PLAINTIFF'S EXHIBIT

MON-3166

Date: 24th November, 1977

Subject: JL 8056 NABB
Your CEA 6006

Engineering Spec.
Piping No. H-328.

Letter No: LFB 263

Monsanto Limited,
c/o The Lummus Co. Ltd.,
58/64 City Road,
London, EC1P 1ES.

Attention Mr. I.F.B. Cameron

Dear Sirs,

Enclosed please find the latest revision of the following Engineering Specification:

H-328 Process and Utility Piping : Material Service Classification Rev. 5.

Yours very truly,
THE LUMMUS COMPANY LIMITED

N.A. Richardson

pp K.J. Hall
Project Manager

SC 15737

LAM024541

THE LUMMUS COMPANY LTD.

MEMO TO: K. HALL | FROM: A. R. LANE

SUBJECT: 8056 Alkylation Unit | DATE: 24-11-77

MESSAGE

Attached please find originals of Engineering Specification for Process and Utility Piping Materials Service Classifications H-328 to Issue 5 to be issued.

Service descriptions corrected in accordance with I. Kanzyk comments of 11-11-77.

All notes referring to wrench operated valves being installed with valve spindle in the vertical position deleted.

REPLY | DATE

Class 537. Vertical check valve with guided piston size increased to 8", material changed to PTFE or FEP.
Checke valves in hastelloy B deleted.
Note 6 concerning electrically grounding the PTFE pipework with grounding gaskets deleted.

LON 1176

INSTRUCTIONS: TO ORIGINATE: HAND OR TYPEWRITE MESSAGE. REMOVE PINK COPY AND CARBON 2. AND FORWARD WHITE AND YELLOWCOPIES WITH CARBON

TO REPLY: WRITE REPLY. SNAP OUT CARBON 1. RETAIN WHITE ORIGINAL AND RETURN YELLOW DUPLICATE.

SC 15738

LAM024542

THE LUMMUS COMPANY LTD.

MEMO TO	FROM

SUBJECT 11 DATE

MESSAGE

Class 58Z Flange faces changed from serrated to smooth finish to 125 RMS.
Valve packing changed from PTFE to packed graphite.
On plug valves reference to note 8 deleted.

Class 59Z Flange faces changed from serrated to smooth finish to 125 RMS.
Valve packing changed from PTFE to packed graphite.

REPLY DATE

Rating changed from 300LB to special rating.
Note 3 thickness of lap joint flange added.

LON 1176

INSTRUCTIONS: TO ORIGINATE: HAND OR TYPEWRITE MESSAGE. REMOVE PINK COPY AND CARBON 2. AND FORWARD WHITE AND YELLOW COPIES WITH CARBON
TO REPLY: WRITE REPLY. SNAP OUT CARBON 1. RETAIN WHITE ORIGINAL AND RETURN YELLOW DUPLICATE.

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THE LUMMUS COMPANY LIMITED
MONMOUTH HOUSE, 58/64 CITY ROAD, LONDON EC1P 1ES
A SUBSIDIARY OF COMBUSTION ENGINEERING INC.

LUMMUS

PROJECT ENGINEERING SPECIFICATION

NO. JL 8056 - H-328

PROCESS AND UTILITY PIPING
MATERIALS SERVICE CLASSIFICATIONS

DESCRIPTION OF CONTENTS	PAGES	DATE
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PROJECT NO.	JL 8056
TITLE	NEW ALKYLATION UNIT, STYRENE MONOMER II PLANT
CLIENT	FORTH CHEMICALS LIMITED
LOCATION	BAGLAN BAY - SOUTH WALES

ISS.	DATE	ISSUE DESCRIPTION	PAGES	REC.	ORIG.	S.M.	APPR. BY
5	XI-7-77	Classes A2A, A4A, A9A B1A, A2HA, B2HA, S3Y, S8Z and S9Z.	74	CV	ARL		23 Nov 1977
4	IX-7-77	CLASS S9Z ADDED. CIASS SERVICES REVISED	74	CV	ARL		18 Oct 77
3	VI-16-77	APPROVED FOR CONSTRUCTION	67	CV	ARL		27/7/77
2	III-25-77	APPROVED FOR DESIGN	63	CV			
1	II-11-77	REVISED WITH COMMENTS	65	CV			
0	I-11-77	FOR COMMENTS	61	CV			

APPROVED BY DATE APPR. BY CLIENT DATE 3/4/77

LON 2230

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CE LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS	NO. JL 8056 H-328
DATE I-11-77		PAGE 1

TABLE OF CONTENT

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2. General Notes — 5 pages

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4. Piping Materials Classes — 60 pages

5. APPENDIX I
Differences between JL 6284 and JL 8056 — 2 pages

6. APPENDIX II
High Integrity Pump Materials -
Hastelloy B casting requirements — 2 pages

7. APPENDIX III
Piping Materials -
Hastelloy B casting requirements — 2 pages

1. REFERENCE SPECIFICATIONS

H-358 - Process and Utility Piping Design Requirements

H-338 - Process and Utility Fabrication Requirements

HD-308 - Steam Tracing and Piping Requirements

H-318 - Coating and Wrapping of Underground Steel Pipe

L-318 - Insulation

O-318 - Painting

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GENERAL NOTES

1.0 SCOPE

This Engineering Specification contains specific requirements for the selection of material to be used in the construction and fabrication of all process and utility piping systems.

2.0 CODES AND STANDARDS

All codes, standards and specifications referred to herein shall be the latest edition of such documents.

3.0 DETAILED MATERIAL SPECIFICATIONS

3.1 The individual Class of the Piping Material specified shall be strictly adhered to in the design, requisitioning, purchasing, fabrication and testing of the piping system.

3.2 Deviation of material from Class specifications may occur due to design conditions. These deviations are permissable if they equal or better the individual Class requirements.

4.0 FABRICATING AND INSPECTION REQUIREMENTS

All elements of the process and utility piping system shall be fabricated and inspected in accordance with specification H-338, Fabricating Requirements and any specific fabricating or inspection requirements under the applicable piping material Class. When the piping material Class in H-328 contains no specific requirements, only the requirements of Specification H-338 shall be met. In the event of conflict between H-328 and H-338, the requirements of H-328 shall govern.

5.0 CLASS DESIGNATION CODE

The Class Designation shall consist of no more than three digits made up of a letter, number, letter (e.g. B4K).

The first letter, indicates pressure rating:-

A	150 lb	E	900 lb	J	250 lb
B	300 lb	F	1500 lb	S	Special
C	400 lb	G	2500 lb	T	Atmospheric
D	600 lb	H	125 lb	V	Vacuum

The middle number indicates differences in the specifications within the same rating and material.

