel, helical torsion spring mounted around a steel shaft in a spring barrel and connected to the door curtain with barrel rings.

2.8.2.8 Hoods

Fabricated from steel sheets conforming to ASTM A446, Grade A; galvanized in accordance with ASTM A525, G90. Reinforced to prevent hood deflection. Minimum thickness to be 0.0299 inch.

2.8.2.9 Operation

Doors are scheduled for electric operation. Provide a compact operator designed and built by the door manufacturer. The motor shall have sufficient power to operate the door at an approximate speed of 1 foot per second. The unit shall be controlled by a momentary contact 3 button pushbutton station marked "OPEN," "CLOSE," and "STOP," and an automatic screw-type limit switch that will break the circuit at the termination of travel. A NEMA Type 12 enclosure is required.

An emergency hand chain operator that does not affect the timing of the limit switch shall be provided to operate the door in case of power failure or the removal of motor for inspection or servicing. An efficient overload protective device that will break the power circuit and eliminate any possible damage to motor windings shall be both heat and current sensing, and installed integrally with the unit. The motor shall be 1/2 HP-460/3/60; the starter shall be Size 1, dustproof combination with circuit breaker. Equip the bottom of the door with a safety edge and an

automatic reversing switch that reverses the door when an obstruction is encountered during the downward travel.

2.8.2.10 Finish

Hot dipped galvanized, with a high-grade, pure zinc coating, 1.25 ounces per square foot of flat metal, conforming to ASTM A525, G90. Galvanized surfaces shall be provided with a phosphate coating for paint adhesion. Other surfaces of door parts shall be primed with 1 shop coat of rust-inhibiting primer.

2.8.3 Finish Hardware

2.8.3.1 Scope

Provide finish hardware for each opening of suitable strength and proper design to meet applicable codes and to provide intended service and installation. Provide hardware items not definitely specified but required for completion of the work, of type, quality and finish suitable to service and installation required, and comparable to adjacent hardware.

2.8.3.2 Quality

Finish hardware shall conform to requirements of ANSI/BHMA A156.

2.8.3.3 Finishes

Hardware shall receive the following finishes unless otherwise noted:

Exterior openings: US32D, satin stainless steel (ANSI/BHMA 630).

2.8.3.4 Fasteners

Finished to match hardware items fastened. Type, size, and quantity proper for each hardware item.

2.8.3.5 Butt Hinges

Five knuckle. Exterior doors shall be stainless steel and have nonrising and nonremovable pins. Butts on all doors shall have ball bearings. All doors shall have a minimum of three hinges. Hinges shall have leaves of sufficient width to clear the trim but not less than 4-1/2" x 4-1/2."

[Hager Hinge Co., St. Louis, MO]

9413202.1506

9413202.1507

2.8.3.6 Closers

Closers shall be the surface-mounted, overhead type and shall be the product of a single manufacturer. Parallel-arm closers shall be used for outswinging exterior doors, doors under 7 feet in height, and when special conditions require parallel-arm operation.

Closers shall be liquid-controlled, rack-and-pinion construction with cast cases and a spindle not less than 9/16 inch in diameter.

Closer arms shall be fabricated from forged steel or ductile iron. Ductile iron arms shall be provided for parallel-arm closer operation. Exposed arms of closers shall have a sprayed-on finish matching the lockset or exit-hardware finish.

Brackets, reinforcing plates, and accessory fittings shall be provided by the closer manufacturer.

[LCN Closers, Princeton, IL]

2.8.3.7 Locksets and Latchsets

Shall have plain design, wrought trim, and shall be the product of a single manufacturer.

Shall have standardized fronts, cases, and strikes so that varying functions will be interchangeable and will require only one mortise for their installation. Locks and latches shall have beveled bronze fronts, bronze bolts and strikes, brass hubs, and cases with the finish specified.

Locksets and lock cylinders shall be keyed in accordance with Buyer's requirements.

Locksets and latchsets shall be lever actuated, cylinder bored type conforming to ANSI 156.2, Series 4000, Grade 1.

Existing locks are Corbin Mortise Lock 8789L2 with MEDECO interchangeable core mortise cylinders #32W0200-RI-BIAXIAL-626 finish, with CAM CT-Z01 keyed alike with 5 each control keys to be issued to the Westinghouse Hanford Company locksmith.

2.8.3.8 Exit Device

Shall be listed by UL and bear the UL label.

Shall be the product of a single manufacturer. Construction shall be of heavy wrought steel, with exposed parts in stainless steel. Crossbar shall be oval seamless tubing.

Exit device shall be mortise type with 3/4" latchbolt throw. No dogging. Night latch and thumb piece shall be provided. Exterior trim shall be by the manufacturer of the exit device.

VonDuprin #3347NL-TP with removable core (MEDECO), 2720 Tobey Drive, Indianapolis, Indiana.

2.8.3.9 Silencers

Model 20 by H. B. Ives, Wallingford, Connecticut. Three each for single doors.

2.8.3.10 Door Stops

Wall mounted door stops shall be provided where practicable. Where impossible to install wall-mounted stops, floor mounted stops shall be provided.

Wall mounted stops: Model 409-1/2 by H. B. Ives, Wallingford, Connecticut.

Floor mounted stops: Model 436 and 438 by H. B. Ives, Wallingford, Connecticut.

2.8.3.11 Automatic Door Bottom

Shall be an automatically operating assembly composed of a rubber seal, a metal seal housing, and an automatic operating device mounted on the bottom of the door. The device shall be designed to seal the space between the bottom of the door and the finished floor when closed and to retract immediately when the door is opened to provide a sill clearance of approximately 1/4 inch.

The door-bottom housing shall be surface mounted, extruded, anodized aluminum, 1/2 inch wide by 2-1/8 inches deep by the full width of the door and attached to the door with countersunk screws.

[Model 330A by National Guard Products, Inc., Memphis, Tennessee]

2.8.3.12 Weatherstripping

Shall consist of a 1/8 inch thick by 1-3/8 inches high neoprene strip housed in an extruded, anodized aluminum housing approximately 0.070 inch thick by 1-1/4 inches high by the full width of the door and attached to the door frame with countersunk screws.

[Model 139 by Zero International, Inc., Bronx, NY]

9413202.1508

9413202.1509

2.8.3.13 Mop Plates and Kick Plates

Shall be 0.050 inch thick stainless steel, wrought brass, or aluminum; bevel edge; finished as specified. Width of mop and kick plates shall be 2 inches less than the width of the door. Height of mop plates shall be 6 inches; height of kick plates shall be 10 inches. Attachment by countersunk screws.

2.8.3.14 Thresholds and Saddles

Aluminum thresholds shall be provided for the full width of the opening at exterior doors. Thresholds shall be mill-finish aluminum 6063-T5 alloy, corrugated, with vinyl inserts. Thresholds shall not exceed 1/2" in total height.

[Model 2005AV by Pemko Enterprises, Inc., Huntington Beach, CA]

Aluminum saddles shall be provided for the full width of openings at locations where concrete meets other flooring material (except at toilet rooms). Saddles shall be mill-finish aluminum 6063-T5 alloy, 2-1/2 inches wide by 1/4 inch high.

[Model S225A by Pemko Enterprises, Inc., Huntington Beach, CA]

2.8.3.15 Generalized Hardware Schedule

HW-1 Exterior Doors

Hinges
Closer
Lockset
Exit Device
Automatic Door Bottom
Weatherstripping
Silencers
Threshold
Door Stop
Kick Plate

2.8.4 Glass and Glazing

2.8.4.1 Standards

Glass and glazing materials shall conform to ANSI Z97.1, ASTM C1036.

2.8.4.2 Fully Tempered Safety Glass

Type I, Class I, Quality q3.

Shall be used in doors and adjacent fixed panels. Glass shall be factory-cut to suit each opening; edges shall be clean cut.

Nominal thickness will be 1/4 inch.

2.8.4.3 Glazing Methods

Glazing gaskets shall be neoprene, EPDM, or silicone rubber. Setting blocks shall be 80-90 durometer hardness neoprene or vinyl. Spacers shall be 40-50 durometer hardness neoprene or vinyl.

2.8.4.4 Installation

Glass shall be totally dry-glazed.

2.9 **FINISHES**

2.9.1 Painting

2.9.1.1 Shop Priming of Steel

Tnemec Series 10 Lead and Chromate Free Alkyd Primer, 2.0 mils. Color: red.

2.9.1.2 Architectural Painting

Products shall be of the same manufacturer for each coating system and for each type of surface.

All surfaces exposed to view will be painted except for:

Factory finished surfaces;

Concealed spaces, concealed pipes and ducts;

Exterior concrete surfaces;

Nonferrous metal and stainless steel surfaces;

Concrete floors;

Application rate and dry film thickness for each coat shall not be less than manufacturer's recommendations for the surface being painted.

Coating manufacturer's requirements, including application procedures, shall be a part of this specification and shall be followed in detail.

9413202.1510

2.9.1.3 Schedule

Products referenced are by Tnemec Company, Inc., Kansas City, Missouri.

All colors as selected from manufacturer's standard samples and in accordance with FED-STD 595B.

Exterior Galvanized Steel

Primer: Series 66 HB Epoxy Polyamide, 4.0 mils

Finish Coat: Series 73 Gloss Polyurethane, 2.0 mils

Exterior Ferrous Metal

Primer: Series 65 Epoxy Polyamide Primer, 3.0 mils

Intermediate: Series 66 HB Epoxy Polyamide, 4.0 mils

Finish Coat: Series 73 Gloss Polyurethane, 2.0 mils

Interior Primed Ferrous Metal

Primer: Shop applied

Intermediate: Series 59 Modified Alkyd Primer, 2.0 mils

Finish Coat: Series 66 Epoxy Polyamide, 2.0 mils

Interior Overhead Steel Deck

One Coat: Series 15 Dry Fall Alkyd Enamel White, 2.0 mils

Interior Pipe

Two Coats: Series 6 Flat Acrylic Emulsion, 2.0 mils

2.10 **SPECIALTIES**

(Not Used)

2.11 **EQUIPMENT**

(Not Used)

2.12 **FURNISHINGS**

(Not Used)

9413202.1511

9413202.1512

2.13 **SPECIAL CONSTRUCTION**

(Not Used)

2.14 **CONVEYING SYSTEMS**

(Not Used)

2.15 **MECHANICAL**

2.15.1 Heating, Ventilating and Air Conditioning

2.15.1.1 General

Selection of equipment shall be based on the LCC analysis procedures outlined in Attachment K, Section 0110-12.7 and 0110-12.8 and Attachment H. Electricity, at $0.0294 (2.94 cents) per kW hour is currently available and shall be used in LCC analysis. Escalation in costs shall be as specified in NBS Handbook 135 which contains current factors and escalation rates. The equipment used shall be of the construction described in the Attachments L, M, N, P, Q, T, U, and V. Pipe identification shall be as shown in Attachment C. The following reference is made to some sections of the Attachments specified above to indicate the quality of materials, construction, standards, etc. but are not limited to these particular references:

1550-1 (Attachment N)	General Sizing and Design Criteria: In considering maintenance cost, cognisance must be given to the equipment, materials, products, etc. used in, or to be used in, the buildings within the overall site perimeter fences administered by the DOE at HWVP Richland, Washington.
1550-2 (Attachment N)	Heating, ventilating and air conditioning systems selection
1550-2.1.1 (Attachment N)	General including LCC analysis (Section 0110-12.7, ASHRAE Fundamental Handbook, etc. 1550-1.6, Energy Conservation - Waste Heat Recovery System shall be considered)
1550-2.5 (Attachment N)	Air handling and air distribution systems including Air Handling Units (1550-2.5.2), Fans/Motors (1550-2.5.3), Coils (1550-2.5.4), Air Cleaning Devices (1550-2.5.5) and Ductwork Systems (1550-2.5.6).

1550-3 (Attachment N)	Testing, adjusting and balancing including AABC Volume A and ASHRAE Systems Handbook.

2.15.1.2 Product and Testing Specification

Reference is made within the Attachments H, L, M, N, P, Q, T, U, and V, to other product documents, references, and specification and attention is drawing to the following documents list below but are not limited to these. The Seller is strongly advised to read these and all related publications. No excuses will be accepted due to lack of knowledge of these or other related publications.

AABC Vol. A

ARI 210

ARI 410

ARI 430

ARI 460

ARI 520

ARI 850

AMCA 99

AMCA 201

AMCA 210

AMCA 261

AMCA 300

AMCA 500

ANSI C2

ANSI N45.2.2

ANSI Z9.2

ASTM A36

ASTM A53

ASTM A105/A105M

9413202.1513

ASTM A527/A527M

ASTM G46

ASHRAE Handbook: 1988 ASHRAE Handbook Equipment; Erratta 1989 Additions and Corrections, 1990 Additions and Corrections, 1991

ASHRAE 20

ASHRAE 24

ASHRAE 51

ASHRAE 15

ASHRAE 52

ASME B16 SERIES

ASME B31.1

UMC

SMACNA: 1975 Accepted Industry Practice for Industrial Duct Construction

SMACNA: 1983 HVAC Systems Testing, Adjusting and Balancing (First Edition)

SMACNA: 1985 HVAC Duct Construction Standards, Metal and Flexible, First Edition

SMACNA: 1985 HVAC Air Duct Leakage Test Manual

SMACNA: 1978 Energy Recovery Equipment and Systems Manual

SMACNA: 1984 Energy Conservation Guide Lines

SMACNA: 1986 Fire, Smoke, and Radiation Damper Installation Guide for HVAC Systems

SMACNA: 1991 Seismic Restraints

UL 207

UL 900

29 CFR 1910

FS-HH-I-545

9413202.1514

FS-HH-I-551

FS-HH-I-558

NFPA 90A

NFPA 90B

NFPA Vol. 1-16

2.15.2 Plumbing Materials

All materials shall be new, free from defects, and of the brand and quality specified, or equal.

2.15.2.1 Pipe and Fittings

2.15.2.1.1 Sanitary Waste and Vent Systems

A. Below Ground

1) Pipe

Service weight cast iron hub and plain end soil pipe conforming to ASTM A74, or NO-HUB cast iron soil pipe conforming to CISPI 301, factory coated inside and out with coal tar enamel.

2) Fittings

Service weight cast iron hub and plain end soil pipe conforming to ASTM A74, or NO-HUB cast iron soil pipe conforming to CISPI 301, factory coated inside and out with coal tar enamel.

3) Gaskets

Neoprene compression gaskets conforming to ASTM C564, or NO-HUB stainless steel coupling with neoprene inner sleeve, conforming to CISPI 310.

2.15.2.1.2 Domestic Cold Water System

A. Below Ground

1) Pipe

Type "K" seamless hard drawn copper tubing conforming to ASTM B88.

9413202.1515

9413202.1516

2) Fittings

Seamless wrought copper solder joint fittings conforming to ASME B16.22.

3) Solder

"Sil-fos" 15 percent silver brazing alloy.

2.15.2.1.3 Dielectric Connectors

2 inches and smaller: 250# threaded insulating union, gasket for service as required, Watts or Epco.

2-1/2 inches and larger: 175# threaded insulating flange set, gasket for service as required, Watts or Epco.

2.15.2.2 Valves

2.15.2.2.1 Domestic Water Systems

TYPE	SIZE	DESCRIPTION	MANUFACTURER
Gate	All	150# bronze, rising stem, screwed bonnet, solid wedge disc with screwed ends.	Crane #431 Powell #514
Ball	All	400# bronze, hard chrome plated ball, screwed ends.	Watts #B-6000 Apollo #70-100

2.15.2.3 Plumbing Fixtures and Trim

2.15.2.3.1 Water Closet (WC-1) (Future)

American Standard #2477.016 "Afwall," white vitreous china wall hung siphon jet bowl, complete with Sloan Royal #110-3 YBYO flush valve, Olsonite #95-CC-SS white, open front seat with self-sustaining check hinge, and Smith, Wade or Zurn carrier and drainage fitting suitable for the application. Furnish #F-72-A1 trap primer on flush valve where required. Mounting height to comply with ANSI A117.1.

2.15.2.3.2 Urinal (U-1) (Future)

American Standard #6540.017 "Allbrook," white vitreous china wash-out action with Sloan Royal #180-1.5-YB flush valve and wall hanger. Mounting height to comply with ANSI A117.1.

9413202.1517

2.15.2.3.3 Lavatory (L-1) (Future)

American Standard #0355.012 "Lucerne," 20 inches by 18 inches white vitreous china, complete with #2385.078 lever handle mixing faucet, #2411.015 grid drain, chrome plated brass L.A. pattern P-trap, loose key angle stops with flexible risers, 0.5 GPM flow restrictors, and Smith #723 support with concealed arms.

2.15.2.3.4 Service Sink (SS-1) (Future)

American Standard #7695.018 "Akron," 24 inches by 18 inches acid resisting enameled cast iron with drilled back, #8341.075 faucet with vacuum breaker, hose end and stops in shanks, #47077-07 rim guard and #7798.176 trap standard with strainer and 3" outlet.

2.15.2.3.5 Electric Water Cooler (Future)

Haws #HWCA8 wall mounted, barrier-free, satin finish stainless steel cabinet and receptor, chrome plated bubbler, hot water dispenser with 1-1/2 quart brass tank, 500 watt metal sheath heater and self-closing cup filler with push lever, 7.5 gph, 1/5 HP, 120V, 60 Hz, 1 phase.

2.15.2.3.6 Electric Water Heaters (Future)

Water Heater (Storage)

A.O. Smith glass lined storage water heater with thermostatic control, sized to provide supply of 140°F water, per ASPE Data Book, Chapter 4: Service Hot Water Systems.

2.15.2.4 Floor Drains

2.15.2.4.1 Floor Drain (FD-1): For Use in Toilet Rooms

Smith #2005-AP cast iron body with clamping collar, 5 inch diameter adjustable nickel bronze strainer and trap primer connection.

2.15.2.4.2 Floor Drain (FD-2): For Use in Other Than Toilet Rooms

Smith #2120Y cast iron body with flashing collar and cast iron tractor grate.

2.15.2.5 Floor Sink (FS-1)

Smith #3150-C-12, 12 inch square by 8 inch deep acid resisting enameled cast iron receptor with flange and clamping collar, dome bottom strainer and 1/2 grate.

2.15.2.6 Cleanouts

2.15.2.6.1 Exterior

Smith #4253 with XH cast iron top in concrete areas.

2.15.2.6.2 Floors

A. Smith #4023 with round nickel-bronze top in finished room floors.

B. Smith #4223 with round cast iron top in unfinished room floors.

C. "Flush-with-floor" type cleanouts, with adjustable watertight covers and integral anchoring flange with clamping collar where waterproofing membrane is used.

2.15.2.7 Access Boxes: For Concealed Valves.

2.15.2.7.1 Floors

A. Smith #4910 with XH plain aluminum or nickel-bronze nonskid top.

B. Smith #4920 for floors covered with vinyl reinforced or pure vinyl tile.

2.15.2.8 Backflow Preventer

Reduced pressure principle backflow preventers.

2.15.2.8.1 1-1/2 inch and smaller: Cla-Val #RP-2 or Watts #909S.

2.15.2.8.2 2 inch and larger: Cla-Val #RP-1 or Watts #909S.

2.15.2.9 Pipe Wrapping

10 mil thick self-adhesive polyethylene tape, Scotchwrap 50 or approved equal.

2.15.2.10 Disinfection of Domestic Water System

Use disinfectant method AWWA C651.

9413202.1518

9413202.1519

2.16 **ELECTRICAL**

2.16.1 Indoor 13.8 kV-480Y/277 volt unit substation.

2.16.1.1 The technical requirements for the fabrication, testing, inspection of 13.8 kV-480Y/277 Volt unit substation shall be per Section 16312.

2.16.2 Panelboards

2.16.2.1 Lighting and power panelboards shall be in accordance with UL 67, NEMA 250 and PB-1, and NFPA 70, Article 384. Panelboards shall be dead-front, circuit breaker type, with a ground bus and a solid neutral bus. Circuit breakers shall be bolt-on type with minimum trip rating of 20 amperes and interrupting rating suitable for the available short circuit current in accordance with UL 489. Each panelboard shall be supplied with a circuit directory.

2.16.2.2 Panelboards shall be suitable for 208Y/120 volt, three phase, four wire or 480Y/277 volt, three phase, four wire service.

2.16.2.3 Panelboards shall be listed by Underwriters Laboratory and bear the UL label.

2.16.3 General Purpose Distribution Transformers

2.16.3.1 General purpose distribution transformers shall be indoor, dry-type in accordance with UL 1561, with 480 volt delta-connected primaries. Secondaries shall be 208Y/120 volt, three phase, with the neutral solidly grounded. Each transformer shall have four 2-1/2 percent full capacity primary taps, two above and two below rated nominal voltage.

2.16.3.2 The ratings of general purpose distribution transformers will be standardized at 15, 30, 45 and 75 kVA.

2.16.3.3 Whenever possible, transformers shall be located adjacent to their associated panelboards.

2.16.4 Lighting

2.16.4.1 Exterior lighting

2.16.4.1.1 Building exterior lights shall be provided for personnel entrances/exits, walkways and roll-up doors.

2.16.4.1.2 Building exterior lights shall be operated at 277 volts from a 480Y/277 volt, three phase, four wire supply.

2.16.4.1.3 Low pressure sodium lighting shall be used for exterior lighting.

2.16.4.1.4 Illumination levels shall comply with IES Handbook illuminance values for building exteriors.

2.16.4.1.5 The exterior lighting system shall be controlled by photocells and/or programmable timer.

2.16.4.1.6 Low pressure sodium fixtures shall have high power factor ballasts in accordance with ANSI C82.9 integral with the fixture.

2.16.4.1.7 Fixtures for outdoor lighting shall be labeled "Suitable for Wet Locations" in accordance with NFPA 70, Article 410-4 and shall meet the requirements of UL 50 for rain-tight enclosures.

2.16.4.1.8 Low pressure sodium lamps shall be in accordance with ANSI C78.41.

2.16.4.2 Interior Lighting

2.16.4.2.1 Interior lighting shall consist of the following systems:

A. Normal lighting consisting of general lighting, to provide a uniform level of illumination throughout the work area and task lighting for specific areas or visual tasks that require higher levels of illumination.

B. Emergency lighting to provide illumination for access/egress lighting, including exit signs, when the normal power system is inoperative.

2.16.4.2.2 Indoor lighting shall be operated at 277 volts from a 480Y/277 volt, three phase, four wire supply.

2.16.4.2.3 Fluorescent lighting shall be used in areas with relatively low ceilings, 12 feet or less.

2.16.4.2.4 Metal halide lighting shall be used in shop areas with ceiling heights greater than 12 feet.

2.16.4.2.5 Illumination levels shall comply with the following:

Area and Task	Foot Candles at 30" Above Floor
Office	75
Restroom	30
Equipment Platform	30
Shop - General Lighting	50

9413202.1520

Emergency Egress/Access Lighting *

*In accordance with NFPA 101, National Life Safety Code

2.16.4.2.6 Lighting shall be controlled by local hand switches for individual rooms and offices. Lighting for large shop areas shall be controlled by means of circuit breakers in area lighting panels. In shop area, luminaries shall be alternately wired on three phase power source to avoid potential flicker and stroboscopic effects.

2.16.4.2.7 Fluorescent fixtures for office shall be 2' x 4', surface mount commercial type with integral ballast.

2.16.4.2.8 Fluorescent fixtures for restrooms, janitor closet and equipment platform shall be open commercial strip light type with wire guard and integral ballast.

2.16.4.2.9 Fluorescent fixtures surface mounted on combustible ceilings shall meet the requirements of NFPA 70, National Electrical Code, Article 410-76.

2.16.4.2.10 Fluorescent fixtures and associated components shall comply with UL 1570 and shall be suitable for T-12 rapid start lamps.

2.16.4.2.11 Ballasts for the fluorescent lamps shall be high power factor in accordance with UL 1570 and ANSI C82.9, rapid start type in accordance with UL 935 and ANSI C82.1, thermally protected in accordance with NFPA 70, National Electrical Code, Article 410-73 with Ballast Efficiency Factor (BEF) not less than 1.05 for two lamp ballasts and 1.805 for one lamp ballasts obtained under test conditions in accordance with ANSI C82.2.

2.16.4.2.12 Fluorescent lamps shall be 40 watt FW40CW/RS, T-12 in accordance with ANSI C78.1C. Ballasts shall be high power in accordance with ANSI C82.1.

2.16.4.2.13 Metal halide lighting fixtures for shop areas shall be industrial type, with integral ballasts and shall comply with UL 1572.

2.16.4.2.14 Metal halide lamp ballasts shall be high power factor in accordance with ANSI C82.9, ANSI C82.4 and UL 1029.

2.16.4.2.15 Metal halide lamps shall be in accordance with ANSI C78.380.

2.16.4.2.16 Exit signs shall be tritium filled, self luminous type. Fixture shall be tamper proof with a 10 year life expectancy.

2.16.4.2.17 Exit signs shall be operated at 277 volts from a 480Y/277 volt, three phase, four wire supply.

9413202.1521

2.16.4.2.18 Emergency lighting fixtures shall be heavy duty industrial emergency lighting units, with 90 minute, 12 volt, maintenance-free battery, automatic charger, test switch and charge monitor light, dual lamp heads, and shall be in accordance with UL 924.

2.16.4.2.19 Emergency lighting fixtures shall be operated at 277 volts from a 480Y/277 volt, three phase, four wire supply.

2.16.5 Convenience Receptacles

2.16.5.1 Convenience receptacles shall be provided throughout the facility as required for specific services and for general maintenance.

2.16.5.2 Convenience receptacles shall be general grade, NEMA 5-20R, two-pole, three-wire, grounded type, rated 20 amperes at 120 V ac.

2.16.5.3 A maximum of six duplex receptacles shall be connected to one 20 ampere branch circuit.

2.16.5.4 Ground fault circuit interrupter receptacles shall be provided as specified in NFPA 70, Article 210-8 and shall be in accordance with UL 943.

2.16.5.5 Maximum spacing of receptacles along walls in shop areas shall be 25 feet. Office areas shall have a minimum of one receptacle on each wall of 10 feet or more in length, with a maximum spacing of 25 feet. Offices shall have a minimum of four receptacles.

2.16.6 Power Receptacles

2.16.6.1 Power receptacles shall be provided throughout the facility as required for specific services.

2.16.6.2 Receptacles shall be specification grade, 480 volt, three phase, three wire, four pole. Ampere rating shall be based on equipment to be served.

2.16.6.3 The fourth pole of each receptacle shall be connected to the facility grounding system through a separate ground wire.

2.16.7 Control Stations and Switches

2.16.7.1 Control stations shall be heavy duty, industrial grade.

2.16.7.2 Snap switches shall be suitable for use at their rated voltage as follows:

2.16.7.2.1 Resistive and inductive loads, including electric discharge lamps, not exceeding the ampere rating of the switch.

9413202.1522

2.16.7.2.2 Tungsten filament lamp loads not exceeding the ampere rating of the switch.

2.16.7.2.3 Motor loads not exceeding 80 percent of the ampere rating of the switch.

2.16.8 Raceway Systems

2.16.8.1 General Raceway Requirements

Electrical wiring shall be enclosed in adequately sized raceway systems. The maximum fill of any conduit or raceway shall not exceed the limits established in NFPA 70.

2.16.8.2 Underground Installation

2.16.8.2.1 Provide PVC Schedule 80 conduit encased in red concrete for permanent power, telephone and LAN circuit entry into the Fabrication Shop. Extend stub-outs 6 feet beyond the boundary of the Fabrication Shop. Stub-outs shall be shown on Seller's drawings and shall be located by dimension and elevation.

2.16.8.2.2 Transition from underground to aboveground will be via rigid steel conduit elbows. The radius of the elbow shall be sized to accommodate the recommended bending radius of the conductors to be installed in the conduit. All parts of buried steel conduit shall be encased in concrete. Intermediate metal conduit (IMC) shall not be used for underground installations.

2.16.8.3 Aboveground Conduit and Raceway

2.16.8.3.1 Aboveground conduit shall be intermediate metal conduit (IMC) in accordance with UL 1242. The minimum conduit size shall be 3/4 inch.

2.16.8.4 Separation of Circuits

2.16.8.4.1 Power and signal wiring shall be adequately separated to minimize the introduction of electrical noise in the signal circuits.

2.16.9 Wire and Cable

2.16.9.1 Single Insulated or Bare Conductors

2.16.9.1.1 Conductors for interior electrical systems shall be copper.

2.16.9.1.2 Conductors for power and lighting circuits shall not be smaller than No. 12 AWG. Conductors for control circuits shall not be smaller than No. 14 AWG. No. 10, 12 and 14 AWG conductors shall be solid and No. 8 AWG conductors and larger shall be stranded.

9413202.1523

2.16.9.1.3 Conductors for power and lighting circuits shall be rated 600 volts type XHHW or THWN in accordance with NFPA 70, Article 310 and UL 44. Insulation for 90°C cable shall be type THHW or THHN.

2.16.9.1.4 Bonding and grounding conductors shall be ASTM B1 solid copper for No. 8 AWG and smaller and ASTM B8 Class B stranded copper for No. 6 AWG and larger. Bonding and grounding conductors shall be type XHHW or THWN.

2.16.10 Grounding

2.16.10.1 Grounding System

A grounding system shall be provided to:

A. Ensure safety to personnel and equipment in case of electrical equipment failure.

B. Provide connection to ground for transformers, and other power system neutrals.

C. Provide a low impedance path for ground fault currents to assure prompt and consistent action of protective devices.

2.16.10.2 Grounding Materials and Methods

The grounding system shall conform to NFPA 70, Article 250 and IEEE 142 and 837.

2.16.10.2.1 Raceway systems shall not be used as the ground path. Separate ground conductors shall be provided.

2.16.10.2.2 Metal enclosures shall be grounded with #2 AWG copper wire taps from the building ground buses.

2.16.10.2.3 A ground ring of two (2) 4/0 bare copper cables in parallel (1-2 foot separation) and bonded at intervals of not more than 50 feet shall be installed 2'-6" below finished grade around the periphery of building. The inner ring of the ground grid nearest to the building shall maintain a minimum distance of four (4) feet to the closest building structure. The ground ring shall be connected to ground rods at intervals not exceeding 50 feet and at each corner of the building. A minimum of one ground rod shall be designated as a test well rod at building.

2.16.10.2.4 Cross ties of #2/0 copper cables shall be used to form a grid or spacings which match the column spacings and equipment locations to provide convenient ground points. These cables shall be embedded a minimum of two (2) inches above the bottom of the concrete floor slab that is in direct contact with the earth and

9413202.1524

shall be bonded to structural steel columns at a minimum of 30 to 50 feet intervals.

2.16.10.2.5 Aboveground conductors, used for grounding taps from the main ground system to the electrical enclosure or ground bus, shall be bare stranded annealed copper conductors. Conductor size shall not be smaller than No. 6 AWG.

2.16.10.2.6 All feeders shall include a grounding conductor for use as an equipment ground and shall be installed with the phase conductors inside the same raceway.

2.16.10.2.7 An exposed copper bar ground bus, connected to the building ground rings via copper conductors, shall be provided at each interior corner of the building. These ground buses shall be welded to the steel building columns. Additional ground buses to be provided as required.

2.16.10.2.8 All exothermic weld connections shall be made by the Caldwell process or equal.

2.16.10.3 Instrument Grounding

A single ground bus shall be located in an electrical enclosure which is accessible and clearly identified as instrument ground.

This bus shall be isolated from the ground system except at a single point. This single point of contact will be at the enclosed ground bus. One insulated ground conductor or bonding cable will be routed between the isolated ground bus and the main building ground system to maintain compliance with NEC (NFPA 70) Article 250-26 and 250-81. The bonding cable shall be installed in rigid steel conduit. The bonding cable shall be exothermically connected to the main building ground, but the bus connection shall be able to be disconnected.

2.16.11 Lightning Protection System

2.16.11.1 The lightning protection system design shall comply with the requirements of NFPA 78, NEC 250-86 and UL 96A.

2.16.11.2 The lightning protection materials and components shall be in accordance with UL 96.

2.16.11.3 The lightning protection system shall comply with the UL requirements to obtain UL master label.

2.16.12 Motor Starters

Starters for 460 volt, three-phase motors shall be combination type consisting of an adjustable instantaneous trip circuit

9413202.1525

9413202.1526

breaker (motor circuit protector), a magnetic contactor with overload relays in each phase, individual control power transformers and other necessary control devices.

2.16.12.1 Minimum starter size shall be NEMA Size 1.

2.16.12.2 Starters shall, in general, be suitable for full voltage starting except for those cases where reduced voltage or adjustable speed control is required.

2.16.12.3 Motor horsepower and voltage ratings shall conform to the following:

Horsepower	Voltage/Phase Motor Nameplate	Voltage/Phase System
Below 1/2 hp	115/1	120/1
1/2 hp and over	460/3	480/3

2.16.12.4 Motor enclosures and insulation shall be suitable for operating and environmental conditions.

2.16.12.5 Disconnecting means capable of disconnecting motors and their related controllers from the supply circuit shall be provided in accordance with NFPA 70, National Electrical Code, Article 430, Part H.

2.16.12.6 For continuous duty motors 20 hp and larger, capacitors shall be installed and switched with the motor to improve the power factor to 0-95 minimum.