The last letter indicates type of materials:-

A	Carbon Steel	N	Cast Iron
B	Carbon Moly	P	Concrete
C		Q	
D	1¼ Chrome, ½ Moly	R	Vitreous Tile
E	2¼ Chrome, 1 Moly	S	Asbestos Cement
F		T	Aluminium
G	5 Chrome, ½ Moly	U	Copper
H	3½ Nickel	V	Brass
J	Nickel	W	Monel
K	Type 304L, 304, or 304H	X	Galvanized Steel
L	Type 316L, 316, or 316H	Y	Lined Steel
M	Type 321	Z	Special

6.0 PIPING

6.1 Pipe dimensions shall be in accordance with BS 1600 for wrought steel, wrought iron and stainless steel pipe.

6.2 All screwed connections shall have API taper threads.

6.3 Pipe made by acid - bessemer process shall not be acceptable. Steel pipe shall be made by open hearth electric furnace or basic-oxygen processes.

7.0 FLANGES

7.1 Flanges shall be in accordance with the following codes:-

125 lb C.I.	)
250 lb C.I.	) USAS B16.1
Rating from 150 lb to 2500 lb	BS 1560
Rating 150 lb to 600 lb over 24" NB	BS 3293

7.2 Raised face steel flange faces shall have serrated finish unless noted otherwise in specification class.

7.3 Orifice flanges shall conform to BP Standard drawing No. 387. Pipe plugs to be same material as flanges.

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7.4 Minimum Brinell hardness for ring joint facings:-

IRON	90
Low Carbon Steel	120
5% Cr. ½ Mo.	145
13% Cr. Alloy	170
Austenitic Stainless Steel	160

7.5 Threads for screwed flanges shall be API Taper threads.

7.6 Bore of weld neck flanges to match bore of pipe.

8.0 FITTINGS

8.1 Threaded joints shall be API Taper threads.

8.2 Forged steel screwed and socket welding fittings shall conform to BS 3799.

8.3 Butt-welding fittings for carbon, ferritic alloy steel and stainless steel up to 24" in size, shall be seamless and shall conform to BS 1640.

9.0 GASKETS

9.1 All gaskets shall conform to BP Standard 173 Pts. 1 & 2.

9.2 Nonmetallic gaskets for flanged pipe joints shall conform to BS 1832 and BS 1560. Appendix F, Table 37.

9.3 Spiral wound gaskets shall conform to BS 3381.

9.4 Compressed asbestos fibre gaskets to be supplied graphited both sides except when used with stainless steel flanges.

10.0 BOLTING

10.1 All bolting shall conform to BP Standard 175. Nuts, bolts and studs shall be to BS 4882. Bolt lengths to APS 8056 - 103.

11.0 THREAD SEALANT

11.1 Teflon tape shall be used for all threaded connections except those required to be seal welded.

12.0 VALVES

Unless noted otherwise in description, valves shall conform to the following:-

12.1 Carbon and Alloy Wedge Gate Valves 1½" and below shall conform to BP Standard 181.

12.2 Steel flanged and B.W. Wedge Gate Valves 150 lb to 2500 lb shall conform to BP Standard 185.

12.3 Steel flanged check valves 150 lb and 2500 lb shall conform to BP Standard 186.

12.4 Cast Iron Flanged Wedge Gate Valves shall conform to BP Standard 187.

12.5 Face to face dimensions and details of flanged valves shall conform to BS 1735, BS 1414, BS 1873 and BS 1868. For valves not covered in these British standards Vendor to furnish certified dimension drawings.

12.6 Flange dimensions of steel, alloy steel and stainless steel flanged valves shall conform to BS 1560.

12.7 Flange dimensions for cast iron flanged valves shall conform to BS 1735.

12.8 Raised face steel flange faces shall have serrated finish to BS 1560 or finish as noted in specification class.

12.9 Socket welding and screwed carbon steel valves shall conform to BS 3808 and BS 2995.

12.10 Unless stated otherwise, swing check valves 2" and larger shall be provided with a boss in accordance with figure 6 at location "G" BS 1868.

12.11 Lubricated plug valves shall be furnished with combination lubricator fitting. Wrench operated plug valves shall be furnished with suitable operating wrench unless otherwise specified.

12.12 All lubricated plug valves shall be tested and shipped with proper factory sealant unless service conditions require special lubrication.

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LON 2229

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12.13 Unless otherwise specified valve stempacking for steel and alloy and stainless steel valves shall be Crane packing 1066 or equal. Valve packing to be in accordance with BP Standard 180.

12.14 Bronze and iron valves shall have manufacturers' standard packing.

12.15 Bonnet gaskets shall be manufacturers' standard.

12.16 The term "hard" when used with reference to seat or disc of valves covers either "stellite facing" or "hardening to 500 Brinell minimum".

12.17 In case of conflict between manufacturers figure number and description, the description shall govern.

12.18 The terminology "GAS COL" denotes that the valve is to be supplied with an extended bonnet to provide a "gas column" surrounding the stem between the restriction where the stem enters the stem hole in the bonnet and the restriction just below the stem packing. Lengths of "gas column" specified are minimum required.

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ENGINEERING SPECIFICATION

PIPING MATERIALS
INDEX - PIPING MATERIAL CLASSES

NO. JL 8056
H-328

DATE I-11-77

PAGE 1

CLASS	FLANGE RATING	BASIC MATERIAL	PRESS TEMP. LIMITS °C	SERVICE
A1A	150	CS	70	5% to 50% caustic solution
A2A	150	CS	230	Dry benzene; wet benzene, PEB feed, ethylene downstream of shut down valve; ethyl chloride; hydrogen chloride; unwashed AL (no $AlCl_3$); washed AL; off gas to flare; relief drum vapour; 2nd and 3RD stage wash emulsion draw-off; 2nd and 3RD stage wash overflow; 2ND and 3RD stage wash drain; LP nitrogen; boiler feed water; WHB blowdown; cold condensate; 1% caustic; caustic return; spent caustic; plant air. (5)
A4A	150	CS	7 Bars 66	Cooling water; canal water.
A7A	150	CS	399	30 PSIG steam; 48 PSIG steam.
A9A	150	CS	232	Vapour leaving caustic scrubber; relief drum feed; relief drum liquid.
B1A	300	CS	399	HP Nitrogen; 200 PSIG steam; 200 PSIG condensate.
B2A	300	CS	399	Ethylene.
A2HA	150	Monel	13.4 Bars 135	BZ scrubber bottoms; vapour leaving BZ and PEB scrubbers; vapour leaving partial condenser; liquid leaving partial condenser. Vapour leaving vent condenser (5)
B2HA	300	Monel	35 Bars 200	PEB scrubber pump discharge.
S3Y	150	PTFE & FEP lined CS	7 Bars 135	Unwashed AL (contains $AlCl_3$) 12% and 24% $AlCl_3$ solution; $AlCl_3$ recovery system; 1st stage with emulsion draw-off; stage wash overflow; 1st stage wash drain.