2.16.12.7 For continuous duty motors 5 hp and larger, the use of high efficiency motors shall be considered.

2.16.13 Public Address System

Provide 3/4 inch conduit and 4 inch square backboxes for the future public address system to cover all spaces.

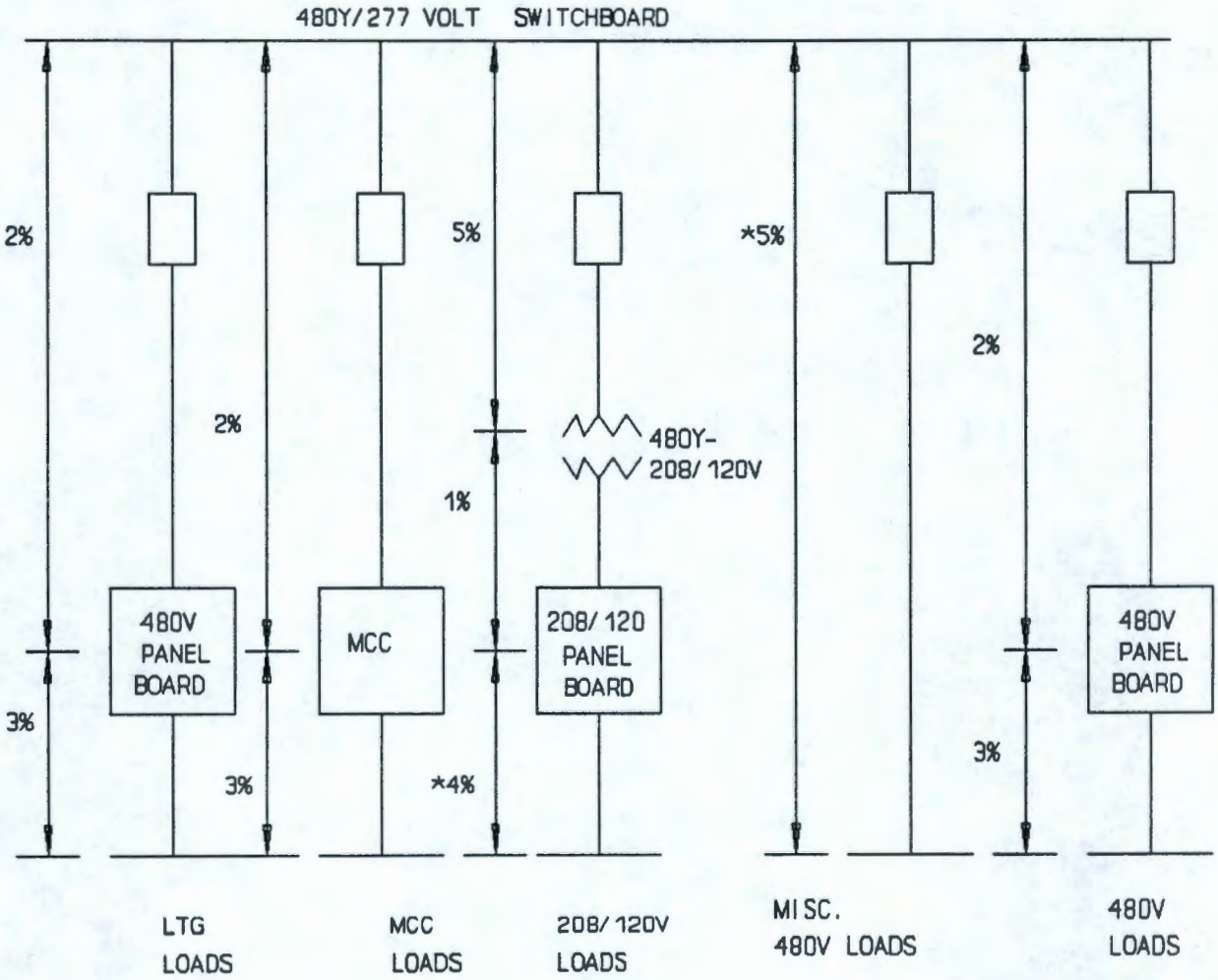
PART 3 EXECUTION

(Not Used)

END OF SECTION

9413202.1527

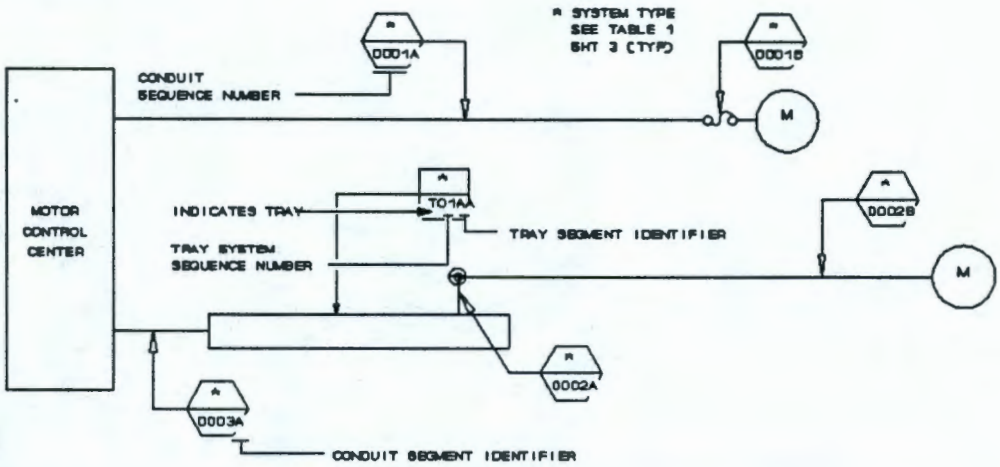
ATTACHMENT A
MAXIMUM ALLOWABLE VOLTAGE DROP IN CABLE



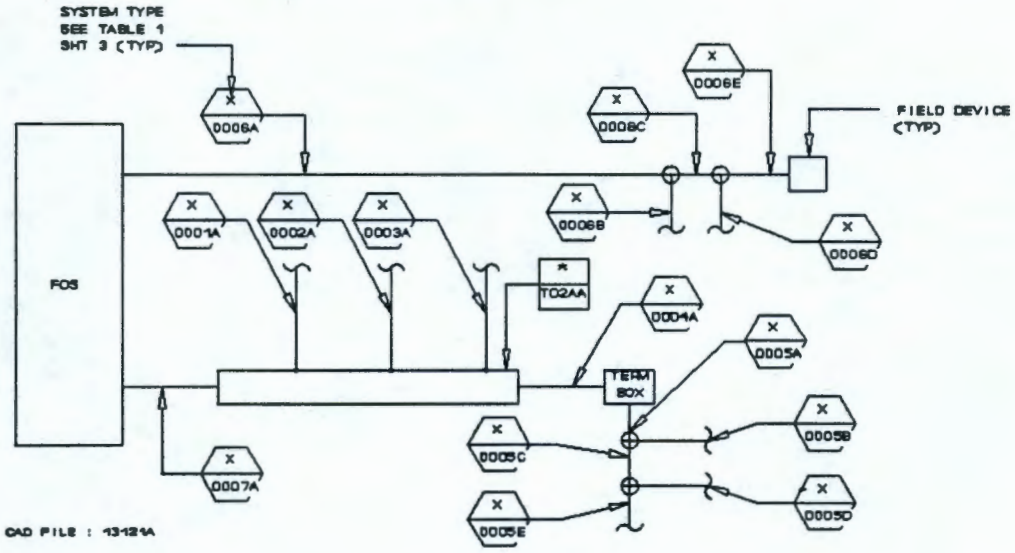
* TO MOST REMOTE FIXTURE, OUTLET, OR LOAD

ATTACHMENT B
CONDUIT, CABLE TRAY AND WIRE IDENTIFICATION

POWER / CONTROL

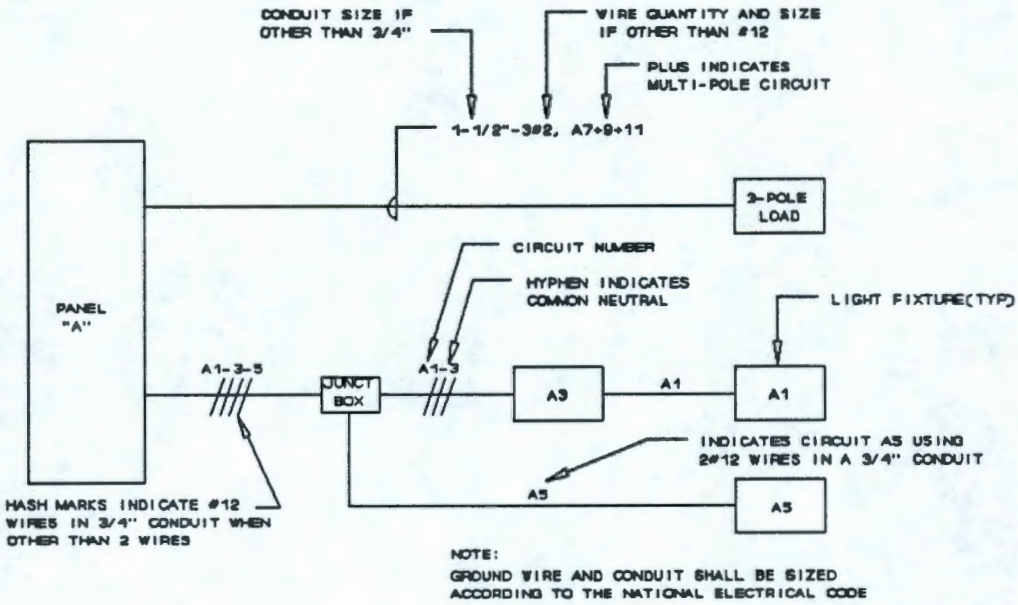


INSTRUMENTATION AND COMMUNICATIONS



9413202.1528

LIGHTING AND HEAT TRACING



CAD FILE : 1312188

TABLE NO. 1 CONDUIT OR CABLE

A - Alarm

B - Control, Interlock, PT Leads DC Ckt., Metering Relaying, RTD's

C - Communication

P - Power 600V and Below

X - Electronic Circuits (10-Soma, 4-zona, 1-5MA)

Y - Thermocouples

G - Ground

TABLE NO. 2 TRAY USE LEGEND

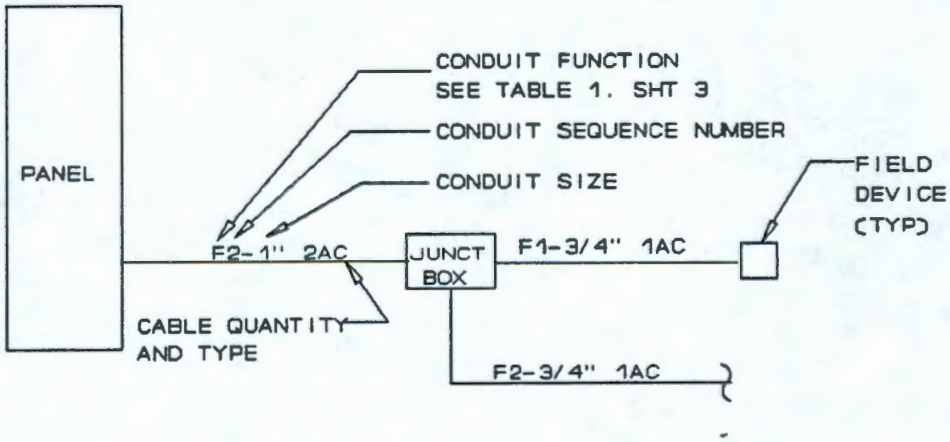
I - Instrument System

P - Power system

F - Fire Alarm

9413202.1550

FIRE ALARM



CAD FILE : 13121B

ATTACHMENT D

(Not Used)

9413202.1531

ATTACHMENT E
PREPARATION AND CONTROL OF ENGINEERING AND FABRICATION DRAWINGS

1.0 DRAWING CATEGORIES

1.0.1 General

1.0.1.1 Drawings fall under two categories: the "SK and "H" series drawings. These series consist of conceptual, modification, prototype, construction, fabrication and non-fabrication drawings, which in turn include different types of drawings (e.g., arrangement, assembly, detail, schematic, wiring diagram, block diagram, flow diagrams, installation, layout, plot plan, P&ID, loop sheets, envelope, altered item, etc.). This list of drawing types is not restrictive and other types not identified may be used if necessary.

1.0.1.2 "SK" or "H" drawing numbers shall be issued and controlled by the Records Storage/Retrieval and Microfilming Group.

1.0.1.3 "SK" or "H" designation shall be assigned by the originator in accordance with these criteria.

1.0.2 H- Series Drawings

H- series drawings shall be prepared to depict permanent installation of facilities, hardware and equipment. These drawings are permanent records, and as such they may be subject to as-built requirements upon completion of construction or fabrication.

1.0.3 SK- Series Drawings

1.0.3.1 SK- series drawings shall be prepared as temporary drawings and shall depict:

a. experimental equipment

b. limited use test equipment

c. limited use interface information (i.e., Conceptual Designs, etc.)

d. short-term application (i.e., temporary changes in design to facilities, hardware and/or equipment)

e. design criteria to equipment vendors

9413202.1532

9413202.1533

1.0.3.2 SK- series drawings shall not be used for permanent records. If the SK- is used for a prototype which is incorporated into a permanent facility, it shall be "As-Built" and renumbered as an H-drawing (see Section 12.0).

NOTE: SK numbers shall NOT be changed to H numbers by changing the SK to H; complete new numbers are assigned.

1.0.3.3 SK drawings used for conceptual designs or to convey design criteria to equipment vendors shall be identified as conceptual or Vendor Information using 1/4-inch lettering immediately above the title block.

1.0.4 Drawings depicting the final design of vendor supplied equipment may be required by procurement documents to be assigned H- series numbers and to be prepared in accordance with these criteria. Such drawings not assigned H- series numbers may utilize the vendor's numbering system and shall be certified by the vendor as "As-Built" and shall be assigned a vendor information (VI) number and shall reside in the VI file maintained by the Record Storage/Retrieval and Microfilming Group.

2.0 DRAWING SIZE

2.0.1 Five standard sheet sizes, listed below, shall be used for drawings in accordance with ANSI Y14.1. The "F" size drawing is the preferred size.

Size	Dimensions in Inches
A	8-1/2 x 11
B	11 x 17
C	17 x 22
D	22 x 34
F	28 x 40

3.0 DRAWING MATERIAL

3.0.1 CAD drawing material shall be 3-mil minimum drafting film, matte on one side, or 100% rag vellum, 17 pound minimum.

4.0 DRAWING ARRANGEMENT

4.0.1 The general drawing arrangement shall conform to ANSI Y14.1, except for the location of the parts list or list of materials and the revision block. Additional spaces have been reserved for Hanford unique items.

4.0.2 All drawings, including continuation sheets (multiple sheet) shall have a complete title block (see Section 7.0. Title Block).

9413202.1534

4.0.3 Drawing components, when required, shall be arranged as shown in Figure 1 and as defined in these criteria.

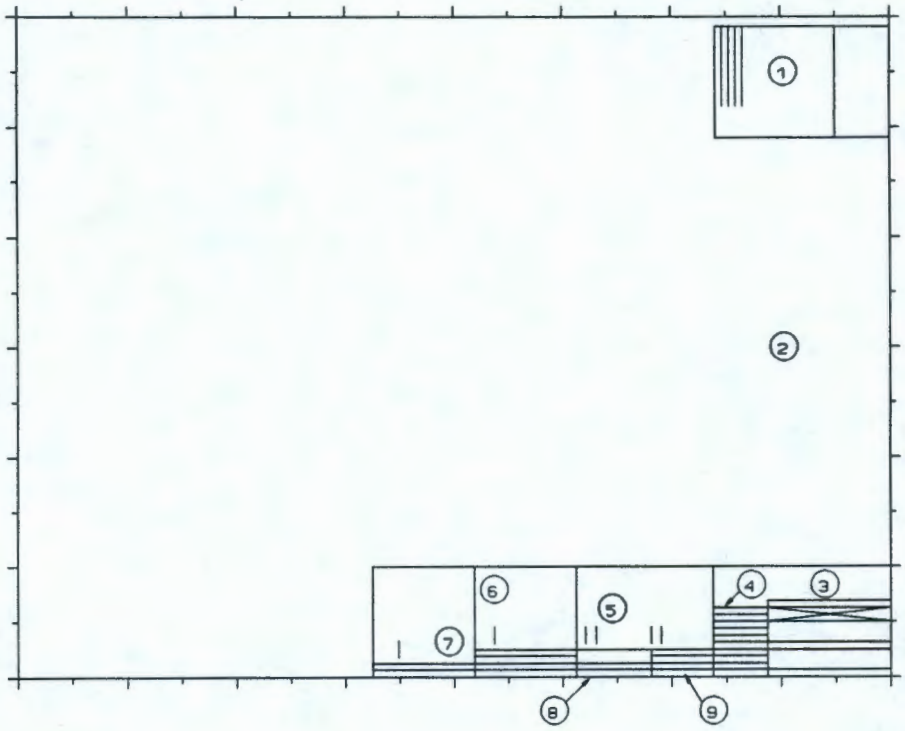


Figure 1. Drawing Arrangement

4.0.3.1 **Parts List or List of Material**

Parts lists or lists of material shall be utilized on fabrication and assembly drawings, when appropriate. Parts lists may be arranged according to individual contractor procedures and Section 11.0. Suggested width of Parts Lists having one quantity column is 7-1/2 inches; added columns may be used as necessary.

4.0.3.2 **General Notes**

Location indicated is the preferred position, but another location may be used if parts list or drawing geometry extend into this area. On multiple sheet drawings general notes start on Sheet 1 but may be continued on subsequent sheets.

9413202.1535

4.0.3.3 **Drawings Status Marking (Optional)**

This space is reserved for tracking drawing status from initiation to release in accordance with individual contractor procedures.

4.0.3.4 **Title Block**

The title block shall be sized and configured as indicated in Section 7.0, Title Block.

4.0.3.5 **Revisions**

The revision block is sized and configured as indicated in Section 8.0, Revisions.

4.0.3.6 **References**

See Section 9.0, Reference Block.

4.0.3.7 **Drawing Traceability (Optional)**

A drawing traceability list is utilized according to individual contractor procedure and shall be configured as indicated in Section 10.0, Drawing Traceability List.

4.0.3.8 **Cadfile**

The Computer Aided Design File (CADFILE) designator is a unique file identification code which is assigned to each CAD data set to allow cross-referencing of CAD plots to specific data sets. The CADFILE designator shall be placed on all CAD data sets prior to plotting and shall be located according to Section 4.0 of these criteria. The designator shall consist of eight (8) characters and shall be formatted as indicated below. Nine (9) characters are permitted for drawings with numbers containing six (6) digits when two alpha characters are required to designate the sheet number and when the drawing is generated on equipment that allows a nine character file name.

EXAMPLES:	H-2-27918, SH7	H-5-498, SH 32
	B027918G - OK CADFILE	E00498JA - OK CADFILE
	B27918G - BAD CADFILE	E0498JA - BAD CADFILE
	H-4-176541, SH 28	
	D176541EA -	OK CADFILE on systems with 9- character capacity
	D176541E -	BADCADFILE cannot be done on systems imposing an 8-character limit.

WARNING!!! DATA SETS WITH 9-CHARACTER CADFILE NUMBERS ARE NOT TRANSFERABLE TO SYSTEMS WITH 8-CHARACTER LIMIT.

CADFILE designators shall be established in accordance with the following convention:

9413202.1536

9413202.1537

X XXXXXX X

SHEET NUMBER Sheet Numbers 1 through 23 are identified by a single alpha character corresponding to the sheet number in the first number column of the Drawing Sheet Identification Convention matrix below. A second alpha character is required to identify Sheets 24 through 529. This two-letter identifier is established by locating the sheet number in the matrix, establishing the first letter from the vertical alpha on the left and the second letter from the horizontal alpha at the top. This left identifier will be used on all systems for drawings having numbers of 5 or less digits. File naming limitations (8 characters) imposed by some systems make it impossible to identify drawings with 6-digit numbers and 24 or more sheets using this system. If more than 23 sheets are required for a drawing with a 6-digit number on systems so limited, additional drawing numbers shall be utilized.

DRAWING NUMBER (Minus area designator, i.e., H-2, etc.) The drawing number generally includes six (6) digits. Leading zeros are used when a drawing number is less than 6 digits. An exception is made when the drawing number is 5 digits and the drawing consists of more than 23 sheets. In this case the sheet number code consists of 2 alpha characters and the drawing number may be 5 digits.

AREA DESIGNATOR The area designator is an alpha character assigned based on the first 2 or 3 characters of the drawing number used to identify a drawing with a particular area or facility. Area designators are assigned from the following:

Alpha Character	Area Designator
A	H-1
B	H-2
C	H-3
D	H-4
E	H-5
F	H-6
G	H-7
H	(Reserved)
I	Not Used
J	H-8
K	H-9
L	H-11

Alpha Character	Area Designator
M	H-12
N	SK-12
O	Not Used
P	SK-11
Q	SK-8
R	SK-7
S	Not Used
T	SK-6
U	SK-5
V	SK-4
W	SK-3
X	SK-2
Y	SK-1
Z	Reserved for non-released standard Hanford data sets

9413202.1538

U.S. DEPARTMENT OF ENERGY
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.
Advanced Technology Division
Fluor Contract 8457

DRAWING SHEET IDENTIFICATION CONVENTION MATRIX

		A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y
A.	1	24	47	70	93	116	139	162	185	208	231	254	277	300	323	346	369	392	415	438	461	484	507
B.	2	25	48	71	94	117	140	163	186	209	232	255	278	301	324	347	370	393	416	439	462	485	508
C.	3	26	49	72	95	118	141	164	187	210	233	256	279	302	325	348	371	394	417	440	463	486	509
D.	4	27	50	73	96	119	142	165	188	211	234	257	280	303	326	349	372	395	418	441	464	487	510
E.	5	28	51	74	97	120	143	166	189	212	235	258	281	304	327	350	373	396	419	442	465	488	511
F.	6	29	52	75	98	121	144	167	190	213	236	259	282	305	328	351	374	397	420	443	466	489	512
G.	7	30	53	76	99	122	145	168	191	214	237	260	283	306	329	352	375	398	421	444	467	490	513
H.	8	31	54	77	100	123	146	169	192	215	238	261	284	307	330	353	376	399	422	445	468	491	514
J.	9	32	55	78	101	124	147	170	193	216	239	262	285	308	331	354	377	400	423	446	469	492	515
K.	10	33	56	79	102	125	148	171	194	217	240	263	286	309	332	355	378	401	424	447	470	493	516
L.	11	34	57	80	103	126	149	172	195	218	241	264	287	310	333	356	379	402	425	448	471	494	517
M.	12	35	58	81	104	127	150	173	196	219	242	265	288	311	334	357	380	403	426	449	472	495	518
N.	13	36	59	82	105	128	151	175	197	220	243	266	289	312	335	358	381	404	427	450	473	496	519
P.	14	37	60	83	106	129	152	175	198	221	244	267	290	313	336	359	382	405	428	451	474	497	520
R.	15	38	61	84	107	130	153	176	199	222	245	268	291	314	337	360	383	406	429	452	475	498	521
S.	16	39	62	85	108	131	154	177	200	223	246	269	292	315	338	361	384	407	430	453	476	499	522
T.	17	40	63	86	109	132	155	178	201	224	247	270	293	316	339	362	385	408	431	454	477	500	523
U.	18	41	64	87	110	133	156	179	202	225	248	271	294	317	340	363	386	409	432	455	478	501	524
V.	19	42	65	88	111	134	157	180	203	226	249	272	295	318	341	364	387	410	433	456	479	502	525
W.	20	43	66	89	112	135	158	181	204	227	250	273	296	319	342	365	388	411	434	457	480	503	526
X.	21	44	67	90	113	136	159	182	205	228	251	274	297	320	343	366	389	412	435	458	481	504	527
Y.	22	45	68	91	114	137	160	183	206	229	252	275	298	321	344	367	390	413	436	459	482	505	528
Z.	23	46	69	92	115	138	161	184	207	230	253	276	299	322	345	368	391	414	437	460	483	506	529

4.0.3.9 **CAD CODE**

The CAD Code shall be placed on each CAD data set near the CAD file before the CAD drawing is plotted and will be referred to by CAD Operations personnel to control the migration of CAD datasets across systems used at Hanford. The CAD Code will contain the following information: The contractor and area, type of hardware, type of graphic software, and the revision of graphic software with a colon (:) used to distinguish each field of information. The format shall be as follows:

XX : XXX : XXXX : X . XXX : XX

Revision of Graphic Software

- Number of characters as required

Type of Graphic Software

- 4 Characters Max
- ACDX (AutoCAD)
- DDMX (Calma)
- EGSX (Hewlett Packard)
- GEOX (Calma GEODRAW)
- M1OX (Hewlett Packard)
- M3OX (Hewlett Packard)
- (FUTURE)

Font Designator

- The font set designation shall be two (2) characters.
- 1st character shall be the line font designator
- 2nd character shall be the text font designator.
- The font set designator shall be as follows:

  S = Standard (vendor supplied)
  N = Nonstandard (contractor supplied)

Fourth character shall be a "2" or "3" to indicate 2 or 3 dimensional drawing generation.

Type of Hardware

- 3 Characters Max.
- APL (Apollo)
- DEC (VAX)
- HP (Hewlett Packard)
- IBM (Including IBM Compatible)
- (FUTURE)

Contractor and Area of Current Residence

1 - Operations Engineering Contractor
2 - Engineer/Construction Contractor
3 - Research and Development Contractor
4 - Site Computer Services Contractor
5 - Fixed Price Contractor

A -- 100 Area
B - 200E Area
C - 200W Area
D - 300 Area
E - 400 Area
F - 600 Area
G - 700 Area
H - 800 Area
J - 1100 Area
K - 3000 Area
L - Offsite

9413202.1540

5.0 DRAFTING PRACTICE

5.0.1 Drafting practices shall be in accordance with ANSI Y14 series or other industry accepted drafting practices and the requirements of these criteria.

5.0.2 Abbreviations shall conform to ASME Y1.1 except for the cases where commonly accepted industry or specific discipline usage dictates a deviation from ANSI Y1.1. Common abbreviations, such as TYP and REF, may be used at all times. Unusual abbreviations shall be used only when space is limited. Hanford Site specific abbreviations and acronyms shall be clearly defined on the design media.

5.0.3 Symbols shall conform to ANSI Y14.36, Y32.2, Y32.2.4, Y32.2.6, Y32.4, and Y32.9.

5.0.4 Drawings shall be prepared so that prints are legible when reduced on microfilm and then re-enlarged. As an example, parallel lines shall be spaced at least 1/16-inch apart to maintain distinction.

5.0.5 Where 20 or more drawings are prepared for a single project, a list of all drawings shall be made on a separate sheet showing the drawing number, index number(s) and drawing title. The drawing list shall be the first drawing in the project set. For between 10 and 20 drawings, a list shall be placed on the first drawing of the set. For multisheet drawings, the number of sheets shall be shown without repeating the rest of the information (e.g., H-I-12345, 6SH). Building numbers shall be included in drawing list when more than one building is involved in the project.

5.0.6 Lettering shall be all upper case gothic except where lower case is standard (e.g., Na, Km, g). Letters and figures shall be at least 1/8-inch high; see ANSI Y14.2M for recommended shape.

5.0.7 If typing is utilized on the drawings, it shall be all upper case of a bold, Gothic style and lines of type shall be a minimum of 1-1/2 spacing. In no case shall type be used with letter height of less than 0.1-inch.

5.0.8 A north arrow shall be placed on all maps, plans, layouts and other drawings where applicable. North shall generally be oriented to the top or right side of the sheet. All plans on a given set of drawings should be oriented the same and should match the existing plant drawing orientation.

5.0.9 The grid system used shall be identified on Site drawings. The coordinate grid system is assumed to be Hanford grid unless noted otherwise on the drawing.

9413202.1591

5.0.10 Each drawing shall, as a minimum, show the project number, where applicable, and the names of the originator and the checker. The exception would be illustrations or figures in documents such as a Functional Design Criteria, an Engineering Study or an Engineering Change Notice.

5.0.11 Prior to submittal to another authority for approval, each drawing shall be independently checked and shall be approved by the responsible engineer. Each sheet shall be treated individually for checking and approval purposes, for the initial release, and for revisions.

5.0.12 Preprinted drafting film may be supplied to offsite companies. For large jobs, the offsite company may be permitted to use drafting film with the company name preprinted in the title block. Offsite companies using plant supplied drafting film shall place the name of their firm in the title block, replacing the existing company name.

6.0 COMPUTER AIDED DRAFTING

6.0.1 Identifier

The CAD-generated drawings shall have CADFILE and CADCODE identifiers. These identifiers shall be located below the revision block and within the border lines of the drawing. The location of the CADFILE and CADCODE identifiers is shown as Items 8 and 9 in Figure 1, Section 4.0.

6.0.2 Manual Modifications or Revisions of CAD-Generated Drawings

6.0.2.1 Manual changes or alterations to a CAD-generated drawing should be avoided. If an issued CAD-generated drawing is changed or altered manually, the CAD data set(s) shall be updated in accordance with normal contractor procedures. Obtaining approval signatures is not considered a change or alteration.

6.0.2.2 Drawings manually changed or altered shall have a single horizontal line drawn through the CADFILE and CADCODE identifiers. This signifies that the drawing has been manually updated and the data set(s) may not be up-to-date.

6.0.2.3 If data set(s) are lost or no longer exist and will not be replaced, the CADFILE and CADCODE identifiers shall be removed from the vault retained drawing(s) at the next manual revision.

9413202.1592

7.0 TITLE BLOCK

7.0.1 Title blocks are to be in conformance with ANSI Y14.1. Contents identified in the title block shall be modified to accommodate Hanford requirements and individual contractor approval procedures. (See Figure 2 for typical title block).

7.0.2 Information shall be entered in the numbered blocks as follows:

		IMPACT LEVEL [10]			EDT	
DRAWN [13] DATE		[1] U.S. DEPARTMENT OF ENERGY Richland Operations Office (C O M P A N Y N A M E)				
CHECKED [14]						
[15]		[2]				
		PROJECT [3]				
		SIZE F	BLDG NO. [4]	INDEX NO. [5]	DRAWING NO. [6]	REV NO. [7]
APPROVED FOR IMPLEMENTATION BY FOR [16] DATE		SCALE [8]		JOB NO. [9]	SHEET [11] OF [12]	

Figure 2. Title Block

1. **FIRM NAME**

2. **DRAWING TITLE**

   a. The title is to be brief but clearly identify the subject matter.

   b. The title is not to include the project or building number and includes the area number only for area-wide presentations.

   c. The total number of characters including spaces shall not exceed 60.

   d. Height of the lettering in the title shall be approximately 3/16- to 1/4-inch.

   e. The title shall be arranged in one, two or possibly three lines centered in the block. All sheets, of multiple sheet drawings, shall have the same title, except that the last line of the title may differ to describe the contents of each sheet.

   f. The same title shall not be used on more than one drawing of a given project unless different buildings are involved. If drawing content is the same for two or more sheets, a multisheet drawing is appropriate.

9413202.1543

9413202.1544

3. **PROJECT (where applicable)**

The official project title preceded by the project number shall be utilized where applicable. Smaller jobs may have "project titles" assigned. Project titles shall be identified on all drawings in a set. Abbreviations may be used.

4. **BUILDING NUMBER**

Numbers for new facilities are maintained by Records Storage/Retrieval and Microfilm Group. Building numbers shall be assigned prior to drawing approval. Where applicable a drawing may show two or more building references. The references shall be separated by a slash (e.g., 405/409).

5. **INDEX NUMBERS**

Index numbers are listed in Section 15.0. A number shall be used for each major category and is required on each drawing. Nonessential numbers are not shown (e.g., 0801 and 0802 are not shown along with 0800 on a single drawing). Numbers shall be assigned to accurately represent drawing content. Multiple index numbers shall be separated by a slash (e.g., 3900/7301).

Offsite A-E/s obtain building index numbers from the appropriate contractor's Project Manager or Engineer.

6. **DRAWING NUMBER**

The drawing number shall be 1/4-to 3/8-inch high. Numbers are obtained from Records Storage/Retrieval and Microfilm Group.

7. **REV**

Current revision number shall be used. 0 shall be used for initial release.

8. **SCALE**

When the entire drawing is to the same scale, the scale shall be shown in this block. The word SHOWN shall be used where more than one scale appears on the sheet. The word NONE shall be used where a scale is not applicable (schematics, flow diagrams, etc.).

9. **JOB NO (OPTIONAL)**

The job number is assigned in accordance with individual contractor procedures to identify drawings prepared for a common effort or project. May be utilized to identify a funding source.

9413202.1545

10. **IMPACT LEVEL (OPTIONAL)**

May be utilized to identify impact level of equipment or facility presented in accordance with individual company procedure.

11. **SHEET**

For single sheet drawings, a "1" shall be entered. For multisheet drawings, the sheets shall be numbered in sequence starting with 1.

12. **OF**

Enter total number of sheets. For single sheet drawings, a 1 shall be entered.

13. **DRAWN**

The initials and surname of the originator shall be written or printed in an individualistic style as long as they are legible.

14. **CHECKED**

The initials and surname of the checker shall be written and shall be legible

15. **APPROVALS**

Used for typical company internal approval. The content may be modified. The signatures shall include the initials and surname and must be legible. Approval signatures on CAD Generated Drawings may be placed adjacent to or above pre-printed names, where applicable.

16. **APPROVED FOR IMPLEMENTATION (AS APPLICABLE)**

The authorizing organization's identification shall be entered (normally an Operating Contractor) following his signature. This signature provides authorization to proceed with construction, procurement, or fabrication.

17. **ENGINEERING RELEASE (AS APPLICABLE)**

An authorized document number used to identify the formal release of a drawing.

8.0 **REVISIONS**

8.0.1 A revision block shall be sized in accordance with Figure 3 and located in accordance with Figure 1. Content may be modified according to individual contractor procedures.

MF	REV NO.	DESCRIPTION	REV BY DATE	APPROVALS			
	REVISIONS						
CADFILE			CADCODE				

SEE FIGURE 1 ITEM 8 SEE FIGURE 1 ITEM 9

Figure 3. Revision Block

8.0.2 Each new revision shall be listed in numerical sequence. Only Released (issued) drawings can be revised and each subsequent revision shall be released and microfilmed before another revision can be made. Latest revision number shall also be shown (see Figure 2).

8.0.3 A concise description of each revision shall be written in the past tense or the authorizing document noted. Each item shall be preceded by a lower case letter in parenthesis and ended with a drawing coordinate or zone (Z) number to facilitate location. Revisions of a general or self-explanatory nature need not have zone or prefix numbers. If a revision is made by an authorizing document, the revision description shall show the document number (ECN, EO, DC, etc.). Conservation of space is essential, therefore ANSI abbreviations shall be normally used to the best advantage.

8.0.4 **Revision Triangle and Cloud**

8.0.4.1 If individual contractor procedures require identification of the location of the revision, a triangle with 3/8-inch sides, containing the current revision number shall be drawn as close as possible to the drawing change. The number shall include the lower case letter when applicable (e.g., 1a or 2). To further assist in locating revisions on complex drawings, the revised area may be encircled by a "cloud" drawn on the back of the drawing.

8.0.4.2 During a subsequent revision, the "cloud" shall be removed, but the triangle may remain. Triangles from prior revision shall be deleted.

8.0.4.3 The revision triangle shall not be used where the possibility of confusion with drawing symbols is likely. It is never used in the title block.

9413202.1546

8.0.5 "As-Built" revisions reflect the actual completed installation as obtained from field inspection or appropriate contractor documentation. The statement "as-built" is entered in the description column.

8.0.6 "General" revisions shall be used on plant key maps, or other reference type drawings and drawings with extensive revisions. It is not required to delineate the changes and, therefore, revision triangles are not shown on the drawing. Current revision approval requires signature approval by appropriate authorities. Initials may be used in place of signatures provided that they are handwritten by the person approving the revision.

8.0.7 Approvals shall be per individual contractor procedure. CAD developed drawings require all previous approval signatures to be printed in the appropriate spaces.

8.0.8 The letter "M" shall be stamped to the left of the Rev column by Records Storage/Retrieval and Microfilming Group to signify that the drawing has been microfilmed for the current revision.

8.0.9 Previously approved and microfilmed revisions may be removed from the drawing when additional space is required. The removal of the revisions shall be noted in the current revision description (i.e., Removed previous revisions 1 through 5, etc.).

9.0 **REFERENCE BLOCK**

9.0.1 This block shall be used to list reference documents necessary for the completion of the work depicted on the drawing.

9.0.2 For Conceptual or Preliminary Design drawings, the reference documents used in preparation may be listed (Figure 4).

①	②
NUMBER	TITLE
REFERENCES	
NEXT USED ON ③	

Figure 4. Reference Block

9.0.3 For Definitive Design drawings, only the reference documents required by the construction/fabrication contractors shall be listed. National consensus standards shall not be listed. Existing equipment shall be referenced by VI (previously identified as CVI or BPF) number when such exists.

1. Number

   The identifying number of the reference document shall be entered in this column.

2. Title

   The actual, abbreviated or condensed title of the reference document shall be entered in this space.

3. Next Used On

   This space is provided for those cases where it is applicable to link together certain drawings such as subassembly, detail and installation drawings. Drawings shall be linked by referencing the next level or generation up (i.e., a subassembly drawing will list the number of the assembly or installation drawing). Drawing list numbers shall not be placed in this space.

9413202.1548

9413202.1549

10.0 DRAWING TRACEABILITY LIST

Existing drawings which are modified by the work depicted on a drawing are entered into the drawing traceability list (see Figure 5). These drawings are not required for the construction or fabrication and are not included in the reference drawing list.

NUMBER	TITLE
DRAWING TRACEABILITY LIST	

Figure 5. Drawing Traceability List

11.0 PARTS LIST

11.0.1 Parts List and configuration shall be governed by individual company practices.

11.0.2 The Parts List shall contain all material and separable components on the drawing. The individual pieces of weldments, or other nonseparable assemblies, are not normally numbered separately.

11.0.3 Effort should be made to arrange the Parts List in a numerical order of importance (i.e., assembly, subassembly, detailed parts, catalog items, etc.). It is not necessary to rearrange the Parts List merely to add an additional entry.

11.0.4 Each arrangement, assembly, subassembly and detail shall have a separate and different part number. Parts that are not physically and functionally interchangeable shall have different part numbers.

11.0.5 Quantities shall be counted accurately and shown in customary trade units.

11.0.6 AR (as required) shall be used where the quantity is not known or where the quantity could vary.

11.0.7 A generic name of the item shall be listed first with supplemental descriptive words following. The description of an item shall be as complete as possible, and in accordance with accepted industry standards. If the item can be completely described in the parts list, it shall be placed there. Where the description is too lengthy to fit into that space, it shall

be placed near the detail or in the NOTES, and referenced in the description column (e.g., SEE DETAIL FOR DESCRIPTION). The complete description shall be stated in one place only, not split in two or more locations.

12.0 **CLASSIFIED AND SENSITIVE DRAWINGS**

When classified or sensitive information is to be contained on any version of a drawing, an Authorized Derivative Classifier (ADC) shall review and determine the Classification Level (Top Secret, Secret, or Confidential) and the Category (Restricted Data, Formerly Restricted Data, National Security Information) of the drawing. Classification questions should be referred to the Classification Office. The originating organization shall mark the drawing to reflect the Classification Level and Category; contact the Classified Files or Document Control organization to establish accountability as required; and, protect the document in accordance with security and document handling requirements.

9413202.1550

13.0 **SUPERSEDED, VOIDED DRAWINGS AND TITLE BLOCK CHANGES**

13.0.1 When official approved "H" or "SK" series drawings are superseded, voided or when a building, index or drawing number is changed, a Drawing Number Change Notice (Form BD-9300-051, Figure 6) shall be completed. The completed form is to accompany the drawing(s) that have been changed in accordance with these criteria and sent to Records Storage/Retrieval and Microfilming Group. All drawings involved must accompany the form after having been prepared as follows:

A. Superseded by a drawing with a different drawing number.

1. For the superseded drawing - Print SUPERSEDED BY DWG _____ near the title block using 1/4-inch high letters. Sign name and date below note. (Superseded drawings are removed from the active data base.)

2. For the new drawing - Complete the title block as for any new drawing. Add note near title block -- SUPERSEDES DWG _____ in 1/4-inch high letters. Complete Form BD-9300-051, Drawing Change Notice, Figure 6.

B. Superseding an approved drawing with a drawing of the same drawing number.

(NOTE: A CAD revised drawing which replaces the CAD original tracing is not superseding a drawing with a drawing of the same number for the purpose of this requirement and thus no form BD-9300-015 is required).

1. For the new drawing - Use the same drawing number and title. Print all original signatures and dates, such as draftsman, checker and approval signatures as appear on the superseded drawing. Add next higher revision number and omit all previous revisions. Add revision note (e.g., REDRAWN, GENERAL CHANGE OF DELINEATION or, REDRAWN DUE TO CONDITION OF ORIGINAL). Add signature of draftsman and date. Complete Form BD-9300-051, Figure 6.

C. Superseding a preliminary (unapproved) drawing with a drawing of the same drawing number.

1. For the superseded drawing - Destroy the original.

2. For the new drawing - Complete title block as for any new drawing. Form BD-9300-051 not required.

D. Voided Drawings

1. For the voided drawing - Print VOID near the title block. Sign name and date below. Complete Form BD-9300-051 (08-87), Figure 6. Deliver the original tracing with the completed form to Record Storage/Retrieval and Microfilming Group. (Voided drawings are removed from the active data base.)

9413202.1551

The following change(s) made to:

☐ Drawing Number _____ Sht. _____ Date_____
Rev. No. _____ is VOIDED

Reasons for Voiding_____ Sht. _____
Date _____ Rev No. _____

☐ Drawing Number _____ Sht. _____ Date_____
Rev. No. _____
is superseded by
Drawing Number _____ Sht. _____ Date_____
Rev. No. _____ (New Original)

☐ Drawing Number _____ Sht. _____ Date_____
Rev. No. _____
Has been changed on
same original to
Drawing Number _____ Sht. _____ Date_____
Rev. No. _____ (New Original)

☐ Drawing Number _____ Change Index _____
To _____

Change Index _____
To _____

☐ Drawing Number _____ Title Changed To_____
To _____

By	Authorized By	Contractor	Date

Figure 6. Drawing Change Notice

E. Changed Drawing Numbers, Index Numbers or Building Numbers

Obtain new number. Remove the old number and add new number. Add the next higher revision number indicating the previous number in the description. Complete Form BD-9300-051, Figure 6. In addition, when a drawing number is changed, print FORMERLY DWG ___Old No.)___ in the vicinity of the title block using 1/4- inch high letters.

F. Changed Title

When it is necessary to change the title of an approved drawing, apply all rules applicable to drawing titles, add next higher revision number indicating previous title in the description and complete Form BD-9300-051, Figure 6. The completed form accompanies the revised original when it is

9413202.1552

submitted to Records Storage/Retrieval and Microfilming Group.

14.0 **DRAWING CONTROL**

14.0.1 Approved drawings shall be transmitted to Records Storage/Retrieval and Microfilming Group for reproduction, distribution, microfilming and storage.

14.0.2 The record copy of all engineering drawings is the silver halide microfilm aperture card. The original engineering drawing is a lifetime retainable document and requires special handling for retention and protection.

14.0.3 A list of persons authorized to retrieve approved drawings is provided to Record Storage/Retrieval and Microfilming Group by the respective company managements.

14.0.4 For DOE-RL managed projects, the DOE-RL Project Engineer shall approve the release of the design drawings for construction, by approving the operating contractor's document which releases the design drawings to Record Storage/Retrieval and Microfilming.

9413202.1553

15.0 **DRAWING INDEX NUMBERING SYSTEM**

15.1 **GENERAL**

The Drawing Index is a system of numerical digits to identify drawings for storage and retrieval. The drawing file is maintained by Record Storage/Retrieval and Microfilming Group, Federal Building, Room 356, Richland, Washington. All drawings for work shall be indexed in accordance with this system and the number shown on the Title block of drawings before drawings are released and before reproduction.

15.2 **INDEX SYSTEM**

The complete index number comprises 4 or 6 numerical digits: Two for the primary subject, 00 to 99; two for the secondary subject, 01 to 99, and two for the tertiary subject, 01 to 99. Thus an index number might be 0804 - Architectural Equipment Location, or 590315 - Instrumentation System, Wiring Diagrams, Safety Circuits.

15.2.1 Primary Subject

00	-	Listing or Index
01 through 07	-	Civil
08 through 14	-	Architectural and Structural
15 through 58	-	Mechanical
59 through 64	-	Instrumentation
65	-	Electronics
70	-	Flow Diagrams

71 through 81	-	Electrical
82	-	Insulation and Heat Tracing
83	-	Blank
84 through 88	-	Piping
89	-	Heating, Ventilating, and Exhaust
90	-	Air Conditioning systems
99	-	Miscellaneous Equipment not Identifiable or Related to Assembled Equipment

15.2.2 The primary subjects are further divided into details or secondary subjects, e.g., 0804, Architectural Equipment Locations, or 7005, Piping and Instrument Diagram-CLS. The 04 and 05 digits are added to denote the details.

15.2.3 The tertiary subjects, containing two digits, are used only in conjunction with the primary subjects, 49, 50, 59, 60, and 85 to indicate the type of drawing.

The complete 6-digit index number for a drawing showing a wiring diagram for safety circuits would be:

```
Instrumentation
|     Wiring Diagram
|     |     Safety Circuits
|     |     |
59    03    15
```

15.2.4 In some instances a drawing may contain two or more index categories, e.g., Cranes (3900) and Electrical Power Plans (7301), or it may apply to two buildings, e.g., 0405 and 4621E. In these instances, both index numbers and both building numbers shall be placed in the Title Block. For example:

0405/4621E 3900/7301

15.2.5 Spare numbers are retained throughout the primary, secondary, and tertiary subject for future expansion. They are not to be used without approval of Record Storage/Retrieval and Microfilming Group.

15.2.6 Additional index numbers will be assigned by Record Storage/ Retrieval and Microfilming Group as required.

15.2.7 The following pages of Section 15.0 are a listing of the index by subject (alphabetical index) and by number.

9413202.1554

9413202.1555

ALPHABETICAL INDEX FOR ENGINEERING DRAWINGS

Accelerator - Instruments	60--50
Acidity - Instruments	6016
Acids, Steam, Air, Gas, Overhead Lines, Piping - Civil	0300
Acids, Steam, Air, Gas, Underground Lines - Civil	0306
Acids, Steam, Air, Gas, Outside Lines - Civil	0308
Air Conditioning Systems - Plans, Sections, Details - Air Conditioning	9000
Airport Runways, Roads, Walks, Parking Areas, Fences-Details and Profiles - Civil	0200
Alarm - Instrumentation	60--43
All Facilities Built into Pile for Testing Purposes - Mechanical	2301
All Test Equipment Where Operation of Pile is Essential to Operation of Test - Mechanical	2300
Alpha - Instrumentation	60--51
Aluminum Component Preparation Caps and Can Cleaning Machine, Methanol Still, Detrex Trichlor Still, Trays, Baskets, Racks - Mechanical	490104
Aluminum Uranium Fuel Elements and Related Components - Caps, Spires, Cans, Sleeves, Cores, Hollow Pieces, or Perfs, Dummies, Spaces, Wafers, Self-Supports - Mechanical	490010
Amplifier - Instrumentation	60--52
Analyzer - Instrumentation	60--53
Aqueous Make-Up - Instrumentation	59--21
Architectural-Elevations, Sections and Details-Miscellaneous Steel for Stairs, Railings, etc. - Architectural	0801
Architectural - Other (includes schedules, architectural equipment details, such as bins, signs, cabinets, laboratory equipment, etc.) - Architectural	0802
Architectural Doors-Shielding-Windows - Architectural	0803
Architectural Equipment Locations - Architectural	0804

Architectural-Plans-May Include Other 0800 Category - Architectural	0800
Area Electrical Key Maps - Civil	0102
Argon Systems - Instrumentation	59--46
Baskets, Tubes, Containers, and Component Parts - Mechanical	500304
Billet Core Preparation - Mechanical	490110
Biological and Thermal Shield T/C System - Instrumentation	59--16
Block Outs, Sleeves, Plans, and Details - Electrical	7101
Boring, Rock - Civil	0600
Burial Grounds Sodium Disposal Area - Civil	0404
Cable Schedules - Instrumentation	5904
Calculator - Instrumentation	60--54
Calculator-Power - Instrumentation	59--14
Calibrator - Instrumentation	60--55
Camera - Instrumentation	60--56
Canning Cycle Control, Flex-O-Timer, Valves, etc. - Mechanical	490206
Canning Furnace and Equipment-Canning Jacks, Canning Baskets, Tongs, Shields, Tools - Mechanical	490204
Capsule, Storage for Strontium - Mechanical	4920
Capsule, Storage for Cesium - Mechanical	4921
Cathodic Protection-Plans, Elevations, Sections, and Details - Electrical	7801
Cathodic Protection-Wiring Diagrams (elementary, connection and inter-connection) Block Diagrams - Electrical	7802
Cathodic Protection-Junction Pull Boxes, Ducts - Electrical	7806
Cell Equipment Fastened to Cell for Mounting Vessels, Nozzles, Dunnage, Y Pads, etc. - Mechanical	2800
Ceramic Fuel Elements and Related Components - Mechanical	490030
Chambers - Instrumentation	60--57

9413202.1556

Charging Machines - Mechanical	2400
Checkers - Instrumentation	60--58
Chemical Storage - Instrumentation	59--30
Chemical Tanks and Piping - Mechanical	490118
Coextrusion Component and Billet Assembly - Mechanical	490220
Columns, Tanks, Dissolvers, Heat Exchangers, Vessels (no moving parts) - Mechanical	2500
Communication-Junction Pull Boxes, Ducts (this series includes sound powered telephone and central station system telephones) - Electrical	7606
Communications-Panel Schedules, Equipment, and Devices - Electrical	7604
Communications-Plans, Elevations, Sections, and Details - Electrical	7601
Communications-Station Schedules - Electrical	7607
Communications-Wiring Diagrams (elementary, connections and interconnections) Block Diagrams - Electrical	7602
Communications-Wire Run Lists, Conduit, Wire Schedules, Cables - Electrical	7605
Component Electronic or Ultrasonic Testing-Transformation Tests, Sort Tester, etc. - Mechanical	490304
Component Mechanical Inspection-Pickle Inspection, Statistical Sampling, Recovered Core Inspection, Gauges - Mechanical	490302
Component of a Mixture - Instrumentation	6020
Composite-Overhead and Underground Piping - Civil	0305
Concrete Structural-Plans - Architectural	0900
Concrete Structural-Elevations, Sections, and Details - Architectural	0901
Concrete Structural-Shop, Reinforcing and Pour Drawings - Architectural	0902
Concrete Structural-Penetrations, Sleeve and Blockout - Architectural	0903

9413202.1557

Concrete Structural-Penetrations, Embedment Schedules - Architectural	0904
Concrete Structural-Demolition - Architectural	0905
Conductivity - Instrumentation	6008
Containers for Disposal of Contaminated Equipment (does not include metal handling buckets and shipping casks) - Mechanical	2302
Control Rod, Absorber, Drive, Disconnect - Mechanical	1907
Control Rods - Mechanical	1905
Control Rods-Assembly Tooling and Handling Equipment - Mechanical	1906
Control Room and Miscellaneous Instrumentation - Instrumentation	59--44
Control System-Poison - Mechanical	1902
Control System-Horizontal Rods-Mechanical	1900
Control System-Vertical Rods - Mechanical	1901
Controller - Instrumentation	60--41
Core Preparation-Pickle Machine-Etch Machine, Nickel Plating - Mechanical	490102
Counters - Instrumentation	60--59
Cranes (all types) - Mechanical	3900
Criticality Monitoring Systems - Electrical	7900
Density - Instrumentation	6005
Differential Pressure - Instrumentation	6015
Digital Data Handling and Display, System 91 - Instrumentation	59-61
Discharging and Manipulator for Rear Face Work - Mechanical	2401
Dissolver Cells - Instrumentation	59--19
Dissolvers, Heat Exchangers, Vessels, Columns, Tanks (no moving parts) - Mechanical	2500
Duplex Furnace and Equipment-Ajax Induction Furnaces, Duplex Agitators, Agitator Baskets, Loader Shields, Tools - Mechanical	490202

9413202.1558

Electrical Control-Junction Pull Boxes, Ducts (this series includes remote signaling door bells, buzzers, annunciators) - Electrical	7506
Electrical - Miscellaneous	9902
Electrical Control-Control Panel Arrangements, Signal Plans, Elevations, Sections, and Details - Electrical	7501
Electrical Control-Wiring Diagrams (elementary, connection and inter-connection) Block Diagrams - Electrical	7502
Electrical Control-Timing Charts - Electrical	7503
Electrical Control-Panel Schedules - Electrical	7504
Electrical Control-Wire Run Lists, Conduit, Cable and Wire Schedules - Electrical	7505
Electrical Control-Relay and Switch Schedules - Electrical	7507
Electrical Control-Control Equipment and Devices - Electrical	7508
Electrical Only-Cable Schedules - Electrical	8005
Electrical Only-Pole Line Details, Sag Curves - Electrical	8003
Electrical Only-Pole Schedules - Electrical	8004
Electrical Only-Transformer Schedules (this series includes all electrical maps other than the "Civil" map series) - Electrical	8009
Electrical Only-Wiring Diagrams (elementary, connection and inter-connection) Area One-Line Diagram - Electrical	8002
Electrical-Outside Lines - Civil	0107
Electrical-General, Wiring Requirements, Electrical	7100
Electrical Utilities Transmission and Distribution Operating Drawings - Electrical	8000
Electrical-Maps, Plot Plans, Plans and Profiles, Plans, Elevations, Sections, and Details (includes substation structures) - Electrical	8001
Electronics-General - Electronics	6500
Electronics-Drill and Trim - Electronics	6505
Elevators - Mechanical	3901

9413202.1559

Emergency Power Generation Equipment (mechanical) - Mechanical	4050
Engineering Diagrams - Flow Diagrams	7001
Equipment Arrangements - Instrumentation	5907
Equipment Located in Hoods, Caves, Enclosure Where Operation is Remote - Mechanical	4705
Equipment Requirements - Instrumentation	5906
Equipment Support, Storage Racks, Hand Trucks, Tables, etc. - Mechanical	500306
Ex-Vessel Irradiated Fuel Handling Equipment - Mechanical	2452
Excavation and Finishing Grading - Civil	0111
Experimental Test Facilities Excluding Fuel Specimens - Mechanical	2303
Extractors - Instrumentation	59--34
Equipment Outline and Interface Requirement - Mechanical	1575
- Instrumentation	5975
- Electrical	7575
- Piping	8575
Extrusion Presses, Containers, Dies, and Tools - Mechanical	490222
Fences, Airport Runways, Roads, Walks, Parking Areas-Details and Profiles - Civil	0200
Fire Alarm and Telephone-Outside Lines - Civil	0108
Fire Alarm-Panel Schedules - Electrical	7704
Fire Alarm-Junction Pull Boxes, Ducts - Electrical	7706
Fire Alarm Plans, Elevations, Sections, and Details - Electrical	7701
Fire Alarm-Wire Run Lists, Conduit, Cable and Wire Schedules - Electrical	7705
Fire Alarm-Wiring Diagrams (elementary, connection, and interconnection) Block Diagrams - Electrical	7702
Fire Protection Sodium Systems - Mechanical	3000
Flow - Instrumentation	6002
Flow and Temperature Monitor Data Logging System - Instrumentation	59--40

9413202.1560

Flux Monitor System 95 - Instrumentation	59--78
Fuel Closed Loop In-Reactor Assembly - Mechanical	4925
Fuel Driver Assembly - Mechanical	4922
Fuel Element Production-Component Supporting Facilities (not for new drawings) - Mechanical	4906
Fuel Element Production-Special Items-Stampers, Tables, Bins Mechanical Counters - Mechanical	4907
Fuel Element Testing, Bond and Pen Tester, Autoclave Test, Bubble Tester - Mechanical	490308
Fuel Element Inspection-Radiography Inspection, Final Inspection Station, Weld Inspection, Length, Brace and Contour Inspection, Film Developing Equipment - Mechanical	490306
Fuel Element Production-General - Mechanical	4900
Fuel Element Production-Cleaning and Preparation - Mechanical	4901
Fuel Element Production-Testing and Inspection - Mechanical	4903
Fuel Element Production-Component Salvage and Recover: Scrap Recovery - Mechanical	4904
Fuel Element Production-Component Testing (not for new drawings) - Mechanical	4905
Fuel Failure Monitoring System 94 - Instrumentation	59--77
Fuel Handling-Irradiated (transfer, etc.) - Mechanical	2450
Fuel Material Open Test Assembly - Mechanical	4931
Fuel Monitor - Instrumentation	59--07
Fuel Oil Storage and Lines - Civil	0307
Fuel Open Test Assembly - Mechanical	4934
Fuel Special Purpose Assembly - Mechanical	4929
Fuels Development - Mechanical	5003
Fuel Element Production-Fuel Element Assembly Equipment - Mechanical	4902
Gas, Acids, Steam, Air, Overhead Lines-Piping - Civil	0300

9413202.1561

Gas, Acids, Steam, Air Underground Lines - Civil	0306
Gas, Acids, Steam, Air Outside Lines - Civil	0308
Gas Seal Tools - Mechanical	2901
Gas Storage Tanks - Mechanical	2504
Gases and Water-Outside Lines - Civil	0104
General - Instrumentation	60--39
General-Maps - Civil	0109
Guard Vessel-Exterior Shields and Other Cavity Components - Mechanical	1553
Heat Exchangers, Vessels, Columns, Tanks, Dissolvers, (no moving parts) - Mechanical	2500
Heating and Ventilating Equipment Location - Heating, Venting, Exhaust	8901
Heating and Ventilating Schedules, Notes - Heating, Venting, Exhaust	8902
Helium Systems - Instrumentation	59--47
Hoods, Caves, Enclosures (remote operated equipment) - Mechanical	4700
Humidity - Instrumentation	6006
Impact Wrenches - Mechanical	4500
In-Vessel Fuel Handling Equipment - Mechanical	2451
Indicator - Instrumentation	60--42
Indicator Controller Alarm - Instrumentation	60--45
Indices - Electrical	7109
Instrument - Miscellaneous	9903
Instrument Engineering Diagrams - Flow Diagrams	7002
Instrumentation Aux. Liquid Metal System, SDD No. 81 - Instrumentation	59--57
Instrumentation Closed Loop, SDD No. 61 - Instrumentation	59--56
Instrumentation-General, Index, Notes, Listings - Instrumentation	5900

9413202.1562

Instrumentation Heating and Venting, SDD No. 25 - Instrumentation	59--51
Instrumentation Heat Transport System, SDD No. 51 - Instrumentation	59--55
Instrumentation Inert Gas Receiving and Processing, SDD No. 82 - Instrumentation	59--58
Instrumentation Impurity Monitoring and Analysis, SDD No. 85 - Instrumentation	59--59
Instrumentation Plant Fire Protection, SDD No. 25 - Instrumentation	59--52
Instrumentation Radioactive Waste, SDD No. 24 - Instrumentation	59--50
Instrumentation Reactor Containment, SDD No. 27 - Instrumentation	59--53
Instrumentation Reactor SDD No. 31 - Instrumentation	59--54
Instrumentation Reactor Plant Control, SDD No. 90 - Instrumentation	59--60
Instrumentation Service Piping, SDD No. 23 - Instrumentation	59--49
Instruments-General - Instrumentation	6000
Interface - Instrumentation	6017
Integrator - Instrumentation	60--46
Internal Structural Component Including Reactor Head - Mechanical	1551
Internals, Nonstructural Items Excluding Controls and Fuels Associated Equipment - Mechanical	1552
Junction Pull Boxes, Ducts - Electrical	7906
Key Area Maps - Civil	0101
Laboratory Apparatus - Mechanical	4800
Layout or Plot Plans-General Facility - Civil	0110
Level - Instrumentation	6003
Lighting-Junction Pull Boxes, Ducts - Electrical	7406
Lighting-Panel, Schedules - Electrical	7404
Lighting-Plans, Elevations, Sections, and Details - Electrical	7401

9413202.1563

Lighting-Wire Run Lists, Conduit, Cable and Wire Schedules - Electrical	7405
Lighting-Wiring Diagrams (elementary, connections and interconnections) - Electrical	7402
Logic Diagram - Flow Diagrams	7003
Machines and Equipment (noncontaminated zones) Shop or General Purpose - Mechanical	2700
Machines and Equipment-Contaminated Zones - Mechanical	4750
Machines, Mechanisms, and Dies for Forming, Fabricating or Assembling - Mechanical	500301
Machines-Process: Agitators, Pumps, Scales, Pulse Generators (moving parts) - Mechanical	2600
Machining, Forming, Including Tooling-Acme Gridley Cut-Off Lathes: Monarch Lathe - Mechanical	490210
Main Data-Logging System - Instrumentation	59--41
Manipulators - Mechanical	4702
Maps-Area Key - Civil	0101
Maps-Electrical, Plot Plans, Plans and Profiles, Plans, Elevations, Sections, and Details (includes substation structures) - Electrical	8001
Maps-General - Civil	0109
Maps-Project Key - Civil	0100
Maps-Area Electrical Key - Civil	0102
Material Handling Equipment-Conveyors, Pallets, Monorail Systems, Casks, Buckets - Mechanical	3902
Material Lists-General - Electrical	7108
Mechanical - Miscellaneous	9901
Mechanical Equipment for Treatment of Water (other than piping) - Mechanical	4300
Mechanisms for Testing, Inspection, Calibration, etc. - Mechanical	500302
Metal Solution Feed Preparation - Instrumentation	59--20

9413202.1564

Metallurgical Test Materials, Destructive and Nondestructive Mechanical	4727
Miscellaneous Equipment Pieces or Parts-Not Identifiable as Electrical, Instrument, or Mechanical Category; Unrelated to the Assembled Equipment - Miscellaneous	9900
Miscellaneous Survey Data-Columbia River Data, Civil Data - Civil	0501
Moderator-Other than Graphite - Mechanical	1600
Moderator-Graphite - Mechanical	1601
Moisture - Instrumentation	6007
Moisture Detection - Instrumentation	59--45
Motor Vehicles and Modifications - Mechanical	4101
Nose and Cutoff Preparation - Mechanical	490114
Open Test Assembly-Post Irradiation - Mechanical	4933
Open Test Assembly-Tooling - Mechanical	4935
Open Test Assembly-Materials - Mechanical	4936
Off-Gas Treatment - Instrumentation	59--33
One-Line Diagrams - Electrical	7201
Optical - Instrumentation	59--38
Optical Systems and Devices (including TV devices) - Mechanical	5000
Other - Mechanical	490116
Other Fuel Elements, as Cluster - Mechanical	490050
Other, Including Triple Dip, Hot Press, Heat Treatment, Hydraulic Press, Heavy-Duty Resistance Furnaces - Mechanical	490224
Outside Catch Tanks - Instrumentation	59--31
Outside Lines - Electrical - Civil	0107
Outside Lines-Sewers and Piping - Civil	0105
Outside Lines-Steam, Air, Gas, and Acids - Civil	0308
Outside Lines-Telephone and Fire Alarm - Civil	0108

9413202.1565

Outside Lines-Water and Gases - Civil	0104
Overhead Lines-Piping-Including Steam, Air, Gas, and Acids - Civil	0300
Overhead Piping Steam Condensate Air and Chemicals - Civil	0106
Overhead and Underground Piping Composite - Civil	0305
Panel Schedules - Electrical	7904
Panel Schedules, Wire Run Lists - Instrumentation	5902
Parking Area, Fences, Airport Runways, Roads, Walks-Details and Profiles - Civil	0200
Partition - Instrumentation	59--25
Penetration, Loader, Baskets - Mechanical	490108
Periscopes - Mechanical	5002
Personnel Radiation Monitor - Instrumentation	59--05
Pile Motion - Instrumentation	59--13
Piping and Mechanical Sections B1-2-3-4 - Piping	855302
Piping and Sewers-Outside Lines - Civil	0105
Piping-Steam-All Others - Piping	8502
Piping-Fire Extinguishing Gas, Vapor, Chemical or Powder - Piping	8515
Piping and Instrument Diagram - Flow Diagrams	7004
Piping and Instrument Diagram CLS - Flow Diagrams	7005
Piping-Jumpers - Piping	8405
Piping and Mechanical Sections A1-2-3 - Piping	855301
Piping and Mechanical Sections C1-2-3-4-5-6-7-8-9 - Piping	855303
Piping and Mechanical Sections D1-2-3-4-5-6 - Piping	855304
Piping and Mechanical Sections E1-2 - Piping	855305
Piping and Mechanical Sections F1-2 - Piping	855306
Piping and Mechanical Sections G1-2-3 - Piping	855307
Piping and Mechanical Sections H1-2-3-4-5-6-7 - Piping	855308

9413202.1566

Piping and Mechanical Sections J1-2 - Piping	855309
Piping and Mechanical Sections K1-2-3-4-5-6-7 - Piping	855310
Piping and Mechanical Sections L1-2-3 - Piping	855311
Piping NA Reactor Primary - Piping	8550
Piping-Process-All Other to Include: Buried or Exposed Inside Piping, Wash Down, Fog Spray, Solvent Blend, Slug Storage, Hot Shop, Utility Outlets Relative to Process Piping: Also Jets, Valves, Miscellaneous Process Piping - Piping	8407
Piping-Process Water-Front or Rear Face - Piping	8401
Piping-Service (includes Grouped Services, viz., Water, Air Steam Drains, etc.; Show on the Same Drawing) - Piping	8510
Piping-Acids and Chemicals - Piping	8503
Piping-Cell Arrangements (includes Diversion Boxes and Trenches) - Piping	8404
Piping-Compressed Air - Piping	8505
Piping-Cover Gas, Argon - Piping	8519
Piping-Demineralized and Distilled Water - Piping	8513
Piping-Drains and Waste Inside-Other than Process - Piping	8509
Piping-Fuel Oil - Piping	8514
Piping-Gas Decay and Disposal - Piping	8504
Piping-Hangers, Support, Anchors, Guards - Piping	8511
Piping-Heating and Cooling Water - Piping	8516
Piping-Heating and Cooling NA and NAK, Insulating Requirements - Piping	8517
Piping-Heating and Cooling Gas - Piping	8518
Piping-Hydraulic - Piping	8512
Piping-Isometric - Piping	8548
Piping-NA All Other - Piping	8554
Piping-NA Closed Loop - Piping	8553