CLASS	FLANGE RATING	BASIC MATERIAL	PRESS TEMP. LIMITS °C	SERVICE
S8Z	150	Hastelloy B2	13.4 Bars at 232	Alkylate, Alkylator vent system, Alkylation drains, catalyst complex (area 100 to CC feed pumps). Catalyst complex (after CC feed pumps).
S9Z	300	Hastelloy B2	19.3 Bars 232	Alkylate and Alkylator circulating loop.
H1X	150	CS galv.	7 Bars	Instrument air.
S1K	150	Stainless Steel	14 Bars 205	Steam tracing.
S2U	150	Copper	14 Bars 205	Potable water.

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LUMMUS

DATE I-11-77

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS A1A
150 lb RF CARBON STEEL

NO. JL 8056
H-328

PAGE 1

SERVICE: 5% to 50% caustic solution.

PRESSURE/TEMPERATURE LIMITS: See BS 1560 Table PE-1. Maximum temperature 71°C (160°F).

CORROSION ALLOWANCE: 0.10"

PIPE:
API 5L Grade A or B Seamless
1½" below - Sch 80 Plain Ends
2" to 6" - Sch 40 Bevel Ends
8" to 16" - Sch 30 Bevel Ends
18" - Std Wt Bevel Ends

A 155 Grade C55 Class 2 EFW Sub-arc weld
Above 18" - Calculate Bevel Ends

NIPPLES:
API 5L Grade A or B Seamless
1½" below - Sch 160 Plain Ends

FLANGES:
150 lb RF, dimensions to BS 1560.
Serrated finish to BS 1560.
Material - BS 1503 - 161 Grade 28 A.
24" & below -
weldneck.
bore to match pipe.

FITTINGS:
24" & below - Buttweld dimensions to BS 1640
Schedule to match pipe
Material - BS 1640 Grade WPB
(Unions not allowed)

GASKETS:
All sizes - 1.5 mm thick. Dimensions to BS 1560
Appendix F, Table 37.
Material - compressed asbestos fibre to BS 1832.

BOLTING:
All sizes - Hexagon headed machine bolts with one hexagon nut
(full bearing type)
Material - BS 1769
Threads unified coarse (UNC) to BS 4882 Inch series
(see note 2).

VALVE PACKING: Crane Packing 1066, Walkers Incoval or equal.

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VALVES:

			Commodity No.
150 lb RF Flanged to BS 1560			
Material BS 1504 - 161 Grade B			
13 Cr. Trim			
8" & below	Globe -	OS & Y. bolted bonnet	2002000 B
1½" & below	Check -	horizontal piston type, bolted cap	2004000 B
2" to 16"	Check -	Swing disc. bolted cap	2003000 B
4" & below	Plug -	Regular pattern, hardened steel plug, wrench operated, lubricated	2007000 B
6" to 12"	Plug -	Short pattern, hardened steel plug, gear operated, lubricated.	2007010 B

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CE LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS A1A 150 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 3.

MAINTENANCE JOINTS: All - Flanged

PIPE JOINTS: All - Buttweld

ORIFICE TAPPINGS: Orifice flanges 2" to 14" - ½" screwed API (seal weld)
½" Sch 160 nipples with plug valve to spec.
16" and above - ¾" D, D/2 tappings half coupling, nipple, flange and plug valve to spec. (see note 3)

TEMPERATURE CONNECTIONS: 1½" flanged in accordance with APS 13.2. Module Nos. TW/007, TW/507, TW/707 and TW/807.

PRESSURE CONNECTIONS: ¼" Sch 160 nipple, flange and plug valve to spec. Module PT-0C0.

VENT & DRAIN:

¾" hydrostatic Vent	Module	VT-003
¾" Valved Vent	Module	VV-0C3
¾" Valved Drain	Module	DV-0C3

BRANCH CONNECTIONS:

Header	Branch	Connection
1½" & below	Reducing size	Reducing Tee
	Equal size	Equal Tee
2"	1½" & smaller	BW reducing Tee
	Equal size	Equal Tee
3" & larger	1½" & smaller	Weldolet
	Equal size	Equal Tee
	Reducing size	Stub in, branch reinforcement to be used when required.

SC 15751

LON 2229

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ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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CUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS A1A 150 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 4

NOTES:

1. Fabrication Requirements:

   (a) Preheat - Up to 30 mm thick, all welds require a dry start with a minimum preheat of 5°C.
   No welding shall be carried out when ambient temperatures are below 0°C.

   (b) Postheat- All welds require temperature 580 - 620°C in accordance with BS 2633 Table 6 for C.S. up to 0.25C, regardless of whether grade A or B pipe is purchased.
   Not required when maximum process temperature is less than 45°C.

2. For bolt lengths see Drg No. APS 8056 - 103

3. Take-off to include flange, bolts and gaskets with OR/NR

4. For dimensions of reversible blinds and spades see Drg No. APS 8056 - 100.

5. Unions, screwed and socket weld fittings are not to be used.

SC 15752

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LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS A2A 150 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 1

SERVICE: Dry Benzene; Wet Benzene, PEB feed; Ethylene downstream of shut down valve; Ethyl Chloride; Hydrogen Chloride; Unwashed AL (no $AlCl_3$), washed AL, offgas to flare, relief drum vapour, 2nd and 3rd stage wash overflow, 2nd and 3rd stage wash drain, LP nitrogen, Boiler feed water, WHB Blowdown, Cold condensate, 1% caustic, Caustic retur spent caustic, plant air. (5

PRESSURE/TEMPERATURE LIMITS: See BS 1560 Table PE-1 Maximum temperature 232°C. (Temperature limitation due to bolting)

CORROSION ALLOWANCE: 0.05".

PIPE:

API 5L	Grade A or B		Seamless
1½" & below	- Sch 80		Plain Ends
2" to 6"	- Sch 40		Bevel Ends
8" to 16"	- Sch 30		Bevel Ends
18"	- Std Wt		Bevel Ends
A 155	Grade C 55	Class 2	EFW Sub-arc weld
Above 18"	- Calculate Bevel Ends.		