9413202.1567

Piping-NA Piping Components, Traps, Cold, Freeze and Vapor - Piping	8556
Piping-NA Receiving and Processing - Piping	8552
Piping-NAK Reactor Secondary - Piping	8551
Piping-Process Water - Piping	8400
Piping-Process Water-Foundation Cooling, Shielding, Horizontal Rods, Risers, and Crossheaders - Piping	8402
Piping-Process Water-Valve Pits or Tunnels - Piping	8403
Piping-Process-Operating or Sample Galleries - Piping	8406
Piping-Propane - Piping	8520
Piping-Radioactive Liquid Waste (water) - Piping	8409
Piping-Reference Drawings - Piping	8576
Piping-Refrigeration, Argon - Piping	8507
Piping-Special Loop - Piping	8555
Piping-Sprinkler Systems - Piping	8508
Piping-Steam Radiators, Coils, and Condensate - Piping	8501
Piping-Vacuum - Piping	8506
Piping-Water Drains and Waste (noncontaminated) - Piping	8408
Piping-Water-Other than Process - Piping	8500
Plans, Elevations, Sections, and Details - Electrical	7901
Plans, Sections, Elevations, and Details (including conduit and tubing) - Instrumentation	5901
Plant Protection System 99 - Instrumentation	59--80
Plutonium Decontamination - Instrumentation	59--26
Plutonium Fuel Elements and Related Components - Mechanical	490040
Poison Column and Associated Items - Mechanical	2250
Power House Equipment (associated with steam generation) - Mechanical	4000

9413202.1568

Power Plant Controls - Instrumentation	59--18
Power-Electrical Equipment (motor, heaters, etc.) - Electrical	7308
Power-Ground Junction, Pull Boxes, Ducts, Raceways - Electrical	7306
Power-Lightning Protection - Electrical	7309
Power-Motor Control Centers, Switchgear, Transformers and Control Panels - Electrical	7303
Power-Motor and Control Station Schedules - Electrical	7307
Power-Panel Schedules - Electrical	7304
Power-Plans, Elevations, Sections, and Details (including grounding, block diagrams, and engineering diagrams) - Electrical	7301
Power-Wire Run Lists, Conduit, Cable, Wire Schedules - Electrical	7305
Power-Wiring Diagrams (elementary, connection and inter-connection) - Electrical	7302
Precycle - Instrumentation	59--24
Pressure - Instrumentation	6004
Pressure Monitor - Instrumentation	59--08
Primary Elements - Instrumentation	60--49
Primary and Secondary Loop Instrumentation - Instrumentation	59--43
Process Flow Diagrams - Flow Diagrams	7000
Process Gas - Instrumentation	59--12
Process Monitoring and Control Containment System 93-1 - Instrumentation	59--63
Process Monitoring and Control Heat Transport System 93-2 - Instrumentation	59--64
Process Monitoring and Control Closed Loop System 93-3 - Instrumentation	59--65
Process Monitoring and Control Service Piping System 93-4 - Instrumentation	59--66
Process Monitoring and Control Radioactive Waste System 93-5 - Instrumentation	59--67

9413202.1569

Process Monitoring and Control Heating and Vent System 93-6 - Instrumentation	59--68
Process Monitoring and Control Fire Protection System 93-7 - Instrumentation	59--69
Process Monitoring and Control Inert Gas Receiving and Process System 93-8 - Instrumentation	59--70
Process Monitoring and Control Aux. Liquid Metal System 93-10 - Instrumentation	59--71
Process Monitoring and Control Refueling System 93-11 - Instrumentation	59--72
Process Monitoring and Control Maintenance System 93-12 - Instrumentation	59--73
Process Monitoring and Control Leak Detection System 93-13 - Instrumentation	59--74
Process Monitoring and Control Annunciator System 93-14 - Instrumentation	59--75
Process Monitoring and Control Piping and Equipment Electrical Heating System 93-15 - Instrumentation	59--76
Process Radiation Monitor - Instrumentation	59--04
Process Tubes - Mechanical	2200
Process Water - Instrumentation	59--11
Process Water Monitor and Sampling - Instrumentation	59--10
Production of Power Reactor - Mechanical	1501
Products of Combustion Detectors - Instrumentation	59--48
Project Key Map - Civil	0100
Quench Machines, Tanks, and Equipment - Mechanical	490208
Radiation - Instrumentation	6014
Radiation Dose Rates - Mechanical	1802
Radiation Monitoring System 96 - Instrumentation	59--79
Railroad Equipment and Rolling Stock Including Cask Car - Mechanical	4100

9413202.1570

9413202.1571

Railroad Structures and Details - Civil	0202
Railroads-Plans, Details, and Profiles - Civil	0201
Reactor Capsules-Metallurgical Tests - Mechanical	4706
Reactor Control Rod and Drive Mechanism - Mechanical	1504
Reactor Core Restraints - Mechanical	1506
Reactor Ex-Vessel Fuel Handling Equipment - Mechanical	1510
Reactor Fuel Transfer - Mechanical	1502
Reactor Gas Seal, Including Boots, Strips, etc. - Mechanical	2900
Reactor In-Vessel Handling and Drive Mechanism - Mechanical	1505
Reactor In-Vessel Storage Module - Mechanical	1507
Reactor Inner Shield - Mechanical	1509
Reactor Instrument Tree and Drive Mechanism - Mechanical	1503
Reactor Outer Shield - Mechanical	1508
Reactor and Vessel Instrumentation System 92 - Instrumentation	59--62
Reactor Vessels-Arrangement Plans, Elevations, and Sections - Mechanical	1550
Recorder - Instrumentation	60--40
Recorder-Controller Alarm - Instrumentation	60--44
Recovered Acid Storage - Instrumentation	59--28
Reflector Assembly - Mechanical	4937
Remotely Operated Connectors - Mechanical	4501
Roads, Walks, Parking Area, Fences, and Airport Runways-Details and Profiles - Civil	0200
Rock, Boring - Civil	0600
Rod Control System - Instrumentation	59--42
Rods Safety (SR) - Mechanical	1909
Rods Scram (CR) - Mechanical	1911

Safety Circuits - Instrumentation	59--15
Samplers Process, Air, Stack Gas, etc. - Mechanical	4600
Schematic Diagrams - Instrumentation	5908
Scope - Miscellaneous	99--01
Seismoscope - Instrumentation	59--37
Self-Actuated Regulating Valve - Instrumentation	60--47
Sewer Lines-Process - Civil	0304
Sewer Lines-Sanitary - Civil	0303
Sewer and Piping Outside Lines - Civil	0105
Shielding-Thermal - Mechanical	1801
Shielding-Biological - Mechanical	1800
Shipping Containers-Boxes, Pallets - Mechanical	5010
Sleeve Preparation-Sleeve Cleaning Machine, Baskets - Mechanical	490108
Sodium Disposal Area Burial Grounds - Civil	0404
Sodium Processing Tanks - Mechanical	2505
Sodium Storage Tanks - Mechanical	2501
Sodium Systems - Instrumentation	59--39
Solvent Treatment - Instrumentation	59--22
Sound - Instrumentation	6019
Special Tools - Miscellaneous	99--03
Special Tools, Wrenches, etc. - Mechanical	500303
Specific Gravity - Instrumentation	6012
Speed - Instrumentation	5009
Stack Sampling - Instrumentation	59--35
Steam, Air, Gas, and Acids Outside Lines - Civil	0308
Steam, Air, Gas, and Acids Overhead Lines Piping - Civil	0300

9413202.1572

Steam, Air, Gas, and Acids Underground Lines - Civil	0306
Steel Structural-Other Stop Logs, Underwater Doors, Trap Gates, Special Nonshield Doors, Allowable Floor Load Data - Architectural	1100
Steel Structural-Plans, Details, Schedules, Equipment Supports, Platforms - Architectural	1000
Steel Structural-Shop or Fabrication Drawings - Architectural	1001
Steel Structural-Penetrations - Architectural	1002
Steel Structural-Bench Marks and Control - Architectural	1101
Studies-General - Electrical	7107
Tank Farms - Instrumentation	59--32
Tanks, Dissolvers, Heat Exchangers, Vessels, Columns (no moving parts) - Mechanical	2500
Telephone and Fire Alarm Outside Lines - Civil	0108
Temperature - Instrumentation System	59--09
Temperature - Instrumentation General	6001
Test Hole Facilities - Instrumentation	59--36
Test or Special Purpose Reactor - Mechanical	1500
Testing Equipment-Destructive - Mechanical	4703
Testing Equipment-Nondestructive - Mechanical	4704
Third Safety System-Ball 3X - Mechanical	2100
Tools and Equipment for Decontamination - Mechanical	2204
Tools and Equipment for Horizontal Control Rods and Vertical Safety Rods Renovation - Mechanical	1903
Tools and Equipment for Overboring Program - Mechanical	2205
Tools and Equipment Includes Tool Dolly - Mechanical	2201
Tools and Equipment for Process Tube Growth Correction - Mechanical	2202
Tools and Equipment Necessary to Operate Equipment in Hoods, Caves, and Enclosures - Mechanical	4701

9413202.1573

Topography - Civil	0103
Transmitters - Instrumentation	60--48
Tubing Run List - Instrumentation	5905
Underground and Overhead Piping-Composite - Civil	0305
Underground Lines, Steam, Air, Gas, and Acids - Civil	0306
Underground Process Water-Piping - Civil	0302
Underground Sanitary Water-Piping - Civil	0301
Underwater Monitor - Instrumentation	59--06
UNH Storage - Instrumentation	59--29
Uranium Decontamination - Instrumentation	59--27
Vacuum Chambers and Component Parts and Equipment - Mechanical	500305
Vendor Information - Miscellaneous	99--02
Ventilation Controls - Instrumentation	59--17
Ventilation Exhaust and Heating System-Plans, Section, Details - Heating, Venting, Exhaust	8900
Vessels, Columns, Tanks, Dissolvers, Heat Exchangers (no moving parts) - Mechanical	2500
Vibration - Instrumentation	6018
Viewing Windows and Ports - Mechanical	5001
Viscosity - Instrumentation	6010
Walks, Parking Areas, Fences, and Airport Runways, Roads-Details and Profiles - Civil	0200
Waste Disposal Systems-Sanitary: Septic Tanks, Tile Fields, Sewage Disposal Plant, Open Ditches, and Surface Drainage and Storm Drainage - Civil	0400
Waste Disposal Systems and Burial Grounds-Process: Cribs, Scavenging Impounding Areas, and Waste Facility Maps - Civil	0401
Waste Line Encasements - Diversion Boxes and Related Components - Civil	0403

9413202.1574

Waste Storage-Tank Farms (including all drawings, except electrical and instrumentation and jumpers) - Civil	0402
Waste Storage Process Underground Tanks - Civil	0405
Waste Storage Tanks Contaminated Waste - Mechanical	2502
Waste Treatment - Instrumentation	59--23
Water and Gases Outside Lines - Civil	0104
Weight - Instrumentation	6011
Weight Factor - Instrumentation	6013
Welders, Buffers and Controls, Collects, Vacuum Welders - Mechanical	490212
Wells, Well Fields-Irrigation Ditches and Water Supply - Civil	0500
Wire Run Lists, Conduit, Cable and Wire Schedules, - Electrical	7905
Wiring Diagrams Elementary Connection and Inter-Connection Block Diagrams - Electrical	7902
Wiring Diagrams-Connections and Inter-Connections Elementary - Instrumentation	5903
Zircaloy Component Preparation - Mechanical	490112
Zircaloy Uranium Fuel Elements, Billets, and Related Components - Cores, Copper or Zircaloy Components, End Caps or Plates, Brazing Rings, Self-Supports, Mixers, Perf, Dummies - Mechanical	490020

9413202.1575

9413202.1576

NUMERICAL INDEX FOR ENGINEERING DRAWINGS

0000	Drawing List
Civil	
0100	Project Key Map
0101	Area Key Maps
0102	Area Electrical Key Maps
0103	Topography
0104	Outside Lines-Water and Gases
0105	Outside Lines-Sewers and Piping
0106	Overhead Piping, Steam Condensate, Air, and Chemicals
0107	Outside Lines-Electrical
0108	Outside Lines-Telephone and Fire Alarm
0109	General Maps
0110	Layout or Plot Plans-General Facility
0111	Excavation and Finishing Grading
0200	Roads, Walks, Parking Areas, Fences, and Airport Runways-Details and Profiles
0201	Railroads-Plans, Details, and Profiles
0202	Railroad Structures and Details
0300	Overhead Lines-Piping-Including Steam, Air, Gas, and Acids
0301	Underground Sanitary Water-Piping
0302	Underground Process Water-Piping
0303	Sewer Lines-Sanitary
0304	Sewer Lines-Process
0305	Composite of Overhead and Underground Piping
0306	Underground Lines, Steam, Air, Gas, and Acids

Civil (Continued)

0307	Fuel Oil Storage and Lines
0308	Outside Lines-Steam, Air, Gas, and Acids
0400	Waste Disposal System-Sanitary: Septic Tanks, Tile Fields, Sewage Disposal Plant, Open Ditches, and Surface Drainage and Storm Drainage
0401	Waste Disposal Systems and Burial Grounds-Process: Cribs, Scavenging Impounding Areas and Waste Facility Maps
0402	Waste Storage-Tank Farms (including all drawings, except electrical and instrumentation and jumpers)
0403	Waste Line Encasements-Diversion Boxes and Related Components
0404	Sodium Disposal Area-Burial Grounds
0405	Waste Storage Process Underground Tanks
0500	Wells, Well Fields-Irrigation Ditches and Water Supply
0501	Miscellaneous Survey Data-Columbia River Data, Civil Data
0600	Rock Boring

Architectural and Structural

0800	Architectural-Plans-May include other 0800 Category
0801	Architectural-Elevations, Sections and Details-Miscellaneous Steel for Stairs, Railings, etc.
0802	Architectural-Other (includes schedules, architectural equipment details, such as bins, signs, cabinets, laboratory equipment, etc.)
0803	Architectural Doors-Shielding-Windows
0804	Architectural-Equipment Locations
0900	Concrete Structural-Plans
0901	Concrete Structural-Elevations, Sections, and Details

9413202.1577

Architectural and Structural (Continued)

0902	Concrete Structural-Shop, Reinforcing and Pour Drawings
0903	Concrete Structural-Penetrations, Sleeve and Blockout
0904	Concrete Structural-Penetrations, Embedment Schedules
0905	Concrete Structural-Demolition
1000	Steel Structural-Plans, Details, Schedules, Equipment Supports, Platforms
1001	Steel Structural-Shop or Fabrication Drawings
1002	Steel Structural-Penetrations
1100	Steel Structural-Other Stop Logs, Underwater Doors, Trap Gates, Special Nonshield Doors, Allowable Floor Load Data
1101	Steel Structural-Bench Marks and Control

Mechanical

1500	Test or Special Purpose Reactor
1501	Production or Power Reactor
1502	Reactor Fuel Transfer
1503	Reactor Instrument Tree and Drive Mechanism
1504	Reactor Control Rod and Drive Mechanism
1505	Reactor In-Vessel Handling and Drive Mechanism
1506	Reactor Core Restraints
1507	Reactor In-Vessel Storage Model
1508	Reactor Outer Shield
1509	Reactor Inner Shield
1510	Reactor Ex-Vessel Fuel Handling Equipment
1550	Reactor Vessels-Arrangements Plans, Elevations, and Sections
1551	Internal Structural Components Including Reactor Head

9413202.1578

Mechanical (Continued)

1552	Internals, Nonstructural Items Excluding Controls and Fuel Associated Equipment
1553	Guard Vessel-Exterior Shields and Other Cavity Components
1575	Equipment Outline and Interface Requirement
1600	Moderator-Other than Graphite
1601	Moderator-Graphite
1800	Shielding-Biological
1801	Shielding-Thermal
1802	Radiation Dose Rates
1900	Control Systems-Horizontal Rods
1901	Control System-Vertical Rods
1902	Control System-Poison
1903	Tools and Equipment for Horizontal Control Rods and Vertical Safety Rods Renovation
1905	Control Rods
1906	Control Rods, Assembly Tooling and Handling Equipment
1907	Control Rod, Absorber, Drive, Disconnect
1909	Rods Safety (SR)
1911	Rods Scram (CR)
2100	Third Safety System-Ball 3X
2200	Process Tubes (This will cover all phases or process tubes from entry of water from common header to exit of water to common discharge header also tubes from point charging machine connects to the point that fuel is discharged).
2201	Tools and Equipment (necessary for installation or removal of process tubes and their associated parts. Includes tool dolly).
2202	Tools and Equipment for Process Tube Growth Correction

9413202.1579

Mechanical (Continued)

2204	Tools and Equipment for Decontamination
2205	Tools and Equipment for Overboring Program
2250	Poison Column and Associated Items
2300	All Test Equipment Where Operation of Pile is Essential to Operation of Test
2301	All Facilities Build into Pile for Testing Purposes
2302	Containers for Disposal of Contaminated Equipment (does not include metal handling buckets and shipping casks)
2303	Experimental Test Facilities Excluding Fuel Specimens
2400	Charging Machines
2401	Discharging and Manipulator for Rear Face Work
2450	Fuel Handling-Irradiated (Transfer, etc.)
2451	In-Vessel Fuel Handling Equipment
2452	Ex-Vessel Irradiated Fuel Handling Equipment
2500	Vessels, Columns, Tanks, Dissolvers, Heat Exchangers (no moving parts)
2501	Sodium Storage Tanks
2502	Waste Storage Tanks (contaminated waste)
2504	Gas Storage Tanks
2505	Sodium Processing Tanks
2600	Machines-Process: Agitators, Pumps, Scales, Pulse Generators (moving parts)
2700	Machines and Equipment (noncontaminated zones) Shop or General Purpose
2800	Cell Equipment Fastened to Cell for Mounting Vessels, Nozzles, Dunnage, Y Pads, etc.
2900	Reactor Gas Seal, Including Boots, Strips, etc.

9413202.1580

Mechanical (Continued)

2901	Gas Seal Tools
3000	Fire Protection Sodium Systems
3900	Cranes (all types)
3901	Elevators
3902	Material Handling Equipment such as Conveyors, Pallets, Monorail Systems, Casks, Buckets
4000	Power House Equipment (associated with steam generation)
4050	Emergency Power Generation Equipment (Mechanical)
4100	Railroad Equipment and Rolling Stock (including cask car)
4101	Motor Vehicles and Modifications
4300	Mechanical Equipment for Treatment of Water (other than piping)
4500	Impact Wrenches
4501	Remotely Operated Connectors
4600	Samplers (process, air, stack, gas, etc.)
4700	Hoods, Caves, Enclosures (remotely operated equipment)
4701	Tools and Equipment Necessary to Operate Equipment in Hoods, Caves, and Enclosures
4702	Manipulators
4703	Testing Equipment-Destructive
4704	Testing Equipment-Nondestructive
4705	Equipment Located in Hoods, Caves, Enclosure where Operation is Remote
4706	Reactor Capsules-Metallurgical Tests
4727	Metallurgical Test Materials, Destructive and Nondestructive
4750	Machines and Equipment-Contaminated Zones

9413202.1581

Mechanical (Continued)

4800	Laboratory Apparatus	
4900	Fuel Element Production-General	
	4900010	Aluminum Uranium Fuel Elements and Related Components-Caps, Spires, Cans, Sleeves, Cores, Hollow Pieces, or Perfs, Dummies, Spaces, Wafers, Self-Supports
	490020	Zircaloy-Uranium Fuel Elements, Billets, and Related Components-Cores, Copper or Zircaloy Components, End Caps or Plates, Brazing Rings, Self-Supports, Mixers, Perf, Dummies
	490030	Ceramic Fuel Elements and Related Components
	490040	Plutonium Fuel Elements and Related Components
	490050	Other Fuel Elements, as Cluster
4901	Fuel Element Production-Cleaning and Preparation	
	490102	Core Preparation-Pickle Machine-Etch Machine, Nickel Plating
	490104	Aluminum Component Preparation-Caps and Can Cleaning Machine, Methanol Still, Detrex Trichlor Still, Trays, Baskets, Racks
	490106	Sleeve Preparation-Sleeve Cleaning Machine, Baskets
	490108	Penetration, Loader, Baskets
	490110	Billet Core Preparation
	490112	Zircaloy Component Preparation
	490114	Nose and Cutoff Preparation
	490116	Other
	490118	Chemical Tanks and Piping
4902	Fuel Element Production-Fuel Element Assembly Equipment	
	490202	Duplex Furnace and Equipment-Ajax Induction Furnaces, Duplex Agitators, Agitator Baskets, Loader Shields, Tools

9413202.1582

9413202.1583

Mechanical (Continued)

	490204	Canning Furnace and Equipment-Canning Jacks, Canning Baskets, Tongs, Shields, Tools
	490206	Canning Cycle Control, Flex-O-Timer, Valves, etc.
	490208	Quench Machines, Tanks, and Equipment
	490210	Machining, Forming, Including Tooling-Acme Gridley Cut-Off Lathes: Monarch Lathe
	490212	Welders, Buffers and Controls, Collects, Vacuum Welders
	490220	Coextrusion Component and Billet Assembly
	490222	Extrusion Presses, Containers, Dies, and Tools
	490224	Other, Including Triple Dip, Hot Press, Heat Treatment, Hydraulic Press, Hevi-Duty Resistance Furnaces
4903	Fuel Element Production-Testing and Inspection	
	490302	Component Mechanical Inspection-Pickle Inspection, Statistical Sampling, Recovered Core Inspection, Gages
	490304	Component Electronic or Ultrasonic Testing-Transformation Test, Sort Tester, etc.
	490306	Fuel Element Inspection-Radiography Inspection, Final Inspection Station, Weld Inspection, Length, Braze and Contour Inspection, Film Developing Equipment
	490308	Fuel Element Testing, Bond and Pen Tester, Autoclave Test, Bubble Tester
4904	Fuel Element Production-Component Salvage and Recover: Scrap Recovery	
4905	Fuel Element Production-Component Testing (not for new drawings)	
4906	Fuel Element Production-Component Supporting Facilities (not for new drawings)	
4907	Fuel Element Production-Special Items-Stampers; Tables; Bins; Mechanical Counters	

Mechanical (Continued)

4920	Capsule, Storage for Strontium
4921	Capsule, Storage for Cesium
4922	Fuel Driver Assembly
4925	Fuel Closed Loop In-Reactor Assembly
4928	Fuel Special Purpose Assembly
4931	Fuel Material Open Test Assembly
4933	Post Irradiation Open Test Assembly
4934	Fuel Open Test Assembly
4935	Open Test Assemblies-Tooling
4936	Materials Open Test Assembly
4937	Reflector Assembly
5000	Optical Systems and Devices (including TV devices)
5001	Viewing Windows and Ports
5002	Periscopes
5003	Fuels Development
	500301 Machines, Mechanisms, and Dies for Forming, Fabricating, or Assembling
	500302 Mechanisms for Testing, Inspection, Calibration, etc.
	500303 Special Tools, Wrenches, etc.
	500304 Baskets, Tubes, Containers, and Component Parts
	500305 Vacuum Chambers and Component Parts and Equipment
	500306 Equipment Support, Storage Racks, Hand Trucks, Tables, etc.
5010	Shipping Containers, Boxes, Pallets Conforming to DOT and RDT Regulations

9413202.1584

Instrumentation System

5900	Instrumentation-General, Index, Notes, Listings
5901	Plans, Sections, Elevations, and Details (including conduit and tubing)
5902	Panel Schedules, Wire Run Lists
5903	Wiring Diagrams (connections and inter-connections), Elementary
5904	Cable Schedules
5905	Tubing Run List
5906	Equipment Requirements
5907	Equipment Arrangements
5908	Schematic Diagrams

Sub-Subject

04	Process Radiation Monitor
05	Personnel Radiation Monitor
06	Underwater Monitor
07	Fuel Monitor
08	Pressure Monitor
09	Temperature
10	Process Water Monitor and Sampling
11	Process Water
12	Process Gas
13	Pile Motion
14	Calculator (Power)
15	Safety Circuits
16	Biological and Thermal Shield T/C System

9413202.1585

9413202.1586

Instrumentation System (Continued)

Sub-Subject (Continued)

17 Ventilation Controls

18 Power Plant Controls

19 Dissolver Cells

20 Metal Solution Feed Preparation

21 Aqueous Make-Up

22 Solvent Treatment

23 Waste Treatment

24 Precycle

25 Partition

26 Plutonium Decontamination

27 Uranium Decontamination

28 Recovered Acid Storage

29 UNH Storage

30 Chemical Storage

31 Outside Catch Tanks

32 Tank Farms

33 Off-Gas Treatment

34 Extractors

35 Stack Sampling

36 Test Hole Facilities

37 Seismoscope

Instrumentation System (Continued)

Sub-Subject (Continued)

38 Optical

39 Sodium Systems

40 Flow and Temperature Monitor Data Logging System

41 Main Data-Logging System

42 Rod Control System

43 Primary and Secondary Loop Instrumentation

44 Control Room and Miscellaneous Instrumentation

45 Moisture Detection

46 Argon Systems

47 Helium Systems

48 Products of Combustion Detectors

49 Instrumentation Service Piping, SDD No. 23

50 Instrumentation Radioactive Waste, SDD No. 24

51 Instrumentation Heating and Venting, SDD No. 25

52 Instrumentation Plant Fire Protection, SDD No. 26

53 Instrumentation Reactor Containment, SDD No. 27

54 Instrumentation Reactor, SDD No. 31

55 Instrumentation Heat Transport System, SDD No. 51

56 Instrumentation Closed Loop, SDD No. 61

57 Instrumentation Aux. Liquid Metal System, SDD No. 81

58 Instrumentation Inert Gas Receiving and Processing, SDD No. 82

59 Instrumentation Impurity Monitoring and Analysis, SDD No. 85

9413202.1587

Instrumentation System (Continued)

Sub-Subject (Continued)

60 Instrumentation Reactor Plant Control, SDD No. 90

61 Digital Data Handling and Display, System 91

62 Reactor and Vessel Instrumentation, System 92

63 Process Monitoring and Control Containment System 93-1

64 Process Monitoring and Control Heat Transport System 93-2

65 Process Monitoring and Control Closed Loop System 93-3

66 Process Monitoring and Control Service Piping, System 93-4

67 Process Monitoring and Control Radioactive Waste System 93-5

68 Process Monitoring and Control Heating and Vent System 93-6

69 Process Monitoring and Control Fire Protection System 93-7

70 Process Monitoring and Control Inert Gas Receiving and Processing System 93-8

71 Process Monitoring and Control Aux. Liquid Metal System 93-10

72 Process Monitoring and Control Refueling System 93-11

73 Process Monitoring and Control Maintenance System 93-12

74 Process Monitoring and Control Leak Detection System 93-13

75 Process Monitoring and Control Annunciator System 93-14

76 Process Monitoring and Control Piping and Equipment Electrical Heating System 93-15

77 Fuel Failure Monitoring System 94

78 Flux Monitor System 95

79 Radiation Monitoring System 96

80 Plant Protection System 99

9413202.1598

Instrumentation System (Continued)

Sub-Subject (Continued)

5975 Equipment Outline and Interface Requirement

Instruments - General

6000 Instruments-General

6001 Temperature

6002 Flow

6003 Level

6004 Pressure

6005 Density

6006 Humidity

6007 Moisture

6008 Conductivity

6009 Speed

6010 Viscosity

6011 Weight

6012 Specific Gravity

6013 Weight Factor

6014 Radiation

6015 Differential Pressure

6016 Acidity

6017 Interface

6018 Vibration

6019 Sound

6020 Component of a Mixture

9413202.1589

Instruments - General (Continued)

Sub-Subject	
39	General
40	Recorder
41	Controller
42	Indicator
43	Alarm
44	Recorder Controller Alarm
45	Indicator Controller Alarm
46	Integrator
47	Self-Actuated Regulating Valve
48	Transmitters
49	Primary Elements
50	Accelerator
51	Alpha
52	Amplifier
53	Analyzer
54	Calculator
55	Calibrator
56	Camera
57	Chambers
58	Checkers
59	Counters
60	Probes

9413202.1590

Electronics - General

6500	Electronics-General (Wave Type-Includes Radio, TV, Microwave and Laser)
6501	Electronics-Plans, Elevations, Sections, and Details
6502	Electronics-Wiring Diagrams (elementary, connection, and interconnections)
6503	Electronics-Transmitters, Amplifiers, Receivers, and Control Consoles
6504	Electronic-Wave Guides and Antennas
6505	Electronic-Drill and Trim
6506	

Flow Diagrams

7000	Process Flow Diagrams
7001	Engineering Diagrams
7002	Instrument Engineering Diagrams
7003	Logic Diagram
7004	Piping and Instrument Diagram
7005	Piping and Instrument Diagram CLS

Electrical

Numerical Subject Series: 73, 74, 75, 76, and 77 (Cover Inside Building - Electrical)

78 and 80 (Cover Outside Building - Electrical)

7100	Electrical-General, Wiring Requirements
	(This series includes drawings of a composite nature. A drawing which shows a complete installation for a facility.)
7101	Block Outs, Sleeves, Plans, and Details
7107	Studies-General

9413202.1591

Electrical (Continued)

7108	Material Lists-General
7109	Indices
7201	One-Line Diagrams
7301	Power-Plans, Elevations, Sections, and Details (including grounding, block diagrams, and engineering diagrams)
7302	Power-Wiring Diagrams (elementary, connection, and inter-connection)
7303	Power-Motor Control Centers, Switchgear, Transformers, and Control Panels
7304	Power-Panel Schedules
7305	Power-Wire Run Lists, Conduit, Cable, Wire Schedules, and Tray Schedules
7306	Power-Grounding Junction, Pull Boxes, Ducts, Raceways
7307	Power-Motor and Control Station Schedules
7308	Power-Electrical Equipment (motors, heaters, etc.)
7309	Power-Lightning Protection
7401	Lighting-Plans, Elevations, Sections, and Details
7402	Lighting-Wiring Diagrams (elementary, connections, and inter-connections)
7404	Lighting-Panel, Schedules
7405	Lighting-Wire Run Lists, Conduit, Cable and Wire Schedules
7406	Lighting-Junction Pull Boxes, Ducts
7501	Electrical Control-Control Panel Arrangements, Signal Plans, Elevations, Sections, and Details
7502	Electrical Control-Wiring Diagrams (elementary, connection, and inter-connection) Block Diagrams
7503	Electrical Control-Timing Charts

9413202.1592

Electrical (Continued)

7504	Electrical Control-Panel Schedules
7505	Electrical Control-Wire Run Lists, Conduit, Cable and Wire Schedules
7506	Electrical Control-Junction Pull Boxes, Ducts (This series includes remote signaling door bells, buzzers, annunciators.)
7507	Electrical Control-Relay and Switch Schedules
7508	Electrical Control-Control Equipment and Devices
7575	Equipment Outline and Interface Requirement
7601	Communications-Plans, Elevations, Sections, and Details
7602	Communications-Wiring Diagrams (elementary, connections, and inter-connection) Block Diagrams
7604	Communications-Panel Schedules, Equipment, and Devices
7605	Communications-Wire Run Lists, Conduit, Wire Schedules, Cables
7606	Communications-Junction Pull Boxes, Ducts (This series includes sound powered telephone and central station system telephones.)
7607	Communications-Station Schedules
7701	Fire Alarm-Plans, Elevations, Sections, and Details
7702	Fire Alarm-Wiring Diagrams (elementary, connection, and inter-connection) Block Diagrams
7704	Fire Alarm-Panel Schedules
7705	Fire Alarm-Wire Run Lists, Conduit, Cable and Wire Schedules
7706	Fire Alarm-Junction Pull Boxes, Ducts
7801	Cathodic Protection-Plans, Elevations, Sections and Details
7802	Cathodic Protection-Wiring Diagrams (elementary, connection, and inter-connection) Block Diagrams
7806	Cathodic Protection-Junction Pull Boxes, Ducts

9415202.1593

Electrical (Continued)

7900	Criticality Monitoring Systems
7901	Plans, Elevations, Sections, and Details
7902	Wiring Diagrams (elementary, connection, and inter-connection) Block Diagrams
7904	Panel Schedules
7905	Wire Run Lists, Conduit, Cable and Wire Schedules
7906	Junction Pull Boxes, Ducts
8000	Electrical Utilities Transmission and Distribution Operating Drawings (including switching diagrams and distribution maps)
8001	Electrical-Maps, Plot Plans, Plans and Profiles, Plans, Elevations, Sections, and Details (includes substation structures)
8002	Electrical Only-Wiring Diagrams (elementary, connection, and inter-connection) Area One-Line Diagram
8003	Electrical Only-Pole Line Details, Sag Curves
8004	Electrical Only-Pole Schedules
8005	Electrical Only-Cable Schedules
8009	Electrical Only-Transformer Schedules (this series includes all electrical maps other than the "Civil" map series)

Insulation and Heat Tracing

8200	Insulation and Heat Tracing Reference Designs
8201	Insulation and Heater Arrangements
8202	Insulation Arrangements
8203	Heater Applications-Piping
8204	Heater Applications-Equipment
8205	Heater Schedules
8206	Insulation Schedules

9413202.1594

9413202.1595

Piping

8400	Piping-Process Water
8401	Piping-Process Water-Front or Rear Face
8402	Piping-Process Water-Foundation Cooling, Shielding, Horizontal Rods, Risers, and Crossheaders
8403	Piping-Process Water-Valve Pits or Tunnels
8404	Piping-Cell Arrangements (includes diversion boxes and trenches)
8405	Piping-Jumpers
8406	Piping-Process-Operating or Sample Galleries
8407	Piping-Process-All other to Include: Buried or Exposed Inside Piping, Wash Down, Fog Spray, Solvent Blend, Slug Storage, Hot Shop, Utility Outlets Relative to Process Piping: Also Jets, Valves, Miscellaneous Process Piping
8408	Piping-Water Drain and Waste (noncontaminated)
8409	Piping-Radioactive Liquid Waste (water)
8500	Piping-Water-Other than Process
8501	Piping-Steam Radiators, Coils, and Condensate
8502	Piping-Steam-All Others
8503	Piping-Acids and Chemicals
8504	Piping-Gas Decay and Disposal
8505	Piping-Compressed Air
8506	Piping-Vacuum
8507	Piping-Refrigeration, Argon
8508	Piping-Sprinkler Systems
8509	Piping-Drains and Waste Inside-Other than Process

Piping (Continued)

8510	Piping-Service (includes grouped services, viz., water, air, steam, drains, etc.; show on the same drawing)
8511	Piping-Hangers, Support, Anchors, Guards
8512	Piping-Hydraulic
8513	Piping-Demineralized and Distilled Water
8514	Piping-Fuel Oil
8515	Piping-Fire Extinguishing Gas, Vapor, Chemical, or Powder
8516	Piping-Heating and Cooling Water
8517	Piping-Heating and Cooling NA and NAK, Insulating Requirements
8518	Piping-Heating and Cooling Gas
8519	Piping-Cover Gas, Argon
8520	Piping-Propane
8548	Piping-Isometric
8550	Piping-NA Reactor Primary
8551	Piping-NAK Reactor Secondary
8552	Piping-NA Receiving and Processing
8553	Piping-NA Closed Loop
855301	Piping and Mechanical Sections A1-2-3
855302	Piping and Mechanical Sections B1-2-3-4
855303	Piping and Mechanical Sections C1-2-3-4-5-6-7-8-9
855304	Piping and Mechanical Sections D1-2-3-4-5-6
855305	Piping and Mechanical Sections E1-2
855306	Piping and Mechanical Sections F1-2

9413202.1596

Piping (Continued)

	855307	Piping and Mechanical Sections G1-2-3
	855308	Piping and Mechanical Sections H1-2-3-4-5-6-7
	855309	Piping and Mechanical Sections J1-2
	855310	Piping and Mechanical Sections K1-2-3-4-5-6-7
	855311	Piping and Mechanical Sections L1-2-3
8554	Piping-NA all Other	
8555	Piping-Special Loop	
8556	Piping-NA Piping Components, Traps, Cold, Freeze, and Vapor	
8557	Piping-Equipment Outline and Interface Requirements	
8576	Piping-Reference Drawings	

Heating, Venting, Exhaust

8900	Ventilation Exhaust and Heating System-Plans, Section, Details
8901	Heating and Ventilating Equipment Location
8902	Heating and Ventilating Schedules, Notes

Air Conditioning Systems

9000	Air Conditioning Systems-Plans, Sections, Details

Miscellaneous

9900	Miscellaneous Equipment Pieces or Parts-Not Identifiable as Electrical, Instrument or Mechanical Category; Unrelated to the Assembled Equipment
9901	Mechanical
9902	Electrical
9903	Instrument

Sub-Subject

01	Scope
02	Vendor Information
03	Special Tools

9413202.1597

ATTACHMENT F

(Not Used)

9413202.1598

ATTACHMENT G

(Not Used)

9413202.1599

ATTACHMENT H
GENERAL HVAC REQUIREMENTS

1.0 DESIGN CALCULATIONS

1.0.1 General design calculations and load estimating procedures shall be based on data in the ASHRAE Handbook of Fundamentals and ASHRAE 90.1.

2.0 FEDERAL SPECIFICATIONS (FS)

a. HH-I-545 Insulation, Thermal Aid and Acoustical (Mineral Fiber, Duct Lining Material)

b. HH-I-551 Insulation Block and Boards, Thermal (Cellular Glass)

c. HH-I-558 Insulation, Blocks, Boards, Blankets, Felt, Sleeving (Pipe and Tube Covering) and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type)

3.0 OUTSIDE AIR INTAKES

Outside air intakes should be located as high as possible above grade and preferably on north or east walls. Where the outside air intake is below 10 feet above grade, a low velocity "drop-out" area shall be considered inside the structure.

4.0 INSULATION

(Not Used)

5.0 EQUIPMENT SELECTION

5.0.1 **Fans**

5.0.1.1 Fans shall be rated per the AMCA Standard 201 and carry their seal of approval.

5.0.1.2 Each fan-motor-drive assembly shall be assembled at the factory and balanced at operating speed. Test results shall be furnished with the Certified Vendor Information Data. (Not required for small utility fans.)

5.0.1.3 Fan shall be selected at approximately its point of maximum mechanical efficiency. (This is an area of stable operation and best minimizes changes in operating conditions.)

9413202.1600

5.0.1.4 The minimum motor size shall be specified and should be conservatively rated with considerations of non-standard air conditions and high ambient temperatures.

5.0.1.5 V-belt drives shall be selected for 120% of rating plus the addition of one extra belt.

5.0.1.6 Axial flow fans require close attention to noise considerations and should not generally be used.

5.0.2 Filters

5.0.2.1 General

A permanently installed means for measuring the differential pressure across each filter stage shall be provided in all filter assemblies 5000 CFM or larger, or where specified. With proper valving and piping, one gage may service several adjacent stages.

5.0.2.2 Filter Banks

Access doors of convenient size shall be provided in the casing and as great a working depth as possible shall be provided for servicing. (Minimum of 3 feet is recommended.)

5.0.3 Coils

5.0.3.1 General

5.0.3.1.1 Casings shall be designed to provide a uniform air velocity across the face of the coil.

5.0.3.1.2 Casings and piping shall be designed to allow for expansion and contraction to prevent stresses at the coil connections.

5.0.3.1.3 Stacked coils shall be supported individually in a structural framework to facilitate individual coil removal without disturbing adjacent coils.

5.0.3.2 Cooling Coils

5.0.3.2.1 Provisions shall be made for collecting and removing moisture condensed on cooling coils. Entrained water shall be prevented from being carried down the ductwork.

9413202.1601

5.0.3.2.2 On direct expansion coils, control shall be provided to prevent the condensed moisture from freezing. Most problems occur at light load.

5.0.3.2.3 Maximum face velocity shall be 600 FPM for personnel comfort and 450 FPM for technical or complex application. See Attachment N, Section 1550-2.5.4 for more details.

5.0.4 **Controls**

5.0.4.1 All heating, ventilating and air-conditioning systems require control. This control shall be automatic unless otherwise specified.

5.0.4.2 Flow controllers should be considered for applications such as laboratories with exhaust hoods where different modes of operation can affect flow conditions.

5.0.4.3 Differential pressure controllers, dampers, and variable volume/pressure fans should be considered when it is necessary to maintain spaces at different static pressures.

5.0.4.4 Automatic temperature devices for personal comfort shall have a minimum control range between 67°F and 81°F within the parameters indicated in ASHRAE 55 and normally 72°F to 78°F as indicated in Attachment N, Section 1550-1.2.2.

5.0.5 **Refrigeration Systems**

The cooling capacity in BTUH of a refrigeration system should be specified in addition to the capacity of the individual components and the responsibility for performance shall rest on one contractor.

6.0 **BALANCING**

6.0.1 The balancing of the air handling system shall be accomplished in such a manner that each space is receiving its designed air supply and proper differential pressures are established between zones. For balancing procedures reference the SMACNA balancing manual or industrial ventilation manual.

6.0.2 Air flow rates should not be restricted to less than the nearest 5 CFM for small flows and 10 CFM for larger flows. A plus or minus 5% variation from desired individual outlet air flow rates is considered a very good balance job, the system design shall accommodate these variations.

9413202.1602

ATTACHMENT J

(Not Used)

9413202.1603

ATTACHMENT K
ENERGY CONSERVATION

0110-12 ENERGY CONSERVATION

0110-12.1 Coverage

For purposes of this section, the term "building" shall mean new commercial, industrial, or residential buildings, or new building additions, unless otherwise stated. The term "Federal Building" means any building, structure, or facility that is constructed, renovated, leased, or purchased, in whole or in part for use by the United States, which includes a heating system, a cooling system, or both.

These criteria shall be applied in the planning and design of new buildings and building additions including their operating systems and energy using equipment.

These criteria shall be applied with the following objectives:

- Minimizing consumption of nonrenewable energy sources on the basis of LCC effectiveness
- Encouraging the use of renewable energy sources

Employee health, safety and environment (including indoor air quality) shall not be compromised in achieving energy efficiency.

0110-12.2 General

For new construction, DOE facilities shall be designed to comply with the requirements of ASHRAE Standard 90.1.

DOE has designated ASHRAE Standard 90.1 as the minimum efficiency standard for new Federal Buildings with the following two exceptions:

- That the DOE LCC methodology shall be used (rather than the ASHRAE methodology)
- That this standard shall not limit further reduction in energy use where such reductions can be achieved on the basis of LCC analysis

The building envelope shall meet the minimum prescriptive energy conservation requirements of ASHRAE Standard 90.1 and the criteria in Section 0110-12.3, Building Envelope Thermal Transmittance Values, and Section 0110-12.4, Building Envelope Air Leakage Criteria. The mechanical system shall meet the minimum prescriptive energy conservation requirements of ASHRAE Standard 90.1 and the requirements of Attachments H, K, L, M, N, P, Q, T, U, and V of this specification, and electrical requirements of this specification.

9413202.1604

Relative to electrical distribution systems, utilization equipment rated greater than 1,000 W and lighting equipment with an inductive reactance load component shall have a power factor of not less than 85 percent under rated load conditions. Utilization equipment with a power factor of less than 90 percent shall be corrected to at least 90 percent under rated load conditions. Power-factor corrective devices, installed to comply with this criterion, shall be switched with the utilization equipment, except where this results in an unsafe condition or interferes with the intended operation of the equipment.

Energy conservation alternatives for measures exceeding the minimum requirements of ASHRAE Standard 90.1 shall be considered for any building described in Section 0110-12.1, Coverage, according to the procedures outlined in Section 0110-12.7, Building Analysis Procedures, with the objective of obtaining the greatest opportunities for energy conservation for the subject building.

Analysis of the building to determine energy conservation features and energy source alternatives shall be accomplished in the preliminary design (Title I) phase. The conceptual design phase cost estimates shall include adequate funding to cover energy conservation alternatives. Determination shall be made before the completion of the preliminary (Title I) design phase as to which energy conservation alternatives shall be incorporated into the building design based on LCC.

The building energy conservation analysis or waiver thereof shall be reported and documented according to the procedures outlined in Section 0110-12.8, Energy Conservation Report Requirements.

HVAC design shall comply with ASHRAE Standard 62.

0110-12.3 Building Envelope Thermal Transmittance Values

The following building envelope criteria shall be the minimum values to be used in the architectural design of new buildings.

As a minimum requirement, the thermal transmittance values ("U" values) and overall maximum allowable combined transmittance values as determined from ASHRAE Standard 90.1 shall be used as basic building envelope criteria. Lower thermal transmittance values shall be considered by LCC analysis as discussed in Section 0110-12.7, Building Analysis Procedures.

Buildings with solar energy sources, high internal heat loads, or other special requirements shall be considered according to the procedures given in ASHRAE Standard 90.1 in order to determine if deviations from the maximum allowable thermal transmittance values would actually result in less annual energy consumption.

9413202.1605

9413202.1606

0110-12.4 Building Envelope Air Leakage Criteria

Building envelope air leakage through walls, window, and doors shall comply with ASHRAE Standard 90.1, and other criteria of this specification which supplement or supersede ASHRAE Standard 90.1.

0110-12.5 Use of Renewable Energy Systems

0110-12.5.1 Active Solar Systems

The DOE Energy Management Coordinator shall determine whether the use of active solar systems shall be considered for a building. The application of active solar systems shall be considered based on LCC. Geographical location, site solar access, conventional fuel availability, and load characteristics are major factors in determining when an active solar system shall be considered. Active solar systems shall be considered when it is determined they can be LCC effective.

0110-12.5.2 Passive Solar Techniques and Daylighting Techniques

The application of passive solar techniques including passive space heating, passive cooling, and daylighting shall be considered for all building projects as directed by the DOE Energy Management Coordinator. Passive solar techniques shall be used wherever they are determined to be technically feasible and economically justifiable.

0110-12.5.3 Other Renewable Systems

The DOE Energy Management Coordinator shall determine whether other renewable energy sources such as photovoltaics, wind, geothermal, or other sources shall be considered.

0110-12.6 Energy Management Systems

Criteria and methodology for the design of an EMS shall comply with TM 5-815-2.

Methodology for estimating the energy conservation performance of an EMS shall comply with NCEL UG-0010.

Implementation and installation of an EMS, a micro EMS (single-building controller) or an interface to an existing EMS, shall be considered in the preliminary (Title 1) design phase for all building projects. Energy management systems shall be evaluated by LCC analysis.

9413202.1607

0110-12.7 Building Analysis Procedures

0110-12.7.1 LCC Analysis Procedures

LCC analysis shall be used to compare the total life-cycle value of various building parameters and systems based on initial cost, annual maintenance costs, and annual operating costs. Furthermore, the present value of future benefits and costs shall be calculated for the various energy conservation alternatives. This analysis shall then form a basis for selecting the optimum building systems for any specific use. LCC analysis shall comply with 10 CFR 436, as amended.

LCC analysis shall use energy costs obtained from the most current four successive quarters as reported in the Quarterly Energy Conservation Report for the site. The annual supplement of NBS Handbook 135, which contains current factors and escalation rates for energy, shall be used for the LCC analysis.

0110-12.7.2 Use of Computer or Other Energy Analysis Techniques

Total energy consumption in a building shall be defined to include both building energy consumption and process energy consumption.

Building energy consumption shall be defined as the energy that is used primarily for heating, ventilation, cooling, domestic water heating, energy distribution and lighting. Process energy consumption shall be defined as energy used in a process, production or research program. A "base-case" annual building energy consumption shall be determined by the methods described in Section 0110-12.7.3, Design Analysis Procedures. Energy analysis of building energy conservation alternatives shall be compared to the "base-case" building.

If the estimated annual total building energy consumption as indicated in the DOE project criteria is expected to exceed 500 million BTU, or the building is larger than 10,000 gross square feet, the evaluation of the "base-case" energy consumption and the analysis of energy conservation alternatives shall be performed using a computer analysis technique approved by the DOE Energy Management Coordinator. If the estimated total building annual energy consumption is not expected to exceed 500 million BTU, the design professional can use either a computerized analysis or a manual analysis method using ASHRAE's Simplified Energy Analysis using the modified bin method to evaluate the energy conservation alternatives and the "base-case" design energy consumption for the building.

The computerized energy analysis shall be made part of the "Energy Conservation Report" as discussed in Section 0110-12.8, Energy Conservation Report Requirements. Energy analysis need not be included in a formal report if the usage is less than 500 million BTU/year.

9413202.1608

0110-12.7.3 Design Analysis Procedures

The energy use of building systems shall be considered at the start of the building design planning process because selection of fundamental building features, such as form, orientation, window/wall ratio, building envelope construction, lighting system types, and HVAC system types have the greatest effect on energy consumption.

Energy consumption characteristics of different building features shall be defined to identify the building energy-consuming systems with the greatest potential for reduction in energy consumption. Systems that shall be considered are lighting, heating , cooling, energy (media) distribution, domestic water heating, and ventilation. Factors that affect these systems, such as building thermal transmittance values, infiltration and ventilation rates, occupancies, building orientation, shading, HVAC system design, and lighting system design shall be optimized. The most effective design solutions shall be identified using LCC analysis.

Energy consumption characteristics of process energy systems shall also be analyzed and the optimum parameters selected.

A "base-case" annual energy consumption for the building shall be determined as described in Part 1 below. This "base-case' annual energy consumption shall be reported in accordance with Section 0110-12.8, Energy Conservation Report Requirements.

Part I – "Base-Case" Building Annual Energy Consumption

1. New Buildings

A. The "base-case" energy usage shall be defined as the energy the building would consume resulting from only the implementation of the energy conservation requirements of ASHRAE Standard 90.1. The "base-case" energy usage shall define the fraction of the building's energy consumption attributable to lighting, cooling, heating, domestic water heating, energy distribution, and ventilation. The "base-case" energy usage shall also define the energy required for process functions. The base-case energy use shall be determined by simulating the "base-case" building through use of energy analysis techniques as discussed in Section 0110-12.7.2, Use of Computer or Other Energy Analysis Techniques. Project criteria shall indicate process energy requirements and related information.

B. The "base-case" building energy analysis shall include input of all building envelope characteristics, including U-values, areas, building orientation, shading features, window/wall/roof thermal characteristics, and infiltration characteristics. The analysis shall include input of all building internal characteristics including lighting demand and usage schedules, occupancy demand and schedules, equipment and miscellaneous heat gains, building usage schedules, and ventilation rates and schedules. The analysis shall include calculations of the

building's heat gains and heat losses and total block heating and cooling loads using all the above listed characteristics and local weather data obtained from AFM 88-29, Chapter 6, bin weather data, or hour-by-hour weather data. The heating and cooling loads shall include the delineation of the portions associated with solar, transmission, ventilation, and internal components.

C. After the thermal heating and cooling loads are calculated, the "base-case" building energy analysis shall indicate the selection of the HVAC system to be applied to the building to offset the heat gains and heat losses. The "base-case" HVAC systems shall meet the requirements of ASHRAE Standard 90.1 and the other design requirements as described in Attachments L, M, N, P, and Q. The energy analysis shall simulate a full year's performance of the systems based on the thermal loads, full and part load efficiencies of HVAC equipment, demand and usage schedules of energy distribution equipment (fans, pumps, auxiliary burdens, etc.) and demand and usage schedules for domestic water heating. Domestic hot water usage shall be calculated according to the methods described in the ASHRAE Systems Handbook. Process energy usage analysis and optimization of the selection of process equipment shall be evaluated separately according to DOE project criteria.

Part II – Evaluation of Energy Conservation Alternatives

Once the "base-case" building energy usage simulation has been determined, the following steps shall be performed in the building energy usage analysis:

1. Evaluate building envelope energy conservation opportunities by analyzing the effects of modifications to "base-case" thermal transmittance values, fenestration areas, building orientation, building exposure to weather conditions, and building shading characteristics or the use of possible solar technologies.

2. Either evaluate the energy effectiveness of various different mechanical/electrical environmental systems by simulating the energy usage of each of these systems using a constant thermal load "base-case" and comparing the results, or evaluate energy conservation modifications to the "base-case" HVAC system. Again, life-cycle evaluation of mechanical/electrical environmental systems shall be performed using efficiencies exceeding the minimum HVAC system or lighting system requirements of ASHRAE Standard 90.1.

3. Evaluate energy conservation alternatives to systems or compare energy usage between systems in an ordered sequence so that energy consequences of one modification over another are included.

4. Evaluate energy conservation modifications to the "base-case" domestic water heating.

9413202.1609

5. LCC analysis shall be performed using typical cost values provided in DOE project criteria and the incremental energy costs determined from Items 1-5 above according to the methods discussed in Section 0110-12.7.1, LCC Analysis Procedures, to determine the optimum energy conservation alternatives.

0010-12.7.4 Waivers of Design Analysis Requirements

Comparative analysis of building envelope, lighting, or HVAC systems can be modified given the following conditions:

- No further comparative analysis of building thermal envelope modifications is required if the building orientation or building construction features are pre-determined and cannot be modified because of special site, safety, or programming considerations. The building still must meet minimum building envelope standards required by ASHRAE Standard 90.1.

- No further comparative analysis between HVAC systems is required if the type of HVAC system is unique to the building or process and cannot be modified due to rigid temperature control, humidity control, air movement requirements, or special programming. The pre-selected system shall still be evaluated for all possible energy conservation modifications available to that particular system.

- No further comparative analysis is required if selections of overall HVAC systems or ancillary sub-systems or equipment are available that by empirical observation clearly consume the least energy and that can be shown through simple cost estimation to have no significant additional first cost and no significant annual maintenance costs over other HVAC systems. A description of these findings shall be in accordance with Section 0110-12.8, Energy Conservation Report Requirements.

Waivers of design analysis of this type must be submitted for approval to the DOE Energy Management Coordinator. Unusual limiting considerations concerning the building envelope, the HVAC systems, the lighting systems, or other systems that allow for waiver of comparative analysis shall be discussed in the "Energy Conservation Report."

0110-12.8 Energy Conservation Report Requirements

0010-12.8.1 General

An "Energy Conservation Report" (summary evaluation) shall be developed for each new building and building addition where *total* energy consumption is expected to exceed 500 million BTU per year or the building is larger than 10,000 gross square feet.

For projects or retrofits of existing buildings where *total* energy consumption is less than 500 million BTU per year, an "Energy Conservation Report" shall be developed at the discretion of the DOE Energy Management Coordinator.

9413202.1610

The report shall be included as part of the preliminary (Title I) design, where final selections of energy conservation features or renewable energy sources are made.

The report shall contain the results of the annual energy consumption calculations for the "base-case" building and the results of the energy analysis and LCC analysis of energy conservation alternatives as listed below. If parts of this analysis are waived, an explanation shall be included in the report. The report shall:

1. Identify the methods used for simulating building energy consumption and the methods of LCC analysis (e.g., dynamic computer analysis, static computer analysis, or manual calculations) used to consider alternative building systems and the use of renewable energy sources.

2. Describe the "base-case" building, including:

   - Building envelope parameters, including U-values, types of fenestration, and percent of gross wall area occupied by fenestration, and orientation

   - Building heating and air-conditioning systems, including types of mechanical refrigeration systems, types of heating systems, types of energy distribution systems, types of automatic temperature controls, types of ventilation systems, and any health and safety requirements that the ventilation system design must satisfy.

   - Types of building lighting systems and controls

   - Building domestic water heating systems

   - Process energy consumption systems, if any

3. Provide backup data to indicate that criteria of ASHRAE Standard 90.1 have been met or exceeded for "base-case" new buildings.

4. Estimate total energy consumption of the "base-case" building, separately identifying building energy consumption and process energy consumption, including:

   - BTU/year by types of energy source (e.g., at point of use electricity, natural gas)

   - Total BTU/year for entire building

   - Total BTU/gross-square-foot/year

   - Total BTU/month and per year and kWh/month and per year for each energy usage category (e.g., lighting, pumps, fans, refrigeration, heating, and domestic water heating)

9413202.1611

5. Describe the major energy conservation modifications to the "base-case" building selected, such as modifications to the building envelope, including "U" values, types of fenestration and percentage of glass in the gross wall area and addition of active or passive solar energy features; modifications to the types of heating and air-conditioning systems, including ventilation, refrigeration, heating and automatic temperature control systems; modification to building systems lighting levels and controls; and all other major modifications considered.

6. Estimate total energy consumption of the "modified" building for each type of proposed energy conservation modification or combination of modifications, separately identifying building energy consumption and process energy consumption. Use the same format as required for the "base-case" building.

7. Estimate energy savings from incorporation of each major energy conservation feature and provide LCC analysis for the addition of each major energy conservation feature.

8. If analyses of active solar systems or use of other renewable energy sources are required by the DOE Energy Management Coordinator, provide the results of the analyses, including backup data for LCC analysis.

9. Discuss the types of permanent metering for energy inputs to the building, types of submetering for process energy use, and compatibility with existing or projected energy management systems. Estimate the total cost for metering and submetering provisions.

0110-12.8.2 Distribution of "Energy Conservation Reports"

For buildings that are expected to exceed 500 million BTU per year in total energy consumption or buildings larger than 10,000 square feet, DOE field organizations shall provide one copy of the "Energy Conservation Report" from the Title I design documentation to the In-house Energy Management Branch, Office of Project and Facilities Management, DOE Headquarters, for review and comment. This report should be submitted immediately on completion of Title I. Reconciliation of Headquarters comments shall be incorporated into Title II design by the design professional and responses to comments provided to Headquarters by DOE field organizations.

DOE field organizations shall include a completed summary form in its "Energy Conservation Report" submission to DOE Headquarters with the following information: 1) site; 2) building; 3) TEC ($M); 4) design/construction status; 5) energy type; 6) building energy consumption (MBTU/yr); 7) process energy consumption (MBTU/yr); 8) total energy consumption (MBTU/yr); 9) metering provided; 10) gross square feet (GSF); 11) BTU/GSF per year; 12) LCC method; 13) major energy conservation features; and 14) LCC.

9413202.1612

ATTACHMENT L
MECHANICAL INSULATION/FIRE PROTECTION

1525 MECHANICAL INSULATION

1525-1 APPLICABILITY

Insulation shall be considered for equipment, ductwork, piping, flue pipe and breeching to minimize energy loss, to prevent condensation, and to provide safe surface temperatures.

All insulation material, media used to apply insulation, and jacketing material shall have a maximum flame spread of not more than 25 fuel-contributed and smoke-developed ratings of not over 50 when tested using UL 723 Test Methods. Exception to the smoke-developed rating of 50 shall be made for exterior underground piping and exterior above-ground piping beyond 15 feet from buildings or individual supports (stanchions).

Asbestos or asbestos-containing materials shall not be used.

1525-2 MINIMIZATION OF ENERGY LOSS

ASHRAE Standard 90.1 shall be the basis for determining insulation thickness in HVAC systems, service water heaters, and recirculation piping in buildings.

Insulation thickness for exterior and underground distribution systems and equipment shall be based on the TIMA Energy Saving Guide.

1525-3 CONDENSATION PREVENTION

Insulation material, thickness, and jacketing shall be designed to provide an exterior skin surface temperature greater than the minimum anticipated ambient dew point.

1525-4 SAFE SURFACE TEMPERATURES

Insulation shall be provided on hot and cold generation equipment, ductwork, piping, flues or breeching, using a material, thickness, and surface treatment that will maintain the surface temperature between 30°F and 125°F for highly conductive (metal) surfaces or between 32°F and 150°F for nonconductive surfaces.

1530 FIRE PROTECTION

1530-1 GENERAL

Fire protection systems shall comply with DOE 5480.7 (Attachment U).

9413202.1613

1530-2 IMPROVED RISK CONCEPT FOR FIRE PROTECTION SYSTEMS

1530-2.1 General

Fire protection design shall incorporate an "improved risk" level of fire protection as directed in DOE 5480.7 (Attachment U) as well as Section 0110-5, (Attachment T) Health and Safety.

1530-2.2 Vital Programs

Fire protection systems for vital programs shall incorporate a "higher standard of protection" than the "improved risk" level as directed by DOE 5480.7 (Attachment U).

1530-2.3 Maximum Possible Fire Loss

1530-2.3.1 General

The "improved risk" level of protection requires that the "maximum possible fire loss" shall be the basis for determining the need to provide automatic fire suppression systems and for additional fire protection systems and features. "Maximum possible fire loss" is defined in DOE 5480.7 (Attachment U). Criteria I through V as discussed in DOE 5480.7 (Attachment U) correspond with Section 1530-2.3.2, Criterion I, through Section 1530-2.3.6, Criterion V. The application of these criteria shall be considered by an experienced fire protection engineer.

1530-2.3.2 Criterion I

Whenever the maximum possible fire loss exceeds $1 million, automatic fire suppression systems shall be provided.

1530-2.3.3 Criterion II

The need for automatic fire suppression systems shall be considered when the maximum possible fire loss is below $1 million.

Some examples of situations where automatic fire suppression systems may be warranted for potential fire losses below $1 million are:

- Facilities that contain critical or long-procurement-time construction items
- A temporary-use trailer used as a control center for a vital one-time activity
- A facility with high public visibility or sensitivity
- Electric power transformers with combustible contents that, if damaged, could result in an extended shut-down of the facilities they serve

9413202.1614

9413202.1615

- Facilities in which a fire could result in the accidental release of toxic or hazardous materials or emissions
- Cooling towers of combustible construction
- Facilities that can be easily protected by extending automatic sprinkler systems from an adjacent protected facility at a low incremental cost
- Facilities in which a fire could damage more important adjacent facilities
- Facilities that may warrant automatic fire suppression systems in the future
- Facilities where required for protection of human life

1530-2.3.4 Criterion III

Automatic fire suppression systems are not required if all of the following conditions are satisfied:

- The maximum possible fire loss is less than $250,000
- There is no hazard to human life
- There is no danger of a fire resulting in release of toxic or hazardous material or emissions
- Important operations or program missions will not suffer unacceptable delays as a result of fire. See DOE 5480.7 (Attachment U) for qualification criteria.

1530-2.3.5 Criterion IV

Whenever the maximum possible fire loss exceeds $25 million, the area shall be subdivided with free-standing fire rated walls or suitable redundant fire protection systems to limit the credible loss to less than $25 million even in the event the primary system fails. In no case shall the maximum loss potential exceed the $75 million loss limit established in DOE 5480.7 (Attachment U); failure-proof systems such as physical separations shall be provided to prevent this possibility.

Response capability of on-site fire departments and availability of adequate water quantity and pressure at well-located hydrants may be the principal basic method of redundant fire protection for most DOE facilities, but automatic redundant protection systems may be needed to meet or exceed "improved risk" levels of protection for some facilities.

Redundant fire protection systems may include dual water supplies to sprinkler systems, dual piping risers, or valving systems such that adequate redundancy in water supply to the sprinkler heads is provided to cover maintenance or emergency outages of either of the water supply systems; or, may include

9413202.1616

multiple types of automatic fire suppression systems (e.g., water sprinklers and carbon dioxide).

Some DOE sites or facilities must rely on local (e.g., city or county) fire department response capability for redundant protection. The fire department capability to reduce loss due to a well-developed fire shall be considered in terms of the following factors:

- Location of fire station(s) with respect to the facility to be protected
- Staffing of stations (e.g., continuously or "on-call" volunteer)
- Ability to perform initial fire attack as outlined in NFPA 1410
- Method(s) of fire department notification or alarm reception
- Familiarity of station staff with the DOE facility, and training in preparation for effective response to an alarm at the DOE facility
- Degree of commitment that fire department(s) make to respond to fire emergencies in DOE facilities. This factor shall be emphasized.

  Portable fire extinguishers, interior fire hose systems, or interior fire detection and alarm systems do not meet the definition of a redundant fire protection system.

1530-2.3.6 Criterion V

The need for redundant fire protection systems or methods, or for supplementing existing redundant fire protection capability, shall be considered on a case-by-case basis when the maximum fire loss potential is below $25 million. Factors to be considered include:

- Fire department response capability
- Hazards involved in the operation
- Operating and program-mission effect of interruption and delays due to fire

1530-3 WATER FLOW AND PRESSURE REQUIREMENTS FOR FIRE PROTECTION

1530-3.1 General

Total volume, pressure, and design flow rate of water necessary to provide fire protection for facilities shall be determined by the methods described in the following paragraphs. All sprinkler or other automatic fire suppression system components shall be UL- or FM-approved for the particular application chosen.

9413202.1617

1530-3.2 Occupancy Hazard Classification

NFPA 13 shall be used to determine the Occupancy Hazard Classification for any facility. Light hazard occupancy rules are prohibited.

1530-3.3 Water Demands for Sprinklered Facilities

1530-3.3.1 Schedule-Designed Sprinkler Systems

For systems designed using pipe schedule methods, NFPA 13 shall be used for calculating water demand in the absence of specific requirements provided by the cognizant DOE fire protection authorities based on unusual occupancies or special hazards.

Precautions shall be taken to ensure that adequate residual pressure exists at full demand flow rate to fulfill the density and coverage requirements for schedule-designed systems. If water supply or pressure is marginal the pressure loss from the base of the riser to the most remote head should be calculated to confirm that the schedule designed-system will meet requirements, or the system shall be hydraulically designed.

1530-3.3.2 Hydraulically Designed Sprinkler Systems

NFPA 13 shall be used to determine water supply requirements for hose streams (gpm) and duration (min). Density curves presented in NFPA 13 shall be used for calculating sprinkler demand for hydraulically designed systems. For hazard classifications not covered in NFPA 13 and certain other special occupancies or hazards, design density and area of coverage shall be as specified by other more appropriate standards referenced in NFPA 13 or project-specific requirements as determined by the cognizant DOE fire protection engineer. For ordinary hazard occupancies and above, hose stream requirements shall be a minimum of 500 gpm regardless of the hose stream demands listed in the above references unless otherwise specified by the DOE project criteria.

Determination of adequacy of water supply shall be made on the basis of actual flow test data gathered using the methods in NFPA 13, Appendix B.

1530-3.3.3 Fire Hydrant Demand

Where reliance is placed on fire department response, either for protection of unsprinklered buildings or where the fire department will serve as redundant (backup) protection, as a general rule the water supply should be adequate to supply at least 0.03 gpm per cubic foot of fuel (building and contents) in the largest fire area (for high-BTU-content fuels, convert to equivalent ordinary BTU loads). This water supply should be available at 20 psig residual pressure at the hydrants.