NIPPLES:

API 5L	Grade A or B	Seamless
1½" & below	- Sch 160	Plain Ends

FLANGES:
150 lb RF, dimensions to BS 1560
Serrated finish to BS 1560
Material - BS 1503 - 161 Grade 28A.
1½" & below - socket weld
2" & above - weld neck.
bore to match pipe.

FITTINGS:
1½" & below - socket weld 3000 lb dimensions to BS 3799
material - BS 1503 - 161 Grade 32A.
2" & above - Buttweld, dimensions to BS 1640
Schedule to match pipe
Material - BS 1640 Grade WPB.

GASKETS:
All sizes - 1.5 mm thick, dimensions to BS 1560 Appendix F, Table 37.
Material - compressed asbestos fibre to BS 1832

BOLTING:
All sizes - Hexagon headed machine bolts with one hexagon nut (full bearing type)
Material - BS 1769
Threads unified coarse (UNC) to BS 4882 Inch series (see note 4).

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LON 2229

VALVE PACKING: Crane Packing 1066, Walkers Incoval or equal.

VALVES:

		Commodity No.
	800 lb socket weld to BS 2995 Material BS 1503 - 161 Grade 28A or BS 1504 - 161 Grade B. 13 Cr. trim.	
1½" & below	Gate - OS & Y. bolted bonnet	4010640 B
	Globe - OS & Y. bolted bonnet	4012640 B
	Check - Vertical ball type. Union bonnet	4015660 B
	Check - Horizontal ball type. bolted cap (to be used where possible).	4016660 B
	Plug - 600 lb regular pattern. lubricated hardened steel plug, wrench operated. (see notes 3 & 8)	401765 KE
	Ball - 600 lb EN 58J SS ball Valves to be supplied with pipe nipple ends (see notes 2 & 8)	4018630 B
	150 lb RF Flanged to BS 1560. Material BS 1504 - 161 Grade B. 13 Cr. trim	
2" to 12"	Gate - OS & Y bolted bonnet	2000000 B
14" to 24"	Gate - OS & Y bolted bonnet, bevel gear operated	2000000 B
2" to 8"	Globe - OS & Y bolted bonnet	2002000 B
2" to 16"	Check - Swing disc. bolted cap	2003000 B
2" to 6"	Ball - Stainless steel ball, PTFE seals wrench operated (see notes 2 & 8)	200801 KE
8" to 16"	Ball - Cr. plated, CS ball, PTFE seals gear operated (see note 2)	2008030 B
2" to 4"	Plug - regular pattern hardened steel plug wrench operated (see notes 3 & 8)	200700 KE
6" to 12"	Plug - short pattern hardened steel plug gear operated (see note 3)	200701 KE

MAINTENANCE JOINTS: 1½" & below - Unions 3000 lb.
2" & below - Flanged.

PIPE JOINTS: 1½" & below - S.W. couplings
2" & below - buttweld.

ORIFICE TAPPINGS: Orifice flanges 2" to 14" - ½" screwed API
½" Sch 160 nipple with gate valve to spec.
16" & above - ¾" D, D/2 tappings half coupling, nipple and gate valve to spec.

TEMPERATURE CONNECTIONS: 1½" flanged connection in accordance with APS 13-2. Modules Nos. TW/007, TW/207, TW/707 and TW/807.

PRESSURE CONNECTIONS: ¾" Sch 160 nipple with gate valve to spec. Module PT-010.

VENT & DRAIN:

¾" Hydrostatic Vent	Module	VT-003
¾" Valved Vent	Module	VV-013
¾" Valved Drain	Module	DV-013

BRANCH CONNECTIONS:

Header	Branch	Connection
1½" & below	Reducing size	Reducing Tee
	Equal size	Equal Tee
2"	1" & smaller	SW half coupling
	1½"	BW reducing Tee
	Equal size	Equal Tee
3" & larger	1½" & smaller	SW Half coupling
	Equal size	Equal Tee
	Reducing size	Stub in, branch reinforcement to be used when required.

SC 15755

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LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS A2A 150 lb RF SF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 4

NOTES:

1. Fabrication Requirements
   (a) Preheat - Up to 30 mm thick, temperature 5°C required and a dry start.
   (b) Posheat - Up to 30 mm thick, none required.
   (c) Radiography - Random 10% in accordance with BS 2633.

2. Ball valves to be fire safe type to OCMA recommendations Use to be restricted to 120°C at 275 PSIG and 232°C at 100 PSIG.
   (Manufacturers press/temp. charts to be checked for confirmation).

3. Plug valves should not be used on services containing strong alkalis and high aromatic solvents.

4. For bolt lengths see drg. No. APS 8056 - 103.

5. For dimensions of reversible blinds and spades see drg No. APS 8056 - 100.

6. Air and water service points to be provided with globe valves, and quick action coupling ¾" Adflow air king claw type. Commodity No. 800462 KE.

7. Nitrogen service point to be provided with globe valve and 1" Adflow Adlock quick acting coupling. Commodity No. 800462 KE.

(5)

SC 15756

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LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS A4A 150 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 1

SERVICE: Cooling water, canal water.

PRESSURE/TEMPERATURE LIMITS: 7 BARS at 65°C.
(Pressure and temperature limitation due to diaphragm valves)

CORROSION ALLOWANCE: 0.05".

PIPE:

API	5L	Grade A or B	Seamless
1½" & below		- Sch 80	Screwed Ends
2" to 6"		- Sch 40	Bevel Ends
8" to 16"		- Sch 30	Bevel Ends
18"		- Std Wr	Bevel Ends

A 155 Grade C 55 Class 2 EFW Sub-arc Weld
Above 18" - Calculate-Bevel Ends

NIPPLES:

API	5L	Grade A or B	Seamless
1½" & below		- Sch 160	Screwed Ends

FLANGES:
150 lb RF dimensions to BS 1560.
Serrated finish to BS 1560.
Material - BS 1503 - 161 Grade 28A
1½" & below - screwed
2" to 24" - weld neck.
bore to match pipe
26" to 48" - weld neck to BS 3293.

FITTINGS:
1½" & below - screwed 3000 lb dimensions to BS 3799
Material - BS 1503 - 161 Grade 32A.
2" & above - Buttweld. dimensions to BS 1640.
Schedule to match pipe.
Material - BS 1640 Grade WPB.

GASKETS:
All sizes - 1.5 mm thick, dimensions to BS 1560 Appendix F Table 37.
Material - compressed asbestos fibre to BS 1832 (see note 2)

BOLTING:
All sizes - Hexagon headed machine bolts with one hexagon nut. (full bearing type)
Material - BS 1769
Threads unified coarse (UNC) to BS 4882 Inch series (see note 3)

SC 15757

LON 2229

LAM024561

VALVES PACKING: Crane Packing 1066, Walkers Incoval or equal.