9413202.1618

1530-4 AUTOMATIC SPRINKLER PROTECTION

1530-4.1 General

All sprinkler systems shall comply with NFPA 13.

1530-4.2 Types of Sprinkler Systems

1530-4.2.1 Wet Pipe

Sprinkler systems shall normally be wet pipe using pipe schedule sizes listed in NFPA 13 for ordinary installations. Hydraulic designs shall be considered for all systems. The system shall be hydraulically designed where residual pressure is marginal, water application rate is high, response time is critical, or special risks are involved.

1530-4.2.2 Dry Pipe

In unheated areas or other areas subject to freezing temperatures, dry pipe systems shall be provided. Because of the time delays associated with release of the air in the system, water demands for dry pipe systems shall be computed over areas 30 percent greater than for comparable wet pipe systems. Where the unheated area is small it may be cost effective to install an antifreeze system or small dry pipe system supplied from the wet pipe system in the main heated area.

1530-4.2.3 Preaction

A preaction system shall be used where it is particularly important to prevent the accidental discharge of water. Need for a preaction system shall be based on review and by recommendation of a professional fire protection engineer. The detection system chosen to activate the preaction valve shall have high reliability and a separate alarm/supervisory signal to indicate status. The detection system must be designed to be more sensitive than the closed sprinklers in the preaction system, but should not be so sensitive as to cause false alarms and unnecessary actuation of the preaction valve.

1530-4.2.4 Deluge

For extra hazard areas and specific hard-to-extinguish fuels such as explosives and pyrophoric metals, a deluge system with open sprinkler heads may be used to wet down the entire protected area simultaneously. Deluge systems shall comply with NFPA 13. If quick response is required, deluge system piping may be primed with water. The nozzles must be provided with blow-off caps for water-filled deluge systems.

9413202.1619

1530-4.2.5 Self Restoring

Self-restoring sprinkler systems, such as the on-off multicycle system or systems using individual on-off sprinkler heads, shall be considered where the water from sprinklers will become contaminated by contact with room contents, where there is a concern for water damage, or where water supply or storage volume is marginal.

1530-4.2.6 Quick-Response

Where there are high-value concentrations (values per square foot), quick-response sprinklers shall be considered in lieu of conventional sprinklers.

1530-5 SPECIAL PROTECTION SYSTEMS

1530-5.1 General

Special protection systems may be used to extinguish or control fire in easily ignited, fast-burning substances such as flammable liquids, some gases, and chemicals. They shall also be used to protect ordinary combustibles in certain high-value occupancies especially susceptible to damage. Special protection systems supplement automatic sprinklers as described by NFPA and shall not be used to substitute for them except where water is not available for sprinkler protection. The added expense of the supplementary system shall be supported by documented justification.

The selection of a particular special suppression system shall be based on:

- The effectiveness of that system or agent for the type of hazard
- The damage likely to be caused by the extinguishing agent, including cleanup and down time

1530-5.2 Types of Special Suppression Systems

1530-5.2.1 Water Spray

Installation of water spray systems shall comply with NFPA 15.

1530-5.2.2 Carbon Dioxide

Agent quantity requirements and installation procedures shall comply with NFPA 12.

1530-5.2.3 Dry Chemical

Systems shall comply with NFPA 17.

1530-5.2.4 Foam

Foam systems shall comply with NFPA 11, NFPA 11A, NFPA 16, and NFPA 16A.

9413202.1620

1530-6 (RESERVED)

1530-7 PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers shall comply with NFPA 10.

1530-8 FIRE DETECTION AND ALARM SYSTEMS

1530-8.1 General

All fire detection and alarm devices shall have UL-listed components or be FM-approved. Devices and systems shall comply with NFPA 71, NFPA 72A, NFPA 72B, NFPA 72C, NFPA 72D, NFPA 72E, NFPA 72F, NFPA 72G and NFPA 72H as applicable.

1530-8.2 Alarm Systems

1530-8.2.1 General

Fire alarm systems shall have the following basic features:

- Transmission of signals to the DOE facility fire department alarm center and other constantly attended locations in accordance with the appropriate NFPA Signaling Systems Standard
- Local alarms for the building or zone in alarm
- Trouble signals as required by the appropriate NFPA Signaling Systems Standard
- Emergency battery backup for system operation
- Electric supervision of all circuits as required by the appropriate NFPA standard
- Supervisory devices for all critical functions (valve position switches, water level, temperature)
- Capability of annunciating at least three separate conditions: 1) a fire alarm, 2) a supervisory alarm, and 3) a trouble signal indicating a fault in either of the first two. Annunciation of each condition shall be separate and distinct from the other two.

Fire alarm systems for new DOE buildings shall be compatible with those for the DOE complex where the new building is to be located.

1530-8.2.2 Alarm Actuating Devices

- Alarms that respond to flow of water shall be provided wherever a sprinkler system is installed and shall comply with requirements of the NFPA standard for the type of signaling system used.

- A manual fire notification method such as manual fire alarm boxes shall be provided and located in accordance with the appropriate NFPA standard

- Combined watch reporting and fire alarm systems, if used, shall be in accordance with the appropriate NFPA standard

1530-8.3 Automatic Fire Detection Systems

1530-8.3.1 General

Automatic detection systems may be used to supplement or to actuate extinguishing systems. Automatic fire detectors shall comply with NFPA 72E. Detector spacing shall be in accordance with NFPA 72E, Appendices A, B and C.

1530-8.3.2 Heat-Actuated Detectors

Heat-actuated detectors are appropriate when any of the following conditions exist:

- Speed of detection is not the prime consideration

- The space is small or confined and rapid heat build-up is expected

- Ambient conditions do not allow the use of other detection devices

1530-8.3.3 Flame-Actuated Detectors

Flame-actuated detectors are appropriate when rapid detection is of prime importance in high hazard areas, such as:

- Fuel-loading platforms

- Industrial process areas

- Hyperbaric chambers

- High ceiling areas

- Atmospheres where explosions or very rapid fires may occur

Since this type of device must "see" the flame to operate, the number of devices and their aiming must be carefully engineered. False trips from extraneous radiation sources are also possible. For the above reasons use of this type of device shall require coordination among the fire protection engineer, DOE project manager, and the equipment manufacturer.

9413202.1621

9413202.1622

1530-8.3.4 Smoke Detectors

Smoke detectors shall be installed in all areas where required by the appropriate NFPA standard or by the cognizant DOE fire protection authority. Smoke detectors shall be of a type operating on one of the principles described in NFPA 72E. A mixture of detector types may be appropriate. Location and required spacing of smoke detectors shall be determined by the methods of NFPA 72E and its Appendix C. Spacing shall be based on threshold fire size, fire growth rate, and ceiling height as described in these standards.

1530-9 WATER STORAGE AND DISTRIBUTION

Wherever practical, dedicated fire water storage and distribution systems shall be used. If a dedicated fire water supply system cannot be provided, the fire protection water supply shall assure availability regardless of simultaneous process and domestic water usage.

Where automatic sprinkler systems or standpipes are fed from a potable water system, approved check valves shall be installed in sprinkler lead-ins to preclude the introduction of pollutants from systems or recirculation of stagnant water that would contaminate the domestic water system.
Underground fire water mains or combined fire and domestic water mains, including valves, hydrants, and fittings, shall be installed, flushed, sterilized, and tested in accordance with NFPA 24 and Section 0260, Piped Utility Materials. Water storage tanks shall comply with NFPA 22. Fire pumps shall comply with NFPA 20. Water storage shall be sufficient to meet the density, pressure, and duration requirements of NFPA 13.

Whenever feasible, all water distribution systems shall be of the looped grid type providing two-way flow with sectional valving arranged to provide alternate water flow paths to any point in the system.

Fire mains (except those supplying a single hydrant or extensions of existing smaller mains) shall be at last 8 inches. Mains shall be sized to supply the largest fire demand plus the largest domestic and process demand with consideration for residual sprinkler system pressure requirements.

Sprinkler supply lead-ins should be at least 6 inches, except lead-ins of 4 inches may be used for very small sprinkler systems when substantiated by hydraulic calculations. In no case shall the lead-in be smaller than the sprinkler riser.

Where combined fire and domestic-process water systems are used, the supplies to each building shall be arranged and valved so that the domestic and process systems can be shut down without shutting off the fire system supply.

Sprinkler risers should be located at an exterior wall. Sprinkler supply lead-ins should run under buildings the minimum distance possible. Where a riser must be located in a potentially contaminated area, consideration should be given to locating the riser exterior to the building in a heated enclosure.

Outside control valves that can be locked open shall be provided on each supply lead-in, located if possible a minimum distance of 40 feet from the building. PIVs should be used where possible. If site conditions preclude the use of PIVs, such as where they would be subject to mechanical damage and cannot be properly guarded, OS&Y valves in pits may be used.

Key-operated buried valves shall not be used for sprinkler control valves. In no case shall there be more than one valve controlling a sprinkler supply lead-in.

All lead-ins shall be connected with the sprinkler system at the base of the riser. Alarm valves shall be located as close as practical to the building entry point. Hydrants shall be provided so that hose lays from hydrants to all exterior portions of a protected building are no more than 300 feet. Hydrants shall not be closer to buildings than 50 feet.

9413202.1623

ATTACHMENT M
PLUMBING/SERVICE PIPING

1540 PLUMBING/SERVICE PIPING

1540-1 PLUMBING

1540-1.1 General

These criteria apply to interior plumbing systems (fixtures, supply, drain, waste and vent piping, service water heating system, safety devices, and appurtenances) up to 5 feet beyond the building exterior wall.

Domestic water shall be supplied by a separate service line and not be a combined fire protection and potable water service or a combined process water and potable water system within the building.

Plumbing shall comply with the Uniform Plumbing Code, ASHRAE Handbooks, and ASHRAE Standard 90.1.

Design criteria for special systems related to the facility process or research requirements shall be provided by the cognizant DOE authority.

Penetrations of piping through security barriers shall be minimized. Such penetrations more than 96 square inches in area and more than 6 inches in minimum dimension shall provide a penetration delay equal to that required for the security barrier. The physical attributes and intended service of the piping and the axial configuration of the barrier penetration shall be considered when evaluating that penetration delay.

1540-1.2 Fixtures

Fixtures and appurtenances shall be suitable for use by handicapped persons. Self-contained mechanical-refrigerated coolers shall be provided wherever a need for drinking fountains exists. Ratings shall be based on ARI 1010. Electrical equipment shall be UL listed.

1540-1.3 Piping

1540-1.3.1 Supply

Type K copper tubing shall be used below grade. Type L copper tubing shall be used above grade. CPVC and PB plastic pipe and tubing may be used in lieu of copper tubing above grade where not subject to impact damage or otherwise prohibited by DOE project criteria.

9413202.1624

Fittings for Type K shall be flared brass, solder-type bronze or wrought copper. Fittings for plastic pipe and tubing shall be solvent cemented or shall use other forms of joining (such as electric heat fusion) at the direction of the cognizant DOE authority or shall use Schedule 80 threaded. No lead solder shall be used for copper pipe in potable water systems.

Stop valves shall be provided at each fixture. Accessible shut-off valves shall be provided at branches serving floors or fixture batteries for isolation, or at risers serving multiple floors. Shut-off valves shall be provided to isolate equipment, valves, or appurtenances for ease of maintenance.

Accessible drain valves shall be provided to drain the entire system. Manual air vents shall be provided at high points in the system.

Provision for expansion compensation shall be included where thermal expansion and contraction cause piping systems to move. The movement shall be accommodated by using the inherent flexibility of the piping system as laid out, by loops, by manufactured expansion joints, or by couplings.

Accessible manufactured water hammer arresters shall be provided. Dielectric connections shall be made between ferrous and non-ferrous metallic pipe.

Where domestic or fire water service lines enter buildings, suitable flexibility shall be provided to protect against differential settlement or seismic activity in accordance with the UPC or NFPA 13, respectively.

1540-1.3.2 Drain, Waste and Vent

Underground lines shall be service weight cast iron soil pipe hub-type (with gasket); hubless cast iron soil pipe may be used in locations where piping is accessible. Aboveground (above grade) lines that are 1-1/2 inch in diameter and larger shall be either hubless or hub-type (with gasket) service weight cast iron soil pipe. Lines 1-1/2 inch through 6 inch in diameter may be ABS or PVC plastic pipe where allowed by DOE project criteria. Pipe and fittings shall be joined using solvent cement or elastomeric seals. Lines smaller than 1-1/2 inch in diameter shall be either 1) Type L copper with solder-type bronze or wrought copper fittings or 2) galvanized steel with galvanized malleable iron recessed threaded and coupled fittings. Cast iron soil pipe fittings and connections shall comply with CISPI guidelines.

Provisions for expansion compensation shall be included as above.

1540-1.4 Service Water Heating Equipment

The service water heating system shall provide flow within 10 seconds of approximately 110°F at the most remote outlet from generation equipment, except where this is deemed unnecessary by the cognizant DOE authority.

Booster heaters shall be provided where sanitizing for dishwashing or where a temperature above the normal water heater outlet temperature is required.

9413202.1625

Generation equipment and system selection shall be based on LCC analysis and available energy sources.

1540-1.5 Safety Devices

Tempering valves shall be the fail-safe pressure balance type.

As directed by project criteria, emergency eye washes, emergency showers, or combination emergency eye wash-showers shall be provided in areas where corrosive or other skin or eye irritant chemicals are stored, handled, used or dispensed. Equipment shall comply with ANSI Z358.1 and be serviced by the potable water system.

Hot water generation equipment shall be provided with ASME code-stamped tanks, when of sufficient capacity, water temperature, or hot input rate to be within the jurisdiction of the ASME Boiler and Pressure Vessel Code. Approved relief devices, combination temperature-pressure or separate units, depending on the application, shall be provided.

Backflow preventers and air gaps shall be used to prevent cross-connection (contamination) of potable water supplies. Vacuum breakers (to prevent back-siphonage) shall be used only in conjunction with administrative controls.

1540-1.6 Appurtenances

1540-1.6.1 Pressure Modification

Pressure-reducing valves shall be provided where service pressure at fixtures or devices exceeds the normal operating range recommended by the manufacturer.

Wherever a pressure-reducing valve's failure may cause equipment damage or unsafe conditions, a pressure-relief valve shall be provided downstream of the reducing valve.

A means to increase the system water pressure shall be provided when incoming water service pressure will provide less than the minimum operating flow and pressure recommended by the manufacturer.

The basic pressure-boosting system should be a manufactured package composed of an ASME-rated hydropneumatic, non-rechargeable tank, multiple alternating pumps, and low-flow/demand tank operation (without pump). Manufactured packages shall include all required operational and safety features.

9413202.1626

ATTACHMENT N
HEATING, VENTILATING AND AIR-CONDITIONING SYSTEMS

1550 HEATING, VENTILATING AND AIR-CONDITIONING SYSTEMS

1550-1. GENERAL SIZING AND DESIGN CRITERIA

1550-1.1 General Selection Procedures for HVAC Systems

The design professional shall evaluate building HVAC systems and sub-systems and select major HVAC equipment components based on a consideration of health and safety requirements, initial costs, operating costs, and maintenance costs according to the procedures listed in 0110-12.7 (Attachment K), Building Analysis Procedures.

HVAC equipment shall be sized to satisfy the building heating and cooling load requirements and to meet all general equipment design and selection criteria contained in the ASHRAE Fundamentals Handbook, ASHRAE Equipment Handbook, ASHRAE Systems Handbook, ASHRAE Applications Handbook, and ASHRAE Refrigeration Handbook. Calculations and equipment selection shall be made according to the procedures given in ASHRAE GRP 158 and appropriate chapters of the ASHRAE Fundamentals Handbook.

1550-1.2 Heat Gain and Heat Loss Calculations

1550-1.2.1 Building Envelope Thermal Transmittance ("U") Values

See Section 0110-12.3 (Attachment K), Building Envelope Thermal Transmittance Values, for criteria to be applied in building planning and design.

1550-1.2.2 Inside Design Temperature and Relative Humidities

Environmental design temperatures and relative humidities for special space uses other than those listed here shall be designated in the project criteria. The design professional shall verify that the recommended design values are within the criteria bounds of ASHRAE Standard 55 (for offices, change rooms, restrooms) and that the values are within energy conservation criteria guidelines as stated in Section 0110-12 (Attachment K), Energy Conservation. The design professional shall alert the cognizant DOE authority if the recommended DOE design values will result in energy inefficiency or occupant discomfort.

When space cooling is required, the inside design temperature to maintain personnel comfort shall be 78°F dry bulb unless otherwise indicated by project criteria. The design relative humidity shall be 50 percent. Summer humidification shall not be provided for personnel comfort. Cooling systems shall be designed to maintain space relative humidity conditions through the normal cooling process and should not have controls to limit the maximum relative humidity unless project specific criteria dictate.

9413202.1627

See Section 1550-1.4, Use of Evaporative/Adiabatic Cooling, for inside design temperature and humidity conditions applicable for adiabatic cooling systems.

The inside wintertime design temperature for personnel comfort shall be 72°F dry bulb unless otherwise indicated here or directed by the project criteria. The following design temperatures shall be used for the space usages indicated in Table 1550-1.2.2.

Table 1550-1.2.2 Inside Design Temperatures

Temperature (°F db)	Space
As indicated by DOE project criteria	Storage (unoccupied)
55	Storage (occupied)
50	Warehouses
60	Kitchens
65	Laundries
65	Shops (high work activity)
70	Toilets
75	Change Rooms (heating only when occupied)

Except where it can be substantiated from recordings or engineering computations that the inside relative humidity will be less than 30 percent, winter humidification for personnel comfort and health shall not be provided. Where such conditions have been substantiated, a design relative humidity of 30 percent shall be used in establishing minimum humidification equipment requirements.

1550-1.2.3 (Not Used)

1550-1.2.4 Weather Data

Weather data for use in connection with HVAC shall be obtained from one or more of the following:

- Local weather station
- AFM 88-29
- Climatic Conditions for the United States, ASHRAE Fundamentals Handbook.
- National Climatic Data Center, NOAA, Federal Building, Asheville, North Carolina 28801

9413202.1628

9413202.1629

1550-1.3 Heating and Air-Conditioning Equipment Sizing and Performance

The capacity of central heating, refrigeration, and ventilation equipment shall be sized for the peak block building or the maximum simultaneous zone heating and cooling design loads and in accordance with the ASHRAE Fundamentals Handbook. The equipment shall not be sized for future additional capacity nor redundancy unless indicated in DOE project criteria. Individual zone equipment shall be sized according to the peak zone load. The requirements of ASHRAE Standard 62 concerning minimum outside air requirements shall also be considered during the sizing process.

All HVAC equipment shall meet the performance and efficiency standards of ASHRAE Standard 90.1, Section 6.

Thermal storage systems shall be considered according to the requirements of 0110-12.7, Building Design Analysis, when required by DOE project criteria.

Safety factors shall also be added as indicated elsewhere in the specification.

1550-1.4 Use of Evaporative/Adiabatic Cooling

In locations where a wide variation exists between the dry and wet bulb temperatures for extended periods of time, evaporative/adiabatic cooling shall be considered for the applications listed below. Selection of cooler types shall depend on the system configuration, user experience, and LCC analysis. All evaporative coolers shall maintain a positive water-bleed and water-makeup system for control of mineral buildup.

Applications that shall be considered include warehouses, shops not requiring close (plus or minus 5°F) temperature control, non-residential size kitchens, makeup air ventilation units, and mechanical equipment spaces.

Air duct design, number and location of coolers, and relief of the higher rate of air supply to the atmosphere shall be considered to ensure a satisfactory operating system. Multi-stage evaporative cooling systems shall also be considered.

For shops and similar large open bay areas, the heating and cooling systems shall not be combined except where it is economically or operationally justified. Two-speed fan operation shall be used: fast speed and higher cfm air flow rate during the cooling cycle and slow speed and lower cfm air flow rate during the heating cycle. Where the difference between heating and cooling air flow requirements is too great to allow for adequate air outlet device performance at the lower air flow requirement, separate heating and cooling systems shall be provided.

Indoor design dry bulb temperatures for spaces air-conditioned by adiabatic cooling systems shall be as specified by project-specific criteria. Design operating efficiency of adiabatic cooling equipment shall be a minimum of 70 percent. System-installed capacity shall be based on the conditioned space

peak design cooling load. An arbitrary air-change rate for design air flow shall not be used. Adiabatic cooler specifications shall be stated in terms of the air capacity and the entering ambient dry and wet bulb temperatures and leaving dry bulb temperature.

1550-1.5 Ventilation-Exhaust Systems Design Requirements

1550-1.5.1 General

The design professional shall select ventilation-exhaust systems for the effective removal of noxious odors, hazardous gases, vapors, fumes, dusts, mists, and excessive heat and for the provision of fresh air to occupants. The design criteria contained in this section shall be followed in determining the required air quantity and quality for ventilation and exhaust systems. Further design criteria are contained in Section 1550-2.5, Air Handling and Air Distribution Systems; Section 1550-3, Testing, Adjusting and Balancing; Section 1595-6, Control of Air Handling Systems; NFPA 90A; and NFPA 91.

The use of exhaust stack(s) shall be considered to provide dispersion and preclude exhaust-to-intake return of air to this or an adjacent facility. Local weather and site conditions along with guidance found in ASHRAE Fundamentals shall be used to determine requirements.

1550-1.5.2 Outdoor Air Quality

Outdoor air shall be used to provide makeup air, dilute non-toxic contaminants and provide acceptable indoor air quality in spaces served by ventilation systems. The outdoor air shall meet the quality required by ASHRAE Standard 62. DOE project criteria shall include test data on ambient air quality. If the outdoor air does not meet the ambient air quality standards for particulates, gases, or other contaminants, it shall be treated to remove particles and gases and vapors as required to meet the minimum ambient air quality standards.

1550-1.5.3 Personnel Ventilation Air Requirements

The outdoor air shall be provided in the quantities indicated for conditioned offices and other occupied spaces in ASHRAE Standard 62. Outdoor air in addition to the quantities required by ASHRAE Standard 62 shall be provided when required to balance a building's or space's exhaust air rate or to maintain the building or space under a positive pressure. Proper ventilation rates shall be demonstrated by calculation if natural ventilation or infiltration is used as the outdoor air introduction method.

Special attention shall be given to design of ventilation systems where smoking will be allowed. For these spaces, the outside air ventilation rate designated for smoking areas by ASHRAE Standard 62 shall be provided or the appropriate air cleaning used.

9413202.1630

9413202.1631

1550-1.5.4 Recirculation

When air is supplied to a space, the portion of the total supply air that exceeds the required outdoor air quantity shall be recirculated through the ventilation system except from areas in which recirculation is specifically prohibited. If the indoor air quality does not meet or exceed the limits given in ASHRAE Standard 62, the recirculated air must be treated and monitored.

Areas from which air shall not be recirculated include areas that produce or emit dust particles, heat, odors, fumes, spray, gases, smoke, or other contaminants that cannot be sufficiently treated and could be potentially injurious to health and safety of personnel or are potentially damaging to equipment. These areas shall be 100-percent exhausted. Project criteria shall indicate other areas of non-recirculation.

Ventilation and exhaust air systems serving these areas or other special areas shall meet all the deliverable-air quantity requirements of ASHRAE Standard 62 and any other specific equipment requirements as discussed in Section 1550-2.5, Air Handling and Air Distribution Systems.

Rest rooms, janitor's closets, garbage rooms, and other malodorous spaces shall be exhausted at a rate of not less than 2 cfm per square foot or as specified in ASHRAE Standard 62, whichever is the more stringent, regardless of any other calculated ventilation requirements. Space ventilation air from adjacent spaces should be used as the ventilation supply air for the 100-percent exhausted spaces, as long as:

Ventilation by this method does not violate any requirements of NFPA 90A, NFPA 101, or special space pressurization requirements

The air supplied is not potentially more hazardous than the air from the space exhausted

1550-1.5.5 Industrial Ventilation Requirements

The facility shall be provided with ventilation (supply and exhaust) systems as required for heat exposure control, or dilution ventilation. Ventilation air shall be provided in the quantities required to maintain OSHA air quality limits, all the PELs established by 29 CFR 1910 and all ACGIH TLVs. Design air quantities and transport velocities shall be calculated according to the calculation methods prescribed by the ASHRAE Systems Handbook, the ASHRAE Applications Handbook, the ACGIH Industrial Ventilation Manual, 29 CFR 1910. Makeup air shall be tempered.

1550-1.5.6 Local Exhaust Systems

Local exhaust systems shall be designed to maintain the required capture air velocities for source contaminant control. Air quantities and transport shall be calculated based on the calculation methods prescribed by the ASHRAE Systems Handbook, the ASHRAE Applications Handbook and the ACGIH Industrial

9413202.1632

Ventilation Manual. Further design criteria for local exhaust systems are contained in Section 1550-2.5, Air Handling and Air Distribution Systems, and Section 1550-99, Special Facilities.

1550-1.5.7 Equipment Room Ventilation

Mechanical and electrical equipment rooms shall be exhausted so that room temperature does not exceed NEMA equipment ratings. DOE project criteria shall provide the space temperature limit criterion. Where mechanical ventilation cannot maintain a satisfactory environment, evaporative cooling systems or other mechanical cooling systems shall be provided. Exhaust air openings should be located adjacent to heat-producing equipment to minimize ambient thermal loads.

Thermostatic controls shall be used to operate the ventilation or exhaust systems as discussed in Section 1595, Controls.

Equipment rooms containing refrigeration equipment shall be ventilated in accordance with ASHRAE Standard 15.

Combustion air for fuel-burning appliances and equipment shall be provided to all equipment rooms with this type of equipment in accordance with the Uniform Mechanical Code.

1550-1.6 Energy Conservation—Waste Heat Recovery Systems

Specific energy-efficient features and waste heat recovery systems for all types of heating, ventilating, and air-conditioning equipment shall be considered according to the methods prescribed in Section 0110-12.7 (Attachment K), Building Analysis Procedures, and in Section 1550-1.1, General Selection Procedures for HVAC Systems. Special consideration shall be given to energy conservation systems if they affect health and safety, for example, corrosiveness of exhaust air to heat recovery coils.

Energy conservation-waste heat recovery systems shall be considered and designed according to the procedures outlined in specific chapters of the ASHRAE Fundamentals Handbook, the ASHRAE Systems Handbook, the ASHRAE Applications Handbook, ASHRAE Equipment Handbook, ASHRAE Refrigeration Handbook, and the SMACNA Energy Recovery Equipment and Systems Manual.

The following types of heat-recovery systems shall be considered for incorporation into the building HVAC system design where applicable:

Use of rotary heat exchanger, heat pipe, or coil run-around systems for heating and air conditioning air handling systems with more than 4000 CFM of outside ventilation exhaust air

Recovery of rejected heat from the condenser systems of central station cooling equipment for use in heating the remainder of the building when the central station cooling equipment must operate during the heating season to cool computer rooms, high internal heat gain areas, or process requirements

Use of thermal heat from the condenser systems of kitchen or other continuously operated refrigeration equipment for space heating or domestic hot water heating when the rejected heat from the equipment is greater than 35,000 BTUh

Use of a free cooling system using cooling tower water (water side economizer) when air-side economizer systems are not feasible

Use of a heat pump run-around loop

These evaluations shall be included in the "Energy Conservation Report" detailed in Section 0110-12.8, Energy Conservation Report Requirements (Attachment K).

9413202.1633

1550-2. HEATING VENTILATING AND AIR-CONDITIONING SYSTEMS SELECTION

1550-2.1 Central Station Cooling Equipment and Systems

1550-2.1.1 General

Selection of central station cooling systems shall be based on the LCC analysis procedures outlined in Section 0110-12.7 (Attachment K), Building Analysis Procedures. Size, selection and design shall be based on ASHRAE Fundamentals Handbook, ASHRAE Systems Handbook, ASHRAE Applications Handbook, and ASHRAE Equipment Handbook. Refrigeration equipment shall comply with ARI 520, ARI 550, and ARI 590.

1550-2.1.2 (Not Used)

1550-2.1.3 Condensers/Condensing Units

Air-cooled condensers and condensing units shall meet the standards, rating, and testing requirements of ARI 460 and ASHRAE Standard 20. Unless project-specific criteria dictate otherwise, <u>these units shall not be located on roofs</u>. The design professional shall locate air-cooled condenser intakes away from any obstructions that will restrict the air flow and from locations that receive peak solar heat gain. Air-cooled equipment shall be located away from noise-sensitive areas, and air-cooled condensers shall have refrigerant low head pressure control to maintain satisfactory operation during light loading.

1550-2.1.4 (Not Used)

1550-2.2 Electric Heating

Modulating electric heating designed to minimize room temperature swings shall be used or other forms of indirect heating shall be considered like heat recovery or release cycle heat pumps, etc.

1550-2.3 (Not Used)

9413202.1634

1550-2.4 (Not Used)

1550-2.5 Air Handling and Air Distribution Systems

1550-2.5.1 General

The design professional shall consider and design air handling equipment and air distribution systems sized to optimize both initial cost and air handling system operating and maintenance costs according to the procedures outlined here and in Section 0110-12.7, Building Analysis Procedures.

The design professional shall provide all air handling system equipment (fans, terminal units, handling units, etc.) with vibration isolators and flexible ductwork connectors to minimize transmission of vibration and noise. Systems shall satisfy the NC levels recommended for various types of spaces and vibration criteria as listed in the ASHRAE Handbooks. Where air handling equipment and air distribution systems cannot meet these requirements, sound attenuation devices shall be installed in the air handling systems.

Air flow diagrams shall be developed and provided in the preliminary design phase unless waived by the DOE project criteria. These diagrams shall be provided for each air handling and air distribution system, and shall include capacities and locations of fans, coils, filters, terminal devices, and other major air distribution system equipment, as well as air flows and air pressures and space pressure differentials.

Air flow velocities shall be designed to minimize settling of entrained particles as outlined in ACGIH Industrial Ventilation Manual.

Air handling and air distribution systems shall meet the energy conservation requirements for transport energy in ASHRAE Standard 90.1. Controls for air handling and air distribution equipment shall comply with Section 1595-6, Control of Air Handling Systems. Supply and or air intakes shall be located a minimum of 10 feet from any exhaust opening.

1550-2.5.2 Air Handling Units

The design professional shall select packaged air handling units complete with filters, coils, mixing boxes, fan section, and other accessories or built-up air handling units based on an evaluation and the requirements of NFPA 90A, AMCA Publication 261, and ARI 430.

1550-2.5.3 Fans/Motors

Fans shall be designed and specified to assure stable, nonpulsing aerodynamic operation in range of operation over varying speeds. Air handling units and fans in sizes over 1 hp use belt drives. Fans with motors of 10 hp or less shall be designed with adjustable motor pulley sheaves to assist in air balancing of systems. Fans with motors greater than 10 hp or less shall use fixed (non-adjustable) drives that can be adjusted by substituting fixed motor sheaves of different diameters. Supply air handling units and return air fans

in variable-air-volume systems shall control capacity through the use of variable-speed drives, inlet vanes or scroll bypass dampers. All fans shall comply with AMCA Standard 210, ASHRAE Standard 51, and ASHRAE Equipment Handbook.

Fans shall be located within the ductwork system according to the requirements of AMCA Publication 201 and ACGIH Industrial Ventilation Manual. The design professional shall consider the use of variable-speed drives on fans in variable-air-volume systems where the supply fans are larger than 5 BHP. Motors shall be sized according to properly calculated BHP fan requirements and shall not use oversized fans and motors to meet future capacity needs unless so directed by DOE project criteria.

The design professional shall consider the selection of fan construction materials based on corrosion resistance and cost. Spark-resistant construction shall be used where required by NFPA.

All fans and accessories shall be designed and specified to meet all smoke and flame spread requirements of NFPA 255.

1550-2.5.4 Coils

Heating and cooling coils shall comply with ARI 410. Heating or cooling coil selection shall not conflict with ASHRAE Fundamentals Handbook or ASHRAE Equipment Handbook. The design professional shall specify that coil manufacturers certify coil performance by ARI certification or provide written certification from a nationally recognized independent testing firm that will verify coil performance to be in accordance with ARI 410.

Heating and cooling coils shall be specified of materials appropriate for corrosive atmosphere in which they are contained.

Cooling coils shall be designed with a maximum face velocity of 600 fpm. Coils designed with face velocities exceeding 450 fpm shall be specified with provisions to prevent condensate carryover, or use moisture eliminators. Coils shall be specified with drain feature.

Recirculating air systems with outside air winter design temperatures below freezing shall be designed with a preheat coil located either in the outside air intake or in the mixed air stream upstream of the cooling coil, unless the theoretical mixed air temperature is calculated to be above 35°F. In this case, the preheat coils may be omitted if adequate baffling is provided to guarantee positive mixing of the return and outdoor air. Preheating coils shall be specified and designed to maintain discharge air temperature without modulation of the steam or hot water flow through use of modulating face and bypass dampers. Steam modulation may be used for control of steam coils in moderate climates where proven to be reliable without concern of coil freeze-up.

9413202.1635

9413202.1636

1550-2.5.5 Air Cleaning Devices

General

Air cleaning equipment for ductwork installation shall be easily removable, serviceable, and maintainable. Air cleaning equipment shall have face velocities as recommended by the filter manufacturer and the design manuals recommended above to achieve maximum efficiency minimum pressure drop.

Filters shall be constructed of noncombustible materials meeting the requirements for UL 900 Class I. Air filters shall be located on the suction side of fans and coils and in other special locations as required for air treatment. Air-filter pressure drop gauges of the diaphragm-actuated, dial-type (preferred) or the inclined manometer type shall be located on all filter assemblies.

Filters for Air Handling Systems Serving Inhabited Spaces

Filters include air filter devices and air filter media used in building environmental air handling systems for removing particulate matter from atmospheric air. These filters shall be specified to meet minimum efficiencies required by the ASHRAE Dust Spot method using atmospheric dust for medium-efficiency applications. Filters shall be specified and installed for use as pre-filters, medium-efficiency filters, or high-efficiency filters. These filters shall comply with ARI 850.

High-efficiency filters and assemblies shall comply with DOE project criteria. Electronic air cleaners and extended dry-surface filters shall be considered for use as high-efficiency filters. Pre-filters are normally provided, being either pre-filter or medium-efficiency filters depending on the upstream air particle size distribution.

Air-Cleaning Devices for Special Applications

Filters include dry type dust collectors, wet collectors, centrifugal collectors, adsorbers, absorbers, oxidizers, and chemical treatment filters that are used primarily in industrial and process-type applications associated with air or gases that have heavy dust loadings in exhaust systems or stack gas effluents. Filters shall be designed according to the requirements given in DOE project criteria, ASHRAE Equipment Handbook, and ACGIH Industrial Ventilation Manual and comply with the State of Washington air quality requirements.

1550-2.5.6 Ductwork Systems

Ductwork systems shall be designed for efficient distribution of air to and from the conditioned spaces with consideration of noise, available space, maintenance, air quality and quantity, and an optimum balance between expenditure of fan energy (annual operating cost) and duct size (initial investment).

9413202.1637

Ductwork systems shall be designed to meet the leakage rate requirements of SMACNA HVAC Air Duct Leakage Test Manual.

Ductwork, accessories, and support systems shall be designed to comply with ASHRAE Fundamentals Handbook, SMACNA Standards, ACGIH Industrial Ventilation Manual, and NFPA 45.

Ductwork shall also be designed to comply with NFPA 90A, including specification and installation of smoke and fire dampers at fire wall penetrations and smoke pressurization/containment dampers as required for smoke pressurization/evacuation systems. Fire dampers shall not be used on exhaust system ducting if it is required to maintain confinement of hazardous materials during and after a fire event.

Exhaust ductwork shall comply with NFPA 91. Ductwork for kitchen exhaust systems shall comply with NFPA 96.

Ductwork shall be designed to resist corrosive contaminants if present. Ductwork that handles air exhausted from shower rooms, dishwashing areas, or other areas causing condensation on the duct interior shall be of aluminum construction, have welded joints and seams, and have drainage at low points.

Ductwork thermal insulation shall comply with ASHRAE Standard 90.1. Ductwork shall be acoustically insulated to meet acceptable noise criteria.

Ductwork systems shall have testing and balancing dampers and accessories specified and led as discussed in Section 1550-3.2, Testing and Balancing Devices. The design professional shall specify automatic controls for ductwork systems and provide them in required locations as discussed in Section 1595, Control of Air Handling Systems.

Table 1550-3.2a Required Balancing Devices for Air Distribution Systems

System Components	Required System Devices
Diffusers, grilles, registers	Round butterfly or square/rectangular opposed blade volume damper, either integral with device or in spin-in take offs
Branch ductwork runs	Rectangular/square or round (with more than one opposed blade damper and terminal device). Sealed test hole for pitot tube traverse
Fan discharge ductwork	Sealed test holes for pitot tube traverse. Sealed test hole for static pressure measurements
Fan suction ductwork	Sealed test hole for static pressure measurement
Cooling coil suction and discharge airstreams	Duct-mounted airstream thermometer

Table 1550-3.2a Required Balancing Devices for Air Distribution Systems

System Components	Required System Devices
Diffusers, grilles, registers	Round butterfly or square/rectangular opposed blade volume damper, either integral with device or in spin-in take offs
Heating coil suction and discharge airstreams	Duct-mounted airstream thermometer
Mixed air plenum airstream	Duct-mounted airstream thermometer

9413202.1638

1550-3. TESTING, ADJUSTING AND BALANCING

1550-3.1 System Performance Tests

The design professional shall specify system performance tests for mechanical air distribution and HVAC water distribution systems to verify compliance with DOE project criteria These tests shall be performed by an independent AABC testing organization in accordance with the guidelines contained in ASHRAE Systems Handbook and AABC Volume A or by others as dictated in project-specific criteria.

1550-3.2 Testing and Balancing Devices

HVAC air and water distribution systems shall be provided with permanently installed calibrated testing and balancing devices and access as needed to accurately measure and adjust water flows or air flows, pressures, or temperatures as required. The design professional shall provide as a minimum the balancing devices in Table 1550-3.2a. Test devices shall be located and installed according to AABC Volume A.

1550-3.3 General Guidelines

Test and measuring locations shall be noted on construction drawings. The use of duct mounted air flow monitoring stations shall be considered where limited duct space or configuration restrict the use of pitot tube traverse procedures or where especially sensitive measuring requirements are dictated by the DOE project criteria.

1550-99 (Not Used)

ATTACHMENT P
REFRIGERATION

1565 REFRIGERATION

1565-1 CHLOROFLUORCARBON (CFC) LIMITATION AS A REFRIGERANT

1565-1.1 Coverage

These criteria provide guidance to reduce DOE dependence on regulated CFCs as refrigerants in HVAC systems. CFC-22 is the only refrigerant in common use for HVAC systems not subject to international regulation due to environmental concerns (ozone depletion). Production of regulated CFCs (CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, and, indirectly, refrigerant mixtures of those regulated CFCs such as CFC-500, CFC-501, and CFC-502) will be reduced 50 percent by 1993, with corresponding reduction of availability and increase in cost. Requirements to recycle and recover these regulated CFCs is expected in the near future. Continued installation of HVAC systems using regulated CFCs is unacceptable from operational and environmental viewpoints and shall be minimized to the maximum extent feasible.

Alternatives to CFC-11 and CFC-12 are being developed for use in existing equipment and future new equipment; however, significant technical problems have yet to be overcome. As technically proven alternative refrigerants become commercially available, these criteria will be updated to include their application. With present technology, the only feasible course to reduce DOE HVAC dependence on regulated CFCs is to limit new equipment to unregulated CFCs (CFC-22) where feasible and replace the existing inventory with equipment designed for CFC-22 as existing units fail.

1565-1.2 Effective Date

These criteria are to be implemented as of the date of this Order (4/6/89). Application is as follows:

- Projects in planning or programming and those in Title I design or less: Comply with these criteria.
- Projects in Title II design and those under construction: Implement where technically and economically feasible.

1565-1.3 Implementation

These criteria require immediate implementation to reduce DOE dependence on regulated CFCs to a minimum. The limitation of refrigerants to CFC-22 will be reviewed and relaxed to include alternative environmentally acceptable refrigerants as they become available. These criteria limit the use of CFCs in DOE design and construction and operations and maintenance programs to nonregulated compounds as follows:

9413202.1639

- New mechanical refrigeration equipment: Use CFC-22 as the refrigerant where feasible.

- Repair-by-replacement projects involving the complete refrigerant side of existing equipment: The replacement equipment shall use CFC-22 as the refrigerant.

1565-1.4 Exceptions

- Equipment in size ranges where CFC-22 equipment is not commercially available by a minimum of two suppliers with adequate operational experience. All available equipment types (reciprocating, and helical) shall be considered before making this decision.

- Repair projects involving partial replacement of the refrigerant side of a system, such as compressor or coil replacement only can use the existing refrigerant.

9413202.1640

ATTACHMENT Q
CONTROLS

1595 CONTROLS

1595-1 GENERAL

This section covers safety and operating controls, automatic temperature and humidity controls, energy monitoring and (central supervisory) control systems, energy conservation requirements for controls, and zoning requirements and restrictions.

Specific safety control system requirements for individual types of equipment are discussed in Section 1550, Heating, Ventilating and Air-Conditioning Systems (Attachment N).

Selection of control system types and associated equipment, shall be based on the most economical and maintainable system.

Control systems shall be designed to use the closed-loop feedback method of control. Open-loop systems shall not be used. Proportional-type control shall be used for all control systems; other type control systems shall be used as needed according to the degree of control required.

All control equipment shall be easily accessible. One temperature control panel shall be provided for each system, complete with panel-face-mounted indicators, switches, pilot lights, and tags. All control interlocks shall be through HOA switches.

Control air compressors shall be duplex non-lubricated type with oil lubricated crankcase and distance piece. Air shall be filtered and dried using refrigerated air dryers for dew point of 15°F.

Copper piping shall be used for high pressure air in inaccessible locations (plastic piping may be used if installed in conduit). Air leakage shall not exceed 5 percent of pressure in 24 hours. Transmitters shall be capable of field calibration and thermometers or pressure gauges shall be provided at transmitters. All controllers and thermostats shall be pilot-bleed type.

1595-2 ZONING

Zoning for automatic control of space temperatures, static pressures, humidities, ventilation, smoke and fire detection, security, and lighting shall satisfy health and safety requirements as indicated in DOE project criteria, NFPA 101, space operational and occupancy requirements, and zoning exposure with relation to building size, orientation and configuration.

9413202.1641

9413202.1642

Zoning requirements are as follows:

- Each HVAC system shall have a separate thermostat for space temperature regulation and a separate humidistat if humidity control is provided.
- No zone shall contain more than a single building floor regardless of floor space.
- Automatic controls shall be provided to shut off heating or cooling to any individual zone.
- Interior zones shall not be combined with external zones.
- Interior space zones shall be placed on separate air handling systems from external, if cost effective. External space zones shall be selected for each individual exposure.
- For office facilities and similar occupancies, each major orientation shall be zoned to have no more than 2,000 square feet of floor area with exterior exposure, and no more than 3,000 square feet of floor area with no exterior exposure.

1595-3 CONTROL SETBACK AND SHUTOFF DEVICES

With the exception of environmentally sensitive spaces identified by DOE project criteria as requiring constant year-round temperature or humidity control, automatic control setback and shutdown devices with manual override feature shall be provided for all HVAC systems. Use of separate or dual setting thermostats, switches, time clocks, or connections for on/off control through EMSs shall be considered for control of air-conditioning to raise cooling setpoint with humidity override during summer unoccupied periods and to control the heating setpoint during winter unoccupied periods.

1595-4 HUMIDITY CONTROL

Summer and winter space or zone humidity control shall be provided only on a space-by-space or zone-by-zone basis and not for the entire central ventilation system unless required for project-specific humidity requirements as stated in the DOE project criteria. No controls shall be provided to dehumidify spaces to below 50-percent relative space humidity or to humidify spaces to greater than 30-percent relative space humidity unless required on a project-specific basis.

1595-5 SIMULTANEOUS HEATING AND COOLING

Simultaneous heating and cooling shall not be used to control comfort conditions within a space by reheating or recooling supply air or by concurrent operation of independent heating and cooling systems serving a common zone except under the following conditions.

- Renewable energy sources are used to control temperature or humidity.

- Project-specific temperature, humidity, or ventilation conditions require simultaneous heating or cooling to prevent space relative humidity from rising above special-space relative humidity requirements.

- Project-specific building construction constraints as determined in DOE project criteria prohibit installation of other types of HVAC systems.

Where simultaneous heating and cooling must be used, the temperature and humidity controls shall be designed to limit energy consumption by the methods given in ASHRAE Standard 90.1.

1595-6 CONTROL OF AIR HANDLING SYSTEMS

1595-6.1 Mechanical Ventilation Control

All supply, return, and exhaust ventilation systems shall be equipped with automatic and manual control of fan operation to shut off the fan when ventilation is not required. These systems shall also be provided with manual gravity-operated or automatic control of dampers for outside air intake and exhaust or relief to prevent introduction of outside air when ventilation is not required. Systems that circulate air shall be provided with minimum outdoor air damper position control to assure that the minimum outdoor air quantity is being introduced to the system. Automatic dampers should fail open for return air and fail closed for outside air.

1595-6.2 Outdoor Air Cooling Control (Economizer Cycle)

All air handling systems that recirculate air and are used for space cooling shall be designed to automatically use outside air quantities up to 100 percent of the fan system capacity for cooling the space, with the exceptions noted in ASHRAE Standard 90.1. Economizer cycle control shall not be used for air handling systems where introduction of the additional outside air would actually increase energy consumption.

The economizer-cycle control system shall have a reset feature.

The economizer cycle control system shall be designed with a relief air control cycle to positively relieve the supply air from the space by sequencing return or relief fans or dampers to maintain a constant room static pressure. Systems using the economizer-cycle should be provided with adequate air filtration to handle the quality of the outside air.

1595-6.3 Automatic Control Dampers

Automatic air control dampers shall be specified to be the low-leakage type with a maximum leakage of 6 CFM/square foot at maximum system velocity of 1500 FPM and 1-inch pressure differential. The dampers shall be opposed-blade type for modulating control, but may be parallel-blade type for two-position control. Dampers shall be sized for at least 20 percent of the total ductwork resistance pressure drop. Return air dampers shall never be sized less than 1500 FPM. Pilot positioners and operators shall be out of airstream.

9413202.1643

1595-6.4 Variable-Air-Volume System Fan Control

Variable-air-volume systems shall be designed with control devices to sense ductwork static air pressure and velocity air pressure and control supply fan airflow and static pressure output through modulation of variable inlet vanes, mechanical speed drive controls, or variable frequency electric drive controls. These control systems shall have a minimum of one static pressure sensor mounted in ductwork downstream of the fan and one static pressure controller to vary fan output either through inlet vane, damper, belt modulator, or speed control. Exhaust fans, supply fans, and return or relief fans shall have control devices that interface the operation of the fans to "track" air volumes and maintain fixed minimum outdoor air ventilation requirements.

1595-6.5 Fire and Smoke Detection and Protection Controls

Engineered smoke pressurization and evacuation systems shall comply with the following:

- NFPA 90A
- NFPA 72E
- ASHRAE Manual, Design of Smoke Control Systems for Buildings
- ASHRAE Systems Handbook

All air handling systems shall be provided with the smoke and fire protection controls required by NFPA 101.

All supply, return, relief, and exhaust air ventilation systems shall have interlock controls that interface with fire and smoke detection system controls and either turn off or selectively operate fans and dampers to prevent the spread of smoke and fire throughout the buildings. These controls shall comply with NFPA 90A.

Special exhaust systems shall be designed to include fire and smoke safety controls as required by NFPA 91. Kitchen exhaust ductwork systems shall be designed to include all fire and smoke safety controls as required by NFPA 96.

1595-6.6 (Not Used)

1595-7 (Not Used)

1595-8 (Not Used)

1595-9 (Not Used)

1595-10 ENERGY MANAGEMENT SYSTEMS

9413202.1644

Central EMSs shall be provided where justified by LCC analysis. If cost effective, an EMS shall be combined with integral fire and smoke detection supervisory systems and lighting control systems. An EMS shall be specified with the capability to connect to additional building utility systems. When an EMS is contemplated for the future, other building system controls and instrumentation shall be selected that will allow for simple future interfacing.

See Section 0110-12.6 (Attachment K), Energy Management Systems.

1595-11 ENERGY METERING

The design professional shall design permanent metering in accordance with 10 CFR 435 for each type of nonprocess energy supplied to and consumed by new buildings and facilities owned and leased by DOE except for the following cases:

- Energy supplied to buildings and facilities where the total energy consumption is not expected to exceed 500 million BTU per year. See Section 0110-12.7 (Attachment K), Building Analysis Procedures.
- A type of energy supply that is estimated to be 10 percent or less of the total energy input to the building
- Renewable energy sources or recovered waste heat

Permanent submetering shall be considered and implemented for each type of process energy consumed in new buildings and facilities owned and leased by DOE if indicated in DOE project criteria.

Interface with an existing EMS shall be determined by DOE project criteria.

9413202.1645

ATTACHMENT R

(Not Used)

9413202.1646

ATTACHMENT S

(Not Used)

9413202.1647

9413202.1648

ATTACHMENT T
HEALTH AND SAFETY

0110-5 HEALTH AND SAFETY

0010-5.1 Performance Objectives

Health and safety performance objectives to be achieved in the design of DOE facilities include:

- Protection of the public and all personnel from injury and from exposure to toxic materials, radiation, and other hazards in accordance with DOE requirements and allowable limits
- Protection of private and public property against damage resulting from DOE operations
- Continuation of operations by minimizing accident potential
- Limitation of loss or damage to Federal property, including losses associated with the inability to readily decontaminate or decommission facilities for other subsequent uses

Specific project design criteria in the areas of emergency preparedness and emergency management shall be developed with the advice and assistance of DOE organizations responsible for DOE emergency management/emergency preparedness programs.

0110-5.2 Safety Analysis

All DOE facilities shall be evaluated for potential risks to the operators, the public, and the environment.

The preliminary safety analysis shall be initiated during the conceptual design phase of the project and further developed during preliminary (Title I) design and detailed (Title II) design phases. In most cases, these analyses are included in the project planning and design documentation (e.g., in conceptual design reports, Title I design reports). Facility design and construction features identified as a result of the PSAR shall be factored into the conceptual design before establishing the project cost estimate and requesting Congressional authorization for design and construction. The PSAR shall be completed and approved prior to the start of construction (including site preparation), consistent with DOE requirements.

The Final Safety Analysis Report (FSAR) shall be developed during the construction phase of the project and shall be completed and approved prior to the initiation of facility operations. The FSAR shall be updated as appropriate to reflect changes affecting safety that are made to the facility during its lifetime.

Areas to be addressed in the safety analysis include, but are not necessarily limited to, the following:

- Form, type, and amount of hazardous materials (nuclear or other) to be stored, handled, or processed
- Principal hazards and risks that can be encountered in facility operation, including potential accidents and predicted consequences of fire, explosion, radiation, toxic exposure, structural failure, wind, flood, earthquake, tornado, operating error, failure of essential operating equipment, and failure of safety systems
- Selected design basis accidents such as DBF, DBW, DBE, DBT, OBA, and DBFL. These shall be postulated and quantified, including the rationale for selection.
- Principal design, construction, and operating features selected for preventing accidents or reducing risks to acceptable levels, including the safety margins used

0010-5.3 Emergency Preparedness Planning

Each facility that has potential on-site or off-site effects during normal or abnormal operations shall have an Emergency Plan prepared which shall be incorporated with the Site Emergency Preparedness Plan.

9413202.1649

9413202.1650

ATTACHMENT U
FIRE PROTECTION

1.0 PURPOSE

To establish requirements for an "improved risk" level of fire protection sufficient to attain Department of Energy (DOE) objectives. A higher standard of protection may be justified in certain instances for the purpose of national security, program continuity, or protection of the public.

2.0 OBJECTIVES

a. to ensure that no threats to the public health or welfare will result from fire;

b. that there are no undue hazards to employees from fire;

c. that vital DOE programs will not suffer unacceptable delays as a result of fire; and

d. that property damage will be held to manageable levels.

3.0 DEFINITIONS

3.1 Improved Risk

The term involves the use and application of judgement and thus does not lend itself to a precise, fixed definition applicable in all locations and situations. It has the same meaning and intent as is commonly understood when this or the term, "Highly Protected Risk," is used in the insurance industry. Generally, an improved risk property is one that would qualify for complete insurance coverage by the Factory Mutual System, the Industrial Risk Insurers, and other industrial insurance companies that limit their insurance underwriting to the best protected class of industrial risk. Essential elements of a program complying with the improved risk concept are included in this directive. This term also implies that qualified fire protection engineering judgement has been used to obtain the highest economically justifiable level of industrial loss prevention. The most evident characteristic of an improved risk property is the existence of reliable, automatic fire extinguishing systems throughout all buildings of combustible construction or content where the building is vital to operational continuity or may experience a large property loss from fire in the absence of an automatic extinguishing system.

3.2 National Security

Those aspects of national security that could be affected adversely by fire, explosion, or other catastrophes.

9413202.1651

3.3 Protection of the Public Health and Welfare

Control of fire, explosion, or effects of hazards to minimize potential injury to the public and damage to property not owned by the Department.

3.4 Property

All Government-owned or leased property for which the Department has responsibility, except:

3.4.1 Property furnished under contract requiring contractor assumption of the risk of loss or damage to Government-furnished property.

3.4.2 Property covered by a private insurance policy specifying the Department of Energy as the beneficiary.

3.5 Fire Protection

Protection from a broad range of fire risks normally included in the analysis conducted by fire protection engineers. These include some aspects of related perils such as explosion, windstorm, earthquake, lightning, and water damage. Fire prevention programs are a necessary part of fire protection programs.

3.6 Maximum Credible Loss

The maximum loss that could occur from a combination of events resulting from a single fire. Considerable judgement is required to evaluate the full range of potential losses, but in general, readily conceivable fires in sensitive areas are considered. Examples are power wiring failures in cable trays, flammable liquid spills, and high-value parts storage areas or combustible exposures to sensitive machines. Any installed fire protection systems are assumed to function as designed. Due to the uncertainties of predicting human action, the effect of emergency response is generally omitted except for post-fire actions such as salvage work, shutting down water systems, and restoring production.

3.7 Maximum Possible Fire Loss

The maximum possible loss that cold occur in a single fire area assuming the failure of both automatic and manual fire extinguishing actions.

3.8 Property Loss

The dollar cost of restoring damaged facilities or equipment to their original condition, whether or not such restoration actually occurs. In determining loss, the estimated damage to the building and contents shall include replacement cost, less salvage value, plus the cost of decontamination and cleanup. Effects upon program continuity, auxiliary costs of fire extinguishment, and consequent effects on related areas should be included if the effects can be determined.

9413202.1652

3.9 Consultant Fire Protection Survey Program

The program under which fire protection surveys of principal DOE facilities are conducted for the Office of Operational Safety by fire protection engineers of selected contractors administered by this organization.

3.10 Fire Protection System

Any system designed to control or extinguish fires or to limit the extent of fire damage. These include:

3.10.1 Automatic suppression systems such as sprinklers or carbon dioxide systems.

3.10.2 Watchmen or automatic detection systems, water supplies, plus a fire department.

3.10.3 Walls and doors.

3.10.4 Building separation with credit for water supplies plus a fire department

4.0 RESPONSIBILITIES AND AUTHORITIES

4.1 The Director of Operational Safety (EH-34)

4.1.1 Develops fire protection requirements for programs and facilities and coordinates the development of design criteria with the Director of Projects and Facilities Management (MA-22) and other appropriate Headquarters organizations to assure the consistency of such criteria with the requirements of applicable codes and standards.

4.1.2 Evaluates and appraises the adequacy of Field Element fire protection programs and provides assistance to all Departmental Elements on all aspects of fire protection.

4.1.3 Administers the consultant fire protection survey program, issues survey reports to applicable Departmental Elements, and reviews programs for handling recommendations resulting from the surveys.

4.2 Program Senior Officials

4.2.1 Review proposed fire protection programs for that property under their responsibility.

4.2.2 Review field requests for exemptions from DOE criteria with EH-34 and MA-22 when requests require approval.

4.2.3 Review field implementation of the recommendations resulting from the consultant fire protection survey program. The Office of Operational Safety will act as the primary point of contact for the survey program and will distribute survey reports to Headquarters and field organizations as applicable.

4.2.4 For DOE facilities not subordinate to a field organization, the procedures of Paragraph 4.3 shall be followed.

4.3 Heads of Field Organizations

4.3.1 Provide and maintain an improved risk level of fire protection adequate to meet the objectives of Paragraph 2.0 for all physical property or material that represents an investment by the Department.

4.3.2 Provide and maintain a higher standard of fire protection than required to meet the improved risk requirements in instances when justified for purposes of national security, program continuity, or protection of the public.

4.3.3 Submit requests for exemptions to EH-34 for those facilities where, in the judgement of the Head of the Field Organization, compliance with Paragraph 2.0 above is not feasible.

4.3.4 Establish and maintain a system to assure that the intent of all DOE fire protection standards is incorporated in the plans and specifications for all new buildings and for major modifications of existing buildings.

4.3.5 Assist the Office of Operational Safety in coordination the consultant fire protection team survey at those facilities included in the survey program, establish action plans for compliance with recommendations resulting from the surveys, and forward compliance plans, exemption requests, and other requested data to EH-34.

4.3.6 Establish and maintain lists of facilities for which they have fire protection appraisal responsibility and designate for each the minimum frequency at which fire protection appraisals will be made. This list shall include facilities at which:

4.3.6.1 Property is valued at $1,000,000 or more. (All values in this paragraph are based on Factory Mutual System's Industrial Cost Trends of 1-87, using a 1-19-87 multiplier of 1.0. Post-1987 escalated values may be based on Factory Mutual or similar indexes.)

4.3.6.2 Property valued at less than $1,000,000 is located but where a fire protection appraisal is deemed to be justified.

4.3.6.3 A credible loss could delay a vital program in excess of 3 months or a significant component of a program in excess of 6 months.

9413202.1653

4.3.7 Conduct fire protection appraisals of facilities for which they have responsibility.

4.3.8 Provide loss prevention advice and assistance to contractors in need of assistance or who do not have their own professional staff assistance.

4.3.9 Submit to the EH-34 an annual summary covering the fire protection program and loss experience of the previous year.

5.0 DELEGATION OF "AUTHORITY HAVING JURISDICTION"

For those fire protection standards specifying alternative means of compliance subject to "the authority having jurisdiction," this authority is the applicable Departmental Element.

6.0 COMPLIANCE WITH IMPROVED RISK OBJECTIVES

6.1 Threats to the Public Health or Welfare and Hazardous to Life

6.1.1 Department of Energy buildings comply with the intent of the Life Safety Code and with specific requirements of 29 CFR Part 1910 applicable to exits and fire protection features.

6.1.2 The potential for fast spreading fires is controlled by severe restrictions on the ratings of interior finish materials for flame spread and smoke development and by compartmentation of hazardous materials.

6.1.2.1 Materials of unusual fire characteristics such as exposed urethane foams and materials developing large quantities of toxic products of combustion shall be prohibited for interior finish.

6.1.2.2 Hazardous materials, such as flammable liquids and explosives, shall be severely restricted in quantity and handled in conformance with all applicable codes. Special protection features suitable to the hazard should be installed and limits imposed on the number of people who must be exposed to the hazard.

6.1.2.3 Where noncompliance with some Life Safety Code provisions may be required for public safety, in some containment structures, additional protective systems and personnel limits should be maintained.

6.1.3 The facility containment systems are designed to preclude an offsite release of hazardous amounts of toxic materials under maximum credible fire conditions.

9413202.1654

6.1.4 Exhaust and ventilation systems, including filters, are protected or isolated from the effects of a credible fire to the extent that hazardous amounts of toxic materials or combustion products will not escape.

6.1.5 Natural or artificial means of controlling liquid runoffs from a credible fire are provided so that contaminated or polluting liquids will not escape the site, including potentially contaminated water resulting from firefighting operations.

6.2 Unacceptable Program Delays

The objective of no unacceptable impairment of a vital program can be considered to have been attained when:

6.2.1 The maximum credible fire will not result in the loss of uses of a vital facility for a period longer than that specified as acceptable to the applicable Program Senior Official.

6.2.2 In the absence of a defined acceptable shutdown period, the maximum credible fire will not result in the interruption of a vital program (weapons production, uranium enrichment) for a period in excess of 3 months, or a significant part of a program (major accelerator, single diffusion plant) for a period in excess of 6 months.

6.3 Property Damage Limitation

The objective of limiting property loss can be considered to have been attained when fire protection systems are provided as follows:

6.3.1 When the maximum possible property loss is in the range of $1-25 million, an automatic fire protection system is provided that will limit the probable loss to the lower figure.

6.3.2 When the maximum possible property loss is in the range of $25-50 million, a redundant protection system is provided that, even in the failure of the primary system, should limit the loss to the lower figure.

6.3.3 When the maximum possible property loss exceeds $50 million, redundant systems are provided as in Subparagraphs 6.3.1 and 6.3.2, above, and a failure-proof type of fire protection system, such as blank walls or physical separation, is provided to limit the maximum property loss to $75 million.

6.4 Higher Standard of Protection

A higher standard of protection, usually including some form of automatic protection, is described in Paragraph 1.0 as being justified when certain considerations, beyond those mentioned in Paragraphs 6.1, 6.2 and 6.3, above, play a major role in the management decision process. The specific level at

9413202.1655

which an automatic protection system should be installed requires qualified fire protection engineering judgement. In general, the probable loss should be limited to $250,000 in such cases. The following points should be considered in evaluating the need for automatic fire extinguishing systems:

6.4.1 Importance

Vital property may require protection without regard to the dollar loss potential. For example, it may be desirable to protect a low-value or temporary storage shed when it may contain critical or long procurement time construction items. In illustration, a trailer may have a temporary protection system when it is used as a control center for a vital, one-time event. Particularly high public visibility or sensitivity may also be justification for protection of otherwise low-value property.

9413202.1656

6.4.2 Effect on Production

Protection costs may be high in relation to the value protected but still warranted, as in the case of cooling towers and electrical switchgear, where loss of the unit could result in the shutdown of other facilities.

6.4.3 Cost Versus Benefit Ratios

A building such as a lumber or paint shed may be of low value and importance but may be easily protected by extending sprinklers from an adjoining protected building at a low incremental cost.

6.4.4 Exposure

Constructions heads or trailers may warrant protection when they must be installed in or adjacent to more important facilities.

6.4.5 Future Conditions

Even when the above conditions are not applicable protection may still be warranted when conditions are extrapolated to the future. For example, a storage building may be of low value when designed, but normal escalation of content value may indicate it would need protection in a few years, in which case it would be more effective to install the protection as part of the original construction. Similarly, evaluation of office or low hazard laboratory occupancies may indicate that the hazard or combustible loading of similar facilities increases consistently with time, justifying protection at an early phase. Provision of automatic protection in the initial construction also allows more flexibility for future modifications. For example, conversion to a higher hazard occupancy may be prohibited due to a lack of appropriate built-in protection.

7.0 ESSENTIAL ELEMENTS OF AN IMPROVED RISK FACILITY

7.1 An improved risk facility is characterized by a sufficiently high level of fire protection to fulfill requirements for insurability by

the Factory Mutual System, Industrial Risk Insurers, or other private industrial fire insurance companies that limit their underwriting to the best protected class of industrial risks. A basic requirement is the provision of automatic fire extinguishing systems in all areas subject to serious property damage or business interruption losses as a result of fire. Above all other requirements, to qualify for an improved risk rating, it is necessary that strong, tangible evidence be available attesting to existence of continuing sincere interest by management and employees in minimizing losses from fire and related perils.

7.2 DOE facilities qualifying as improved risk will incorporate the following physical improvements and internal programs, and maintain records for appraisal of the programs:

7.2.1 Review of plans prior to contemplated construction to assure adequacy of fire risk appraisal and protection, and follow up review to ensure that fire protection features are provided where necessary to comply with Paragraph 6.0 above.

7.2.2 Regular self-inspections, tests, fire loss potential reviews and appraisals to identify the nature, location, and severity of fire risks (injuries, dollar loss, programmatic interruption, release of toxic and radioactive materials) as well as to determine adequacy of fire loss control devices and activities.

7.2.3 Periodic audits by outside fire protection authorities such as contractor facility appraisals by field fire protection engineers.

7.2.4 Plans, procedures, devices, and trained personnel adequate to permit controlling any credible fire emergency that may arise on the facility.

7.2.5 Limitation by physical means (e.g., geographic isolation, fire-walls, firedoors, draft barriers) of areas that can be directly damaged in the event of a single fire.

7.2.6 Quality construction which in most cases is defined as fire resistive or noncombustible type buildings with segregation or isolation of particularly hazardous operations.

7.2.7 Enclosures of adequate fire resistant construction for stairways, elevators, ducts, and other openings coupled with fixed or manual devices (such as self-closing doors or dampers, draft stops, or water curtains) to control or limit both vertical and horizontal fire spread potentials.

7.2.8 Protection of special hazards by isolation, segregation, or use of special fire control systems (e.g., automatic sprinklers, inert gas flooding, explosion suppression) together with devices (e.g., relief valves, filters, roof hatches, scuppers, blast walls) for limiting or

9413202.1657

controlling damage potentials of fire, hazardous smoke, gases, and water runoff, or other occurrences, that may reasonably be anticipated during a fire emergency.

7.2.9 Adequate, reliable fire protection water supplies and distribution systems coupled with adequate hydrants, inside standpipes, and other devices to facilitate utilization of such water during fire emergencies.

7.2.10 Adequate automatic and manual means for detecting and reporting incident fires including, but not limited to, watchman service.

7.2.11 Automatic sprinkler protection for all combustible construction or occupancies where potential losses exceed Departmental criteria.

7.3 Improved risk facilities shall be appraised periodically by the appropriate organization in sufficient depth to establish that:

7.3.1 The programs described in Subparagraph 7.2 above are being conducted.

7.3.2 Loss potentials, including programmatic effects, have been determined and appropriate protection system shave been provided to reduce the effects to the acceptable lees in Paragraph 2.0 or an exemption from these requirements has been obtained.

7.3.3 Effective action has been taken to comply with previous recommendations, initiate corrective actions on previously identified deficiencies, and reduce the adverse effects of noncompliance in areas where compliance has not yet been achieved or where exemptions have been allowed.