VALVES:

		Commodity No.
	150 lb screwed to BS 2995 Material - Bronze to BS 1400 - LG2-C Trim bronze to BS 1400 - LG2-C	
1½" & below	Globe - Inside screw, rising stem, union bonnet	4602000 B
¾" & below	Gate - Inside screw, rising stem, union bonnet (for instrument connections only)	4600000 B
1½" & below	Check - 200 lb, screwed bonnet, swing type	4603000 B
1½" & below	Ball - 200 lb PTFE seals, Bronze ball. (see note 6).	4608000 B
	150 lb Flanged to BS 1560 Material - BS 1504 - 161 Grade B 13 Cr. trim.	
2" to 12"	Gate - OS & Y bolted bonnet	2000000 B
14" to 24"	Gate - OS & Y bolted bonnet, bevel gear operated	2000000 B
2" to 16"	Check - swing disc, bolted bonnet	2003000 B
2" to 12"	Diaphragm - Raised face, rising stem with limit stop, bolted bonnet. Oil resistant rubber diaphragm (Diaphragm valve 10" restricted to 70 PSIG 12" restricted to 60 PSIG Not to be used as isolating valves on mains)	200941 KE
2" to 8"	Globe - OS & Y bolted bonnet.	2002000 B

SC

15758

ON 2229

LAM024562

MAINTENANCE JOINTS: 1½" & below - Unions 3000 lbs.
2" & above - Flanged

PIPE JOINTS: 1½" & below - Screwed couplings
2" and above - Buttweld

ORIFICE TAPPINGS: Orifice flanges 2" to 14" -½" screwed API
½" Sch 160 nipples with gate valve to spec.
16" & above - ¾" D, D/2 tappings half coupling, nipple and gate valve to spec.

TEMPERATURE CONNECTIONS: 1" screwed API connection in accordance with APS 13-1
Modules Nos. TW/100, TW/700 and TW/800.

PRESSURE CONNECTIONS: ¾" Sch 160 nipple with gate valve to spec. Module PT-010.

VENT & DRAIN:

¾" Hydrostatic Vent	Module	VT-002
¾" Valved Vent	Module	VV-012
¾" Valved Drain	Module	DV-012

BRANCH CONNECTIONS:

Header	Branch	Connection
1½" & below	Reducing size	Reducing Tee
	Equal size	Equal Tee
2"	1" & smaller	Scrd half coupling
	1½"	BW reducing Tee
	Equal size	Equal Tee
3" & larger	1½" & smaller	Scrd half coupling
	Equal size	Equal Tee
	Reducing size	Stub in, branch reinforcement to be used when required

SC 15759

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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CUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS A4A 150 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 4

NOTES:

1. Fabrication Requirements

   (a) Preheat - Up to 30 mm thick, temperature 5°C required and a dry start.
   (b) Postheat - Up to 30 mm thick, none required.
   (c) Radiography - Random 5% in accordance with BS 2633.

2. Full face gaskets to be used with flat face flanges.

3. For bolt lengths see drg No. APS 8056 - 103.

4. For dimensions of reversible blinds and spades see drg No. APS 8056 - 100.

5. Underground pipework to be coated and wrapped to Engineering Specification H-318.

(5)

SC 15760

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	I-11	II-11	III-25	X	IX-7	X				

CUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS A7A 150 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 1

SERVICE: 30 PSIG steam, 48 PSIG steam.

PRESSURE/TEMPERATURE LIMITS: See BS 1560 Table PE-1. Maximum temperature 400°C. (Temperature limit of carbon steel)

CORROSION ALLOWANCE: 0.05".

PIPE:

API 5L Grade A or B Seamless

1½" & below	- Sch 80	Plain Ends
2" to 6"	- Sch 40	Bevel Ends
8" to 16"	- Sch 30	Bevel Ends
18"	- Std WT	Bevel Ends

A 155 Grade C 55 Class 2 EFW Sub-arc weld
above 18" - Calculate-Bevel Ends

NIPPLE:

API 5L Grade A or B Seamless
1½" & below - Sch 160 Plain Ends

FLANGES:

150 lb RF, dimensions to BS 1560
Serrated finish to BS 1560
Material - BS 1503 - 161 Grade 28A

1½" & below	- socket weld
2" to 24"	- Weld neck bore to match pipe.
26" to 48"	- weld-neck to BS 3293.

FITTINGS:

1½" & below	- socket weld 3000 lb dimensions to BS 3799 Material - BS 1503 - 161 Grade 32A (Unions are not to be used)
2" & above	- Buttweld dimensions to BS 1640 Schedule to match pipe Material - BS 1640 Grade WPB

GASKETS:

All sizes - 1.5 mm thick. Dimensions to BS 1560 Appendix F Table 37.
Material - compressed asbestos fibre to BS 1832.

BOLTING:

All sizes - Stud bolt with two hexagon nuts.
Studs to BS 4882 Grade B7
Nuts to BS 4882 Grade 2H
Threads unified coarse (UNC) to BS 4882 Inch series

SC 15761

LON 2229

LAM024565

VALVE PACKING: Crane Packing 1066, Walkers Incoval or equal.

VALVES:

		Commodity No.
	800 lb Socket weld to BS 2995 Material - BS 1503 - 161 Grade 28A or BS 1504 - 161 Grade B 13 Cr. trim Valves to be in accordance with BS 2995	
1½" & below	Gate - OS & Y bolted bonnet to BS 3808	4010640 B
	Globe - OS & Y bolted bonnet	4012640 B
	Check - horizontal ball type bolted cap	4016660 B
	Check - Vertical ball type bolted cap (horizontal type to be used where possible)	4015660 B
	150 lb RF Flanged to BS 1560 Material - BS 1504 - 161 Grade B 13 Cr. trim	
2" to 12"	Gate - OS & Y bolted bonnet to BS 1414	2000000 B
14" to 24"	Gate - OS & Y bolted bonnet to BS 1414 bevel gear operated	2000000 B
2" to 8"	Globe - OS & Y bolted bonnet to BS 1873	2002000 B
2" to 16"	Check - Swing type bolted cap to BS 1868	2003000 B
2" to 12"	Parallel Slide - OS & Y bolted bonnet hard faced seat	200957 KE
14" to 24"	Parallel Slide - OS & Y bolted bonnet hard faced seat bevel gear operated.	200957 KE
	(Parallel Slide valves to be used for (all shut-off valves outside battery (limits. Valves 8" & above to be (fitted with integral type byepass. (Valves to be suitable for steam (operating conditions of 3.5 Bar (and 205°C)	

SC 15762

MAINTENANCE JOINTS: All - Flanged

PIPE JOINTS: 1½" & below - couplings
2" & above - buttweld

ORIFICE TAPPINGS: Orifice flanges 2" to 14" - ½" screwed API
½" Sch 160 nipple with gate valve to spec.
16" & above - ¾" D, D/2 tappings half coupling, nipple and gate valve to spec.