7.3.4 Losses, impairments, and unusual incidents are investigated and analyzed in sufficient depth to identify causes, economical and effective corrective methods, and areas where similar problems may exist or where additional studies may be required.

7.4 In addition to internal, Headquarters, and field appraisals, improved risks are generally characterized as those also surveyed by independent third party interests. For major facilities, this service is provided by consultant fire protection survey program.

7.5 Periodic fire protection appraisals of each facility shall be initiated by qualified fire protection engineering personnel as soon as practicable after listing of the facility by the Department. The appraisals shall include the items under Subparagraph 7.3, above.

7.6 In addition to performing periodic appraisals, the appraising office will maintain a continuous surveillance of improved risk facilities by:

9413202.1658

7.6.1 Assuring that plans, proposals, loss reports, investigation report, and other applicable materials are reviewed by knowledgeable personnel in sufficient depth to determine that the facility is maintaining the review and protection programs described in Subparagraph 7.2, above.

7.6.2 Providing technical assistance and advice as requested by the contractor and as deemed necessary by the field organization.

7.6.3 Assuring that facility management is kept advised of requirements, programs, and applicable information generated by Headquarters, or other agencies, and that information developed by the facility or by other facilities with mutual interests, is disseminated among the interested parties.

9413202.1659

8.0 CONSULTANT FIRE PROTECTION SURVEY PROGRAM

8.1 Consultant fire protection team surveys will be conducted periodically at facilities determined to be of major importance to the DOE mission. Major improved risk survey groups have been contracted to conduct surveys of the improved risk status of Department facilities.

8.1.1 A survey shall be conducted at each facility containing more than $25,000,000 in replacement value of Government property.

8.1.2 Following the initial survey, a resurvey shall be made at each facility at approximately 5-year intervals.

8.1.3 Reports of the surveys shall be submitted to EH-34 for review and distribution to the appropriate contractors through the appropriate DOE element.

8.2 For each survey, Heads of DOE Elements:

8.2.1 Shall designate a coordinator to assist the team in obtaining logistical support, facility access, and technical information as determined necessary by the Office of Operational Safety.

8.2.2 Shall review the contractor's compliance efforts and forward compliance data as requested by EH-34.

8.2.3 May omit any appraisal that would coincide with the period in which the consultant fire protection team survey is being conducted.

8.3 Following each survey, the appropriate organization will be requested to submit an action plan.

8.3.1 Action plans are submitted directly to the Office of Operational Safety.

8.3.2 Initial action plans are requested in the transmittal letter accompanying the final report of the survey and will be due at the next scheduled update.

8.3.3 Action plans will be reviewed by EH-34 and revised status reports will be requested approximately once a year for those sites requiring prolonged corrective actions.

8.4 Output data from the action plans shall be furnished yearly to appropriate Departmental Elements for budgeting and planning purposes.

9413202.1660

9413202.1661

ATTACHMENT V
QUALITY ASSURANCE

Facility design shall be conducted under QA requirements to ensure that the established program and project quality objectives are satisfied. A QA program shall be developed and implemented in compliance with DOE requirements.

Control mechanisms shall be established to ensure that: (1) design inputs are correctly translated into design documents in a timely manner; (2) organizational and physical interfaces are identified and controlled; (3) changes to design are controlled in a manner commensurate with the original design; (4) the design is independently verified to be adequate; (5) documentation and records of the design and design verification processes are maintained in accordance with the QA program.

QA encompasses all those planned and systematic actions and controls necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. QA includes *quality control*, which includes actions needed to ensure that the physical characteristics of a material, structure, component, or system meet predetermined requirements.

An adequate QA program provides the following assurances:

- Organizational interfaces are identified and controlled.
- The design is independently verified to be adequate.
- A document control system is in place.
- A change control system is in place.

The QA program shall include quality control functions in the following areas:

- The design will satisfy program and project requirements.
- The prepared drawings and construction specifications adequately incorporate QA, design, and codes and standards requirements and are available in a timely manner.
- Construction can be performed in accordance with design.
- Tests, reviews, or inspections confirm the adequacy of design and quality of construction and manufactured components, where appropriate.
- Lock and tag systems are provided for turnover acceptance, maintenance, and system outages.

As a part of the QA program, architectural and engineering portions of design should be closely coordinated and *functionally analyzed* during the conceptual, preliminary (Title I), and detailed (Title II) design phases to avoid conflicts that could result in costly changes during construction. Prior to initiating Title I and Title II design, QA requirements shall be established for the project systems, subsystems, and components. The following shall be determined:

- What the facility is to accomplish
- The range of operating conditions
- The required degree of reliability
- The intended useful life
- How it can be maintained, repaired, or replaced

Wherever possible, design shall reflect experience gained on similar projects or similar types of construction.

Provisions shall be made for review and checking design calculations, drawings, and construction specifications by qualified personnel other than those responsible for the original design.

Deviations from specified standards shall be identified and procedures established to ensure their control.

To the extent practicable, and particularly in the case of innovative design, the design should be independently reviewed by competent consultants in construction or manufacturing techniques to confirm the practicability of construction or manufacture.

9413202.1662

U.S. DEPARTMENT OF ENERGY
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

FLUOR DANIEL, INC.
Advanced Technology Division
Fluor Contract 8457

SECTION 16312
13.8 kV-480Y/277 VOLT UNIT SUBSTATION
B-595-C-A920-16312

APPROVED FOR CONSTRUCTION

9413202.1663

REVISION 0
ISSUE DATE 3-10-93

WAPA YES ___ NO X
QUALITY LEVEL I ___ II X
SAFETY CLASS 1__ 2__ 3__ 4 X

ORIGINATOR:

Reza Nikkhah 3/8/93
Reza Nikkhah, Electrical Engineer Date

CHECKER:

3/8/93
S. Sobh, Electrical Engineer Date

APPROVED BY:

MAR 1 2 1993

K. A. Owrey
K. A. Owrey Lead Discipline Engineer

3-8-93
Date

SECTION 16312
13.8 kV-480Y/277 VOLT UNIT SUBSTATION
B-595-C-A920-16312

TABLE OF CONTENTS

PART		PAGE
PART 1	GENERAL	1
1.1	SUMMARY	1
1.2	REFERENCES	1
1.3	RELATED REQUIREMENTS	2
1.4	DEFINITIONS	2
1.5	SYSTEM DESCRIPTION	2
1.6	SUBMITTALS	2
1.7	CLASSIFICATION OF SYSTEMS AND COMPONENTS	4
1.8	PROJECT OR SITE ENVIRONMENTAL CONDITIONS	4
PART 2	PRODUCTS	4
2.1	MATERIALS/EQUIPMENT	4
2.2	FABRICATION AND MANUFACTURE	11
PART 3	EXECUTION	12

ATTACHMENTS

ATTACHMENT	TITLE
A	ONE-LINE DIAGRAM
B	METAL-ENCLOSED INTERRUPTER SWITCHGEAR, DATA SHEET A920-DS-1
C	DRY-TYPE TRANSFORMER, DATA SHEET, A920-DS-2

9413202.1664

9413202.1665

SECTION 16312
13.8 kV-480Y/277 VOLT UNIT SUBSTATION

PART 1 GENERAL

1.1 SUMMARY

This specification covers the technical requirements for the design, fabrication, inspection, testing and delivery of an indoor 13.8 kV-480Y/277 Volt Unit Substation for Fabrication Shop. The assembly shall be furnished as a coordinated package and shall consist of load interrupter switch, dry-type transformer and low voltage switchboard.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation.

AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)

ANSI C57.12.51	1981 Ventilated Dry-Type Power Transformers, 501 kVA and Larger, 3 Phase, with High-Voltage 601 to 34,500 Volts, Low Voltage 208Y/120 to 4160 Volts, Requirement for (R-1989)
ANSI C37.20.3	1987 Metal Enclosed Interrupter Switchgear
ANSI C37.47	1981 Distribution Fuse Disconnecting Switches, Fuse Supports, and Current Limiting Fuses, Specification for (R-1988)
ANSI C37.55	1989 Switchgear-Metal Clad Switchgear Assemblies - Conformance Test Procedures
ANSI/IEEE C57.13	1978 Standard Requirements for Instrument Transformers (R-1987)
ANSI 242	1986 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)

IEEE C57.12.01	1989 Standard General Requirements for Dry-Type Distribution and Power Transformers Including those with Solid Cast and/or Resin-Encapsulated Windings.

9413202.1666

IEEE C57.12.91	1979 Standard Test Code for Dry-Type Distribution and Power Transformers

NATIONAL ELECTRIC MANUFACTURER'S ASSOCIATION (NEMA)

NEMA 250	1985 Enclosures for Electrical Equipment (1000 Volts Maximum), Rev. 2, 1988
NEMA ST-20	1986 Dry-Type Transformers for General Applications
NEMA PB2	1989 Dead-Front Distribution Switchboards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	1990 National Electric Code (NEC)

UNDERWRITERS LABORATORIES INC. (UL)

UL 891	1984 Standard for Safety Dead-Front Switchboards (Edition 1991)

1.3 RELATED REQUIREMENTS

Specification Section 01730 Operation and Maintenance Data

Specification Section 13121 Fabrication Shop Building

1.4 DEFINITIONS

Subcontractor - Fabrication Shop Manufacturer

1.5 SYSTEM DESCRIPTION

The 13.8 kV-480Y/277 Volt Unit Substation shall provide permanent service to the Fabrication Shop Building.

1.6 SUBMITTALS

Submit the following in accordance with the Vendor Drawing and Data Requirements section of the Order/Subcontract.

1.6.1 Data Sheets

Submit Product Data Sheets for load interrupter switch, transformer, switchboard and interconnection.

9413202.1667

1.6.2 Shop Drawings

1.6.2.1 Submit the following:

1.6.2.1.1 Dimensional plan and front elevation.

1.6.2.1.2 Interconnecting bus arrangement.

1.6.2.1.3 Conduit entrance locations.

1.6.2.1.4 Connection between shipping sections to be installed during field assembly.

1.6.2.1.5 Neutral and ground bus connections.

1.6.2.1.6 Weight of equipment for each shipping section.

1.6.2.1.7 Elementary diagram of overall system.

1.6.2.1.8 Size and location of anchor bolts hold down and/or base frame details.

1.6.3 Materials List

Material list shall be furnished for equipment supplied, listing the quantity, type, rating and manufacturer's catalog number of all equipment in each unit.

1.6.4 Spare Parts List

A list of manufacturer's recommended spare parts for start-up and one (1) year's operation. Include sufficient data to permit procurement from the original manufacturer or any subsupplier.

1.6.5 Installation, operating, and maintenance manuals shall be in accordance with Specification Section 01730.

1.6.6 Test Reports

Submit factory certified test reports after performing Factory Acceptance Tests in accordance with Paragraph 2.2.1.

1.6.7 Detailed Factory Acceptance Test procedures for Buyer's approval, to include factory tests described under Factory Acceptance Test Paragraph 2.2.1.

1.6.8 Recommended field acceptance test procedures.

9413202.1668

1.6.9 Rating Certification

Seller shall provide certification that equipment is rated for continuous operation in the environmental conditions defined in this specification.

1.6.10 Underwriter's Laboratories Listing

A copy of the UL Listing Card showing compliance with applicable UL Standards as listed in this specification.

1.6.11 Installation Instructions

Submit manufacturer's installation instructions.

1.6.12 Operation and maintenance data in accordance with Specification Section 01730, "Operation and Maintenance Data."

1.7 **CLASSIFICATION OF SYSTEMS AND COMPONENTS**

(Not Used)

1.8 **PROJECT OR SITE ENVIRONMENTAL CONDITIONS**

1.8.1 Climatic and Geographic Site Conditions

A.	Site Elevation	714 feet above sea level
B.	Barometric Pressure	14.3 psia

1.8.2 Electrical equipment and material shall be suitable for continuous operation at the following ambient temperatures:

Area	Design Ambient Temperature Range
Outdoors	110°F maximum, -20°F minimum
Indoors - General	104°F maximum

PART 2 PRODUCTS

2.1 **MATERIALS/EQUIPMENT**

2.1.1 Load Interrupter Switchgear

2.1.1.1 The metal-enclosed switchgear assembly shall consist of indoor self-supporting structure, containing interrupter switch and power fuses with the necessary accessory components, all completely factory-assembled and operationally checked in accordance with ANSI C37.20.3 and ANSI C37.55. The unit shall be designed for top

9413202.1669

entry and be provided with a means to permanently anchor the unit to its foundation pad.

2.1.1.2 The switchgear shall be designed for use on a 13.8 kV, three-phase, three-wire, 60 Hz, 2000 A resistance-grounded power system, with rms symmetrical fault current as shown on the data sheet (Attachment B).

2.1.1.3 The switchgear shall be closed coupled to the transformer. The switchgear can be mounted on the same skid as the transformer or mounted separately on its own skid with facilities for lifting and base construction for rolling the assembly in either direction.

2.1.1.4 Phase-to-phase and phase-to-ground clearance, equivalent to 95 kV BIL minimum, shall be maintained throughout the switchgear unit.

2.1.1.5 Air Interrupter Switch

2.1.1.5.1 The interrupter switch shall be rated as shown on the data sheet and 3-pole group operated by the means of a switch.

2.1.1.5.2 The interrupter switch shall be closed and opened manually.

2.1.1.5.3 Switch operator shall be of the stored energy type. Switch shall be equipped with an integral quick-make quick-break mechanism.

2.1.1.5.4 The door of switch section shall be mechanically interlocked with the switch to prevent opening of the door with the switch closed or closing the switch with the door open.

2.1.1.5.5 The door shall have a Plexiglas or equal wide-view window to permit checking the switch position.

2.1.1.5.6 Provision shall be made for padlocking the operating mechanism in the open position.

2.1.1.5.7 Furnish all 15 kV cable lugs. Lugs shall be solderless type.

2.1.1.6 Power Fuses

2.1.1.6.1 Fuses shall be solid-material type, self-contained and shall provide fast and complete interruption with a minimum of let-through current in accordance with ANSI C37.47.

2.1.1.6.2 Fuses shall be equipped with a blown-fuse indicator that shall provide visible evidence of fuse operation while installed in the fuse mounting.

2.1.1.6.3 Fuses shall be sized by the switchgear supplier to protect the dry type transformer per Article 450 of the NEC.

2.1.1.6.4 Fuses shall be accessible for inspection, removal and changeout.

2.1.1.6.5 One set of spare fuses shall be provided.

2.1.1.7 Ground Bus

2.1.1.7.1 A continuous copper ground bus shall be provided the entire length of the assembly. It shall be equipped with solderless crimp connectors for No. 2/0 AWG copper cable at each end for connection to ground grid.

2.1.1.8 Switchgear Identification

2.1.1.8.1 The switchgear assembly shall be provided with an external stainless steel nameplate indicating the manufacturer's drawing number, voltage ratings (kV, nominal; kV, maximum; kV, BIL), main bus continuous rating (amperes), short-circuit ratings (amperes, rms symmetrical), and the momentary and fault-closing ratings (amperes, rms asymmetrical).

2.1.1.9 Warning Signs

2.1.1.9.1 External door and hinged bolted panels providing access to high voltage shall be provided with "CAUTION - HIGH VOLTAGE - KEEP OUT" signs.

2.1.1.9.2 Protective screens providing access to high voltage shall be provided with "DANGER - HIGH VOLTAGE - KEEP OUT - AUTHORIZED PERSONNEL ONLY" signs.

2.1.2 Dry-Type Transformer

2.1.2.1 The transformer shall be dry-type, resin encapsulated type, in accordance with ANSI C57.12.51, IEEE C57.12.01 and NEMA ST-20.

2.1.2.2 The transformer shall be mounted in NEMA Type 1 ventilated enclosure free standing, suitable for indoor installation with provision for future forced cooling.

2.1.2.3 The transformer shall be three phase, 60 hertz with primary and secondary voltages as shown on Attachment C.

2.1.2.4 The transformer shall be designed for continuous operation at the specified KVA rating and at the specified ambient temperature and site elevation conditions without exceeding the average winding temperature rise. Specified KVA rating and temperature rise shall be as shown on Attachment C.

2.1.2.5 Insulating level (BIL) shall be as specified on Attachment C and in accordance with IEEE C57.12.01.

9413202.1670

9413202.1671

2.1.2.6 The percent impedance shall be based on the self-cooled rating of the transformer as shown on Attachment C and in accordance with IEEE C57.12.01.

2.1.2.7 Transformer Enclosure

2.1.2.7.1 The enclosure shall be constructed of heavy gauge sheet steel in accordance with ANSI C57.12.51, IEEE C57.12.01 and NEMA ST-20 for indoor enclosure. The base shall be constructed of structural steel members to permit skidding or rolling in any direction.

2.1.2.8 Short Circuit Requirements

The transformer, including all items such as bushings, connections, buses and taps, shall be designed and constructed to withstand the mechanical and thermal stresses produced by external short circuits having a duration of 2 seconds and a magnitude specified in accordance with IEEE C57.12.01.

2.1.2.9 Nameplates

2.1.2.9.1 A stainless steel nameplate shall be mounted approximately at eye level height on transformer enclosure, and shall present as a minimum the following information:

A. Graphic representation of the connections of the high voltage and low voltage windings.

B. The KVA rating and temperature rise.

C. Transformer impedance, on the base KVA rating.

D. Tap position, voltage, and full load current at each tap setting.

E. Low voltage rating and full load current.

F. Temperature rise in °C.

G. Total weight, and weight of core and coils.

H. Conductor material of each winding.

2.1.2.9.2 In addition to the above, provide a nameplate as described in Paragraph 2.1.8 with the following inscriptions:

XT-32B-001
13,800-480Y/277 Volt
750 KVA Transformer

9413202.1672

2.1.2.10 Taps

2.1.2.10.1 Four (4) 2.5 percent full capacity no load taps shall be supplied at the high voltage windings, two (2) above and two (2) below rated voltage.

2.1.2.11 Bushings

2.1.2.11.1 The insulation level of the line bushings shall be not less than that specified for the winding terminals to which they are connected.

2.1.2.11.2 Neutral connection shall be furnished for three phase Wye-connected windings. Neutral shall be connected to the ground bus.

2.1.2.12 Grounding

The transformer cores shall be grounded to the base and to the ground bus.

2.1.2.13 Provisions for Handling and Field Erection

2.1.2.13.1 Lifting

Means for lifting the complete transformer shall be provided. Lifting means, such as lifting lugs or eyes, shall be free of sharp edges.

2.1.2.13.2 Moving Facilities

The base shall permit sliding or rolling (using pipe rollers) in the directions of both center lines of the transformer and provision shall be made for moving the transformer in these directions.

2.1.2.14 Warning Signs

2.1.2.14.1 The transformer shall be provided with appropriate precautionary warning signs to call attention to potential hazards of the equipment.

2.1.2.14.2 External door providing access to high voltage shall be provided with a warning sign reading "DANGER - HIGH VOLTAGE - KEEP OUT - AUTHORIZED PERSONNEL ONLY."

2.1.3 Distribution Switchboard

2.1.3.1 The distribution switchboard shall be part of the indoor 13.8 Kv-480Y/277 Volt Unit Substation and shall meet NEMA Standard PB2 and UL 891. The switchboard shall be braced to withstand 65 ka Rms short-circuit current.

9413202.1673

2.1.3.2 The switchboard shall be rated 1200 amp and shall be designed for 480Y/277 Volt, 3-phase, 4-wire, 60 hertz, solidly grounded system.

2.1.3.3 The switchboard shall be totally enclosed, dead front, self-supporting and front accessible. The enclosure shall be Type 1 per NEMA Standard 250.

2.1.3.4 Number and type of branch breakers shall be by the Subcontractor. Additional 20 percent spare branch breakers shall be provided fully equipped for future use. The switchboard shall also include an additional row of space for future 480 V, three-phase and 277 V, single pole breakers.

2.1.3.5 Switchboard shall be double row construction and provided with a removable top plate for outgoing feeders.

2.1.3.6 Switchboard shall be provided with lifting means and anchoring capability.

2.1.3.7 Busses

Main bus and distribution busses shall be tin or silver-plated copper and shall meet U.L. and NEMA standards for temperature rise. They shall be 100 percent rated.

2.1.3.7.1 The neutral bus shall be 100 percent rated.

2.1.3.7.2 The ground bus shall extend the entire length of the switchboard and shall be equipped with solderless crimp connectors for No. 2/0 AWG copper cable at each end.

2.1.3.7.3 Provisions shall be provided for future extension on one end.

2.1.3.8 Protective Devices

2.1.3.8.1 Overcurrent devices shall meet the requirement of NEC (NFPA 70) for rating.

2.1.3.8.2 The main disconnect device shall be fixed solid state trip molded case circuit breaker with long time, short time and ground fault protection.

2.1.3.8.3 Feeder circuit breakers shall consist of 600 Volt, 3-pole, 100 amp frame minimum, molded case circuit breaker with thermal magnetic trip.

2.1.4 Control Wiring and Terminal Blocks

2.1.4.1 Internal control wiring shall be flexible stranded copper conductor, minimum #14 AWG, 600 volt, single conductor having moisture

9413202.1674

resistant and flame retardant insulation. All wiring shall be bundled and supported by straps.

2.1.4.2 All screw-type wire terminations shall make use of compression type connectors which grip the conductor and employ insulated compression sleeves to grip the wire insulation.

2.1.4.3 Terminal blocks shall be located so that control wiring is accessible without exposing personnel to bus voltage. Terminal blocks shall have at least 20 percent spare terminal positions.

2.1.4.4 Short circuiting type terminal blocks shall be provided for current transformer circuits.

2.1.5 Meters

2.1.5.1 Both voltmeter and ammeter shall be semi-flush mounted square with scale spread 250 circular degrees. Moving elements shall be provided with zero adjustment. Accuracy shall be ±1 percent of full scale deflection.

2.1.6 Selector Switches

2.1.6.1 Both voltmeter and ammeter selector switches shall be heavy duty switchboard type with "Knurled Knob" handles.

2.1.7 Instrument Transformers

2.1.7.1 Current Transformers

2.1.7.1.1 The current transformers thermal and mechanical capabilities shall be sufficient to withstand, without damage, the momentary and interrupting requirements same as the switchboard.

2.1.7.1.2 Normal current-carrying capacities and ratio shall be as indicated on the One Line Diagram (Attachment A).

2.1.7.1.3 Metering accuracy shall meet or exceed ANSI/IEEE C57.13.

2.1.7.2 Potential Transformers

2.1.7.2.1 The potential transformers shall be accessible from the front of the switchboard and shall be equipped with current limiting fuses sized to prevent overload to the potential transformers. Fuses shall be installed in both the high and low voltage circuits.

2.1.8 Nameplates

2.1.8.1 Nameplates shall be engraved phenolic to show black letters on white background. Attachment of nameplate shall be by means of self-tapping screws. Rivets or sheet metal screws are not

acceptable. Assembly nameplate lettering shall be a minimum of 3/4 inch high and miscellaneous items shall have lettering height of 1/8 inch minimum.

2.1.8.2 The switchboard shall have a nameplate with the following inscriptions:

Fabrication Shop
SB-32B-001
480Y/277 Volt
3Ø, 4W, 1200A, 60 Hz

2.1.8.3 The switchboard shall have a stainless steel nameplate indicating as minimum the switchboard rating for voltage, phase, frequency, continuous ac main bus ampacity and RMS symmetrical short circuit capacity.

2.2 **FABRICATION AND MANUFACTURE**

2.2.1 Factory Acceptance Test

2.2.1.1 Load Interrupter Switch

2.2.1.1.1 The complete switchgear shall be subjected to factory acceptance tests in accordance with ANSI C37.20.3 and ANSI C37.55.

2.2.1.1.2 Inspection checks of the switch mechanism and manual operation shall be made prior to electrical test of the switch.

2.2.1.2 Dry-Type Transformer

Transformer shall be subjected to a Factory Acceptance Test in accordance with IEEE C57.12.91. As a minimum, the following tests shall be performed.

2.2.1.2.1 Resistance measurements of all windings on the rated voltage tap of transformer.

2.2.1.2.2 Ratio tests on the rated voltage connections and on all tap connections.

2.2.1.2.3 Polarity and phase relation tests on the rated voltage connections.

2.2.1.2.4 No load losses and excitation current at rated voltage and frequency on the rated voltage connections.

2.2.1.2.5 Impedance voltage and load loss at rated current and rated frequency on the rated voltage tap and tap extremes.

2.2.1.2.6 Applied potential and induced potential tests.

9413202.1675

2.2.1.2.7 Regulation and efficiency calculations at rated load and rated voltage. Regulation shall be stated at both 0.8 and 1.0 power factor. Efficiency shall be stated at 1/4, 1/2, 3/4 and full load on the self-cooled rating.

2.2.1.2.8 Temperature rise test.

2.2.1.3 Switchboard

Switchboard shall be subjected to Factory Acceptance Tests per NEMA PB2 and UL 891. The complete switchboard shall be tested for operation under simulated service conditions to assure correct electrical and mechanical functioning of all equipment. Before energizing the equipment, the insulation resistance of each bus shall be measured from phase-to-phase and from phase-to-ground with disconnect devices open.

9413202.1676

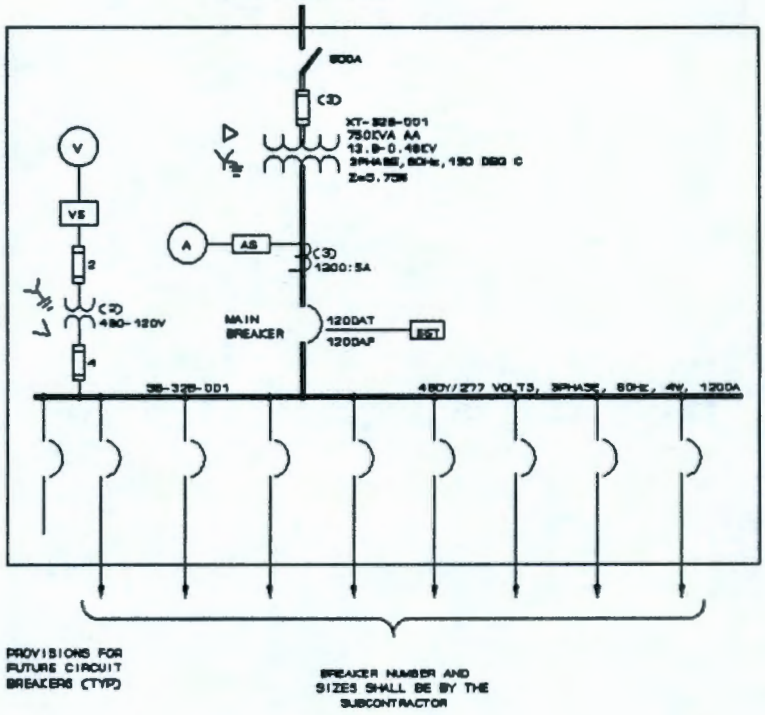
PART 3 EXECUTION

(Not Used)

END OF SECTION

ATTACHMENT A

ELECTRICAL DISTRIBUTION
ONE-LINE DIAGRAM
FABRICATION SHOP



CAD FILE: 16312

9413202.1677

LEGEND:

SYMBOLS	DESCRIPTION
	LOAD INTERRUPTER SWITCH
	CIRCUIT BREAKER
	POWER TRANSFORMER
(3)	CURRENT TRANSFORMER (NUMBER IN PARENTHESIS INDICATES QUANTITY)
(2)	POTENTIAL TRANSFORMER (NUMBER IN PARENTHESIS INDICATES QUANTITY)
4	FUSE (NUMBER INDICATES QUANTITY)
Δ	TRANSFORMER CONNECTION SYMBOL 3-PHASE, 3-WIRE, DELTA
Y	TRANSFORMER CONNECTION SYMBOL 3-PHASE, GROUNDED NEUTRAL, WYE
	TRANSFORMER CONNECTION SYMBOL OPEN DELTA, SECONDARY GROUNDED

DEVICE	DESCRIPTION
A	AMMETER
AS	AMMETER SWITCH
V	VOLTMETER
VS	VOLTMETER SWITCH
SST	SOLID STATE TRIP

CADFILE: 16312A

9413202.1678

ATTACHMENT B

FLUOR DANIEL

DATA SHEET

U.S. Department of Energy
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

METAL-ENCLOSED INTERRUPTER SWITCHGEAR

NO.	BY / DATE	REVISION

SHEET NO. A920-DS-1	REV 0
DATE	CONTRACT 845734
SECT NO. 16312	ITEM NO N/A
ORIG BY RN	CHK'D SS / APPR'D

REFER TO SPECIFICATION NO. Section 16312
FOR GENERAL REQUIREMENTS.

REFER TO ONE-LINE DIAGRAM, DRAWING NOS. See Attachment A

SITE CONDITIONS

ELEVATION: 714 FEET

MIN./MAX. TEMP.: -20 °F/ 110 °F

ENCLOSURE

☒ INDOOR ☐ OUTDOOR

☐ OUTDOOR WITH MAINTENANCE AISLE

RATINGS

VOLTAGE CLASS 15 KV MVA CLASS

BIL 95 KV FREQUENCY 60 Hz

CLOSE & LATCH 40 kA KA

MAIN BUS

☒ COPPER ☐ ALUMINUM ☐ 2000 AMP

☒ 600 AMP ☐ 1200 AMP

INCOMING SUPPLY

☐ PORCELAIN ROOF BUSHINGS

☐ CONDUIT HUBS NO. REQUIRED One

SIZE 2" LOCATION Top

☐ REMOVABLE BOTTOM PLATE REQUIRED

☒ COPPER CABLE ☐ ALUMINUM CABLE

OUTGOING CABLES

☐ TOP ☐ BOTTOM

☒ COPPER ☐ ALUMINUM

CONTROL CABLES

☐ TOP ☐ BOTTOM

FUSE TYPE

☐ POWER (EXPULSION)

☒ CURRENT LIMITING

ACCESSORIES AND SPECIAL FEATURES

	REQ'D
SPACE HEATERS	
SPECIAL MAINT. TOOLS	
KEY INTERLOCKS	
SURGE ARRESTORS	

OTHER

TESTS AND INSPECTION

	REQ'D	WITNESSED
INSPECTION BY BUYER	X	X
ROUTINE TESTS	X	X
SPECIAL TESTS		

OTHER REQUIREMENTS:

9413202.1679

ATTACHMENT C

FLUOR DANIEL

DATA SHEET

U.S. Department of Energy
Hanford Waste Vitrification Plant
Richland, Washington
DOE Contract DE-AC06-86RL10838

DRY-TYPE TRANSFORMER

NO.	BY / DATE	REVISION

SHEET NO.	A920-DS-2
REV.	0
DATE	
CONTRACT	845734
SPECIFICATION SECT NO.	16312
XFMR NO.	XT-32B-001
ITEM NO.	N/A
ORIG BY	RN
CHK'D	SS
APPR'D	

A RATINGS		
1. Kva at Self-Cooled Rating		750
2. Impedance-% on Self-Cooled Rating		5.75
3. Temp. Rise - °C at AA Ratings		150
4. High Voltage Winding	Volts Line-to-Line	13.8Kv
	Connection	DELTA
5. Low Voltage	Volts Line-to-Line	480V
	Connection	WYE
6. Vector Group		Dyn1
B. TYPE OF COOLING		
1. AA		
2. AA/FA		X
3. AFA		
4. ANV		
5. ANV/FA		
6. GA		
C. FORCED COOLING CONTROL METHOD		
1. Winding Temperature		X
2. Top Gas Temperature Switch		
3. Single Stage Cooling		X
D. TAPS		
1. No-Load Taps 5 Position with Four 2-1/2% Taps	Above	2
	Rated Volts	
	Below	2
E. LOW VOLTAGE TERMINATIONS		
1. Side Bushings		
2. Flanged Throat for Bus Duct		
3. Terminal Chamber for Cable Connections	Air	
	Oil	
4. Incoming Conduits	Size & No.	
	Size & No.	
5. Cable Lugs (Phase) (Solderless)	No. Per Ø	
	Cable Size	

F. HIGH VOLTAGE TERMINATION			
1. Side Bushings			
2. Flanged Throat for Bus Duct			
3. Terminal Chamber		Air	
4. Air-Filled Fused (CL) Disconnect Switch			
5. Fused Load Break Disconnect Switch		Air	X
6. Non-Load Break Disconnect Switch		Air	
7. Incoming Conduits		Size & No.	
		Size & No.	
8. Type of Feed		Single	X
		Double	
		Loop	
9. Potheads or Cable Terminators	1/C or 3/C		
	No. per Ø		
	Cable Size		
10. Cable Lugs (Solderless)	No. per Ø		
	Cable Size		
11.			
G. Additional Accessories			
1. High Temperature Alarm Switch			
2. Winding Temperature Alarm Switch			
3. Current Transformers			
	H1-H2-H3	No. per Ø	
		Multi-Ratio	
		No.	
		Ratio	
	X1-X2-X3	No. per Ø	
		Ratio	
	X0	No.	
		Multi-Ratio	

SPECIAL INSTRUCTIONS

BIL: 95 kV, Primary
10 kV, Secondary

Auxiliary power for the transformer cooling system shall be 120 vac supplied by the Buyer

H. Hazard Areas

1. Transformers and Accessories shall be suitable for operation in a nonhazardous area

9413202.1680