TEMPERATURE CONNECTIONS: 1½" Flanged connection in accordance with APS 13-2.
Modules Nos. TW/007, TW/207, TW/707 and TW/807.

PRESSURE CONNECTIONS: ¼" Sch 160 nipple with gate valve to spec. Module PT-010.

VENT & DRAIN:

¾" Hydrostatic Vent	Module	VT-003
¾" Valved Vent	Module	VV-013
¾" Valved Drain	Module	DV-013

BRANCH CONNECTIONS:

Header	Branch	Connection
1½" & below	Reducing size	Reducing Tee
	Equal size	Equal Tee
2"	1" & smaller	SW half coupling
	1½"	BW reducint Tee
	Equal size	Equal Tee
3" & larger	1½" & smaller	SW half coupling
	Equal size	Equal Tee
	Reducing size	Stub in, branch reinforcement to be used when required

15763

SC

LON 2229

LAM024567

NOTES:

1. Fabrication Requirements

   (a) Preheat - Up to 30 mm thick, temperature 5°C required and a dry start.
   (b) Postheat - Up to 30 mm thick, none required.
   (c) Radiography - Random 10% in accordance with BS 2633.

2. Steam traps for steam tracing to be ½" NB screwed ends, thermostatic type, Spirax Sarco SM 250 or equal, commodity number 8000 IIKE. Steam traps for line traps to be ½" NB screwed ends thermodynamic type, Spirax Sarco TD 3-2 or equal, commodity number 800003 KE. 50 PSIG steam to return to 30 PSIG condensate header providing vertical return leg not more than 20 ft. 30 PSIG steam to run to drain.

3. For dimensions of reversible blinds spaces see drg number APS 8056 - 100.

4. All screwed connections to be seal welded after assembly.

5. Steam service point to be provided with globe valve and 1" adflow boss GT/X34. Commodity No. 800461 KE.

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CUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS A9A 150 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 1

SERVICE: Vapour leaving caustic scrubber, relief drum feed, relief drum liquid.

PRESSURE/TEMPERATURE LIMITS: See BS 1560 Table PE-1. Maximum temperature 232°C. (Temperature limitation due to bolting)

CORROSION ALLOWANCE: 0.125".

PIPE: API 5L Grade A or B Seamless

1½" & below	Sch 80	Plain Ends
2"	Sch 80	Bevel Ends
3" to 6"	Sch 40	Bevel Ends
8" to 16"	Sch 30	Bevel Ends
18"	Std Wt	Bevel Ends

A 155 Grade C 55 Class 2 EFW Sub-arc weld
Above 18" - Calculate-Bevel Ends

NIPPLES: API 5L Grade A or B Seamless
1½" & below - Sch 160 Plain Ends

FLANGES: 150 lb RF, dimensions to BS 1560
Serrated finish to BS 1560
Material - BS 1503 - 161 Grade 28A
1½" & below - socket weld
2" & above - weld neck
bore to match pipe.

FITTINGS: 1½" & below - socket weld 3000 lb dimensions to BS 3799
Materials - BS 1503 - 161 Grade 32A.
2" & above - Buttweld dimensions to BS 1640
Schedule to match pipe
Material - BS 1640 Grade WPB

GASKETS: All sizes - 1.5 mm thick Dimensions to BS 1560 Appendix F Table 37
Material - compressed asbestos fibre, to BS 1832

BOLTING: All sizes - Hexagon headed machine bolts with one hexagon nut. (full bearing type)
Material - BS 1769
Threads unified coarse (UNC) to BS 4882 Inch series (see note 4)

SC 15765

LON. 2229

LAM024569

VALVE PACKING: Crane Packing 1066, Walkers Incoval or equal.

VALVES:

		Commodity No.
	800 lb socket weld to BS 2995 Material BS 1503 - 161 Grade 28A or BS 1504 - 161 Grade B 13 Cr. trim Valves to be in accordance with BS 2995	
1½" & below	Gate - OS & Y bolted bonnet to BS 3808	4010640 B
	Globe - OS & Y bolted bonnet	4012640 B
	Check - Vertical ball type Union bonnet	4015660 B
	Check - Horizontal ball type balted cap (to be used where possible)	4016660 B
	Ball - 600 lb Type 316 SS ball to BS 5351 Valves to be supplied with pipe nipple ends (see notes 2 & 5)	4018630 B
	Needle- OS & Y bolted bonnet	4012680 B
	150 lb RF Flanged to BS 1560 Material BS 1504 - 161 Grade B 13 Cr. trim	
2" to 12"	Gate - OS & Y bolted bonnet to BS 1414	2000000 B
14" to 24"	Gate - OS & Y bolted bonnet to BS 1414 bevel gear operated	2000000 B
2" to 8"	Globe - OS & Y bolted bonnet to BS 1873	2002000 B
2" to 16"	Check - swing disc bolted cap to BS 1868	2003000 B
2" to 6"	Ball - stainless steel ball PTFE seals wrench operated (see notes 2 & 5) to BS 5351	200801 KE
8" to 16"	Ball - Cr. plated CS ball PTFE seals gear operated (see note 2) to BS 5351	200803 KE

SC 15766

MAINTENANCE JOINTS: 1½" & below - Unions 3000 lb
2" & above - Flanged

PIPE JOINTS: 1½" & below - SW couplings
2" & above - buttweld

ORIFICE TAPPINGS: Orifice flanges 2" to 14" - ½" screwed API
½" Sch 160 nipple with gate valve to spec.
16" & above - ¼" D, D/2 tappings half coupling, nipple and gate valve to spec.

TEMPERATURE CONNECTIONS: 1½" Flanged connection in accordance with APS 13-2.
Modules Nos. TW/007, TW/207, TW/707 and TW/807.

PRESSURE CONNECTIONS: ¼" Sch 160 nipple with gate valve to spec. Module PT-010.

VENT & DRAIN:

¾" Hydrostatic Vent	Module	VT-003
¾" Valved Vent	Module	VV-013
¾" Valved Drain	Module	DV-013

BRANCH CONNECTIONS:

Header	Branch	Connection
1½" & below	Reducing size	Reducing Tee
	Equal size	Equal Tee
2"	1" & smaller	SW half coupling
	1½"	BW reducing Tee
	Equal size	Equal Tee
3" & larger	1½" & smaller	SW half coupling
	Equal size	Equal Tee
	Reducing size	Stub in, branch reinforcement to be used when required.

SC 15767

NOTES:

1. Fabrication Requirements

   (a) Preheat - Up to 30 mm thick, temperature 5°C required and a dry start.
   (b) Postheat - Up to 30 mm thick, none required.
   (c) Radiography - Random 10% in accordance with BS 2633.

2. Ball valves to be fire safe type to OCMA recommendations. Use to be restricted to 120°C at 275 PSIG and 232°C at 100 PSIG. (Manufacturers press/temp. charts to be checked for confirmation).

3. For bolt lengths see drg No. APS 8056 - 103.

4. For dimensions of reversible blinds and spades see drg No. APS 8056 - 100.

(5)

SC 15768

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS B1A 300 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 1

SERVICE: H.P. Nitrogen, 200 PSIG steam, 200 PSIG condensate.

PRESSURE/TEMPERATURE LIMITS: See BS 1560 Table PE-1 Maximum temperature 400°C. (Temperature limits of carbon steel).

CORROSION ALLOWANCE: 0.05".

PIPE: API 5L Grade A or B Seamless

1½" & below - Sch 80 Plain Ends
2" to 6" - Sch 40 Bevel Ends

API 5L Grade B Seamless

8" to 18" - Sch 30 Bevel Ends

A 155 Grade C 55 Class 2 EFW Sub-arc weld
Above 18" - Calculate-Bevel Ends

NIPPLES: API 5L Grade A or B Seamless
1½" & below - Sch 160

FLANGES: 300 lb RF, dimensions to BS 1560
Serrated finish to BS 1560
Material - BS 1503 - 161 Grade 28A
1½" & below - socket weld
2" to 24" - weld neck.
bore to match pipe.

FITTINGS: 1½" & below - socket weld 3000 lb dimensions to BS 3799
Material - BS 1503 - 161 Grade 32A
(Unions not to be used)
2" to 24" - buttweld dimensions to BS 1640
Schedule to match pipe
Material BS 1640 Grade WPB

GASKETS: All sizes - 1.5 mm thick. Dimensions to BS 1560 Appendix F Table 37.
Material - compressed asbestos fibre to BS 1832.

BOLTING: All sizes - Stud bolt with two hexagon nuts
Studs to BS 4882 Grade B7
Nuts to BS 4882 Grade 2H
Threads unified coarse (UNC) to BS 4882 Inch series

SC 15769

LON 2229

LAM024573

VALVE PACKING: Crane Packing 1066, Walkers Incoval or equal.

VALVES:

		Commodity No.
	800 lb socket weld to BS 2995 Material BS 1503 - 161 Grade 28A or BS 1504 - 161 Grade B 13 Cr. trim Valves to be in accordance with BS 2995	
1½" & below	Gate - OS & Y bolted bonnet to BS 3808	4010640 B
	Globe - OS & Y bolted bonnet	4012640 B
	Check - Horizontal ball type bolted cap (to be used where possible)	4016660 B
	Check - Vertical ball type Union bonnet	4015660 B
	Plug - 600 lb regular pattern lubricated hardened steel plug wrench operated (see notes 2 & 4)	401765 KE
	300 lb RF Flanged to BS 1560 Material BS 1504 - 161 Grade B 13 Cr. trim	
2" to 12"	Gate - OS & Y bolted bonnet to BS 1414	2000300 B
14" to 24"	Gate - OS & Y bolted bonnet to BS 1414 bevel gear operated	2000300 B
2" to 8"	Globe - OS & Y bolted bonnet to BS 1873	2002300 B
2" to 12"	Check - Swing type bolted cap to BS 1868	2003300 B
2" to 4"	Plug - regular pattern lubricated hardened steel plug wrench operated (see notes 2 & 4) to BS 1570.	200730 KE
6" to 12"	Plug - Venturi pattern lubricated hardened steel plug gear operated (see note 2). to BS 1570.	200731 KE

SC 15770

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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CUMMUS

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS B1A
300 lb RF CARBON STEEL

NO. JL 8056
H-328

DATE I-11-77

MAINTENANCE JOINTS: All - Flanged

PIPE JOINTS: 1½" & below - SW couplings
2" & above - buttweld

ORIFICE TAPPINGS: Orifice flanges 2" to 14" - ½" screwed API
½" Sch 160 nipple with gate valve to spec.
16" and above - ¾" D, D/2 tappings half coupling, nipple and gate valve to spec.

TEMPERATURE CONNECTIONS: 1½" flanged in accordance with APS 13-2. Modules Nos. TW/007, TW/207, TW/707 and TW/807.

PRESSURE CONNECTIONS: ¾" Sch 160 nipple with gate valve to spec. Module PT-010.

VENT & DRAIN:

¾" Hydrostatic Vent	Module	VT-003
¾" Valved Vent	Module	VV-013
¾" Valved Drain	Module	DV-013

BRANCH CONNECTIONS:

Header	Branch	Connection
1½" & below	Reducing size	Reducing Tee
	Equal size	Equal Tee
2"	1¼ & smaller	SW half coupling
	1½"	BW reducing Tee
	Equal size	Equal Tee
3" & larger	1½" & smaller	SW half coupling
	Equal size	Equal Tee
	Reducing size	Stub-in, branch reinforcement to be used when required

SC 15771

ON 2229

LAM024575

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	I-11			VI-16		XI-7				

CUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS B1A 300 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 4

NOTES:

1. Fabrication Requirements

   (a) Preheat - Up to 30 mm thick, temperature 5°C required and a dry start.
   (b) Postheat - Up to 30 mm thick, none required.
   (c) Radiography - Random 10% in accordance with BS 2633.

2. Plug valves should not be used as services containing strong alkalis and high aromatic solvents or on service temperatures above 232°C.

3. Steam traps for line traps to be ½" NB flanged ends, thermodynamic type, spirax sarco TD 351 or equal commodity number 800012 KE. These traps are not to return condensate to a header where the pressure of the condensate header is more than 80% of the steam pressure.

(5)

SC 15772

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	I-11	II-11	III-25							

CE LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS B2A 300 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 1

SERVICE: Ethylene.

PRESSURE/TEMPERATURE LIMITS: See BS 1560 Table PE-1 Maximum temperature 400°C. (Temperature limit of carbon steel).

CORROSION ALLOWANCE: 0.05".

PIPE: API 5L Grade A or B Seamless

1½" & below - Sch 80 Plain Ends
2" to 6" - Sch 40 Bevel Ends
8" to 18" - Sch 30 Bevel Ends

A 155 Grade C 55 Class 2 EFW Sub-arc weld
20" & above - calculate-Bevel Ends

NIPPLES: API 5L Grade A or B Seamless

1½" & below - Sch 160 Plain Ends

FLANGES: 300 lb RF dimensions to BS 1560
Serrated finish to BS 1560
Material - BS 1503 - 161 Grade 28A
1½" & below - socket weld
2" to 24" - weld neck, bore to match pipe.

FITTINGS: 1½" & below - socket weld 3000 lb dimensions to BS 3799
Material - BS 1503 - 161 Grade 32A
(Unions not to be used)
2" to 24" - buttweld dimensions to BS 1640
Schedule to match pipe
Material to BS 1640 Grade WPB

GASKETS: All sizes - 1.5 mm thick Dimensions to BS 1560 Appendix F Table 37
Material - compressed asbestos fibre to BS 1832

BOLTING: All sizes - Stud bolt with two hexagon nuts
Studs to BS 4882 Grade B7
Nuts to BS 4882 Grade 2H
Threads unified coarse (UNC) to BS 4882 Inch Series

SC 15773

ON 2229

LAM024577

VALVE PACKING: Crane Packing 1066, Walkers Incoval or equal.

VALVES:

		Commodity No.
	800 lb socket weld, to BS 2995 Material BS 1503 - 161 Grade 28A or BS 1504 - 161 Grade B 13 Cr. trim Valves to be in accordance with BS 2995	
1½" & below	Gate - OS & Y bolted bonnet to BS 3808	4010640 B
	Globe - OS & Y bolted bonnet	4012640 B
	Check - Horizontal ball type bolted cap (to be used where possible)	4016660 B
	Check - Vertical ball type Union bonnet	4015660 B
	300 lb RF Flanged to BS 1560 Material BS 1504 - 161 Grade B 13 Cr. trim	
2" to 12"	Gate - OS & Y bolted bonnet to BS 1414	2000300 B
14" to 24"	Gate - OS & Y bolted bonnet to BS 1414 bevel gear operated	2000300 B
2" to 8"	Globe - OS & Y bolted bonnet to BS 1873	2002300 B
2" to 16"	Check - Swing disc, bolted cap to BS 1868	2003300 B

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS B2A 300 lb RF CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 3

MAINTENANCE JOINTS: All - Flanged

PIPE JOINTS: 1½" & below - SW couplings
2" & above - buttweld

ORIFICE TAPPINGS: Orifice flanges 2" to 14" - ½" screwed API
½" Sch 160 nipple with gate valve to spec.
16" & above - ¾" D, D/2 tappings, half couplings, nipple and gate valve to spec.

TEMPERATURE CONNECTIONS: 1½" flanged in accordance with APS 13-2. Modules Nos. TW/007, TW/207, TW/707 and TW/807.

PRESSURE CONNECTIONS: ¾" Sch 160 nipple with gate valve to spec. Module PT-010.

VENT & DRAIN:

¾" Hydrostatic Vent	Module	VT-003
¾" Valved Vent	Module	VV-013
¾" Valved Drain	Module	DV-013

BRANCH CONNECTIONS:

Header	Branch	Connection
1½" & below	Reducing size	Reducing Tee
	Equal size	Equal Tee
2"	1" & smaller	SW Half coupling
	1½"	BW reducing Tee
	Equal size	Equal Tee
3" & larger	1½" & smaller	SW half coupling
	Equal size	Equal Tee
	Reducing size	Stub-in, branch reinforcement to be used when required.

15775

SC

LAM024579

NOTES:

1. Fabrication Requirements

   (a) Preheat - Up to 30 mm thick, temperature 5°C required and a dry start.
   (b) Postheat - Up to 30 mm thick, none required.
   (c) Radiography - Random 10% in accordance with BS 2633.

15776

SC

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	I-11	II-11	III-25	X	IX-7	XI-7				

ELUMMUS

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS A2HA
150 lb RF MONEL

NO. JL 8056
H-328

DATE I-11-77

PAGE 1

SERVICE: BZ Scrubber Bottoms, vapour leaving BZ and PEB scrubbers, vapour leaving vent condenser, vapour leaving partial condenser, liquid leaving partial condenser. Vapour leaving vent condenser. (5)

PRESSURE/TEMPERATURE LIMITS: 13.4 Bars at 30°C Maximum temperature 135°C. (Temperature limitation based on maximum working pressure of valves).

CORROSION ALLOWANCE: Nil

PIPE: Monel to ASTM B 165 Seamless Annealed

½" & ¾" - Sch 40S Bevel Ends
1" to 12" - Sch 10S Bevel Ends

NIPPLES: Monel to ASTM B 165 Seamless Annealed

½" & ¾" - Sch 80S

FLANGES: 150 lb RF
All - Lap joints
Backing flange dimensions to BS 1560
Material - BS 1503 - 161 Grade 28A.
Stub end dimensions to BS 1640
Material - ASTM B 366 Grade WPNC
(Blind and Figure '8' flanges ½" to 2" in Monel 400 B 164
2½" & larger - carbon steel with monel liner)

FITTINGS: All - Buttweld dimensions to BS 1640
Schedule to match pipe
Material - ASTM B 366 Grade WPNC
or ASTM B 366 Grade WPNCW
(see note 2)

GASKETS: All - 5 mm thick monel spiral wound with CAF filler
3 mm thick carbon steel centering ring.
Dimensions to BS 3381 Table 1.

BOLTING: All - Stud bolts with two hexagonal nuts
Studs to BS 4882 Grade B7
Nuts to BS 4882 Grade 2H
Threads unified coarse (UNC) to BS 4882 Inch series

VALVE PACKING: TFE also TFE gaskets.

VALVES:

150 lb RF Flanged to BS 1560
Material - Monel, Cast to ASTM A 296 Grade M35
Monel trim

		Commodity No.
3" & below	Plug - Monel plug PTFE sleeve wrench operated (see note 5)	275708 KE
4" & above	Plug - Monel plug PTFE sleeve gear operated	275709 KE
½" to 12"	Gate - OS & Y BB Split wedge disc.	275000 KE
½" to 6"	Globe - OS & Y BB Loose disc.	275200 KE
½" to 4"	Check - Swing disc Bolted cap	275300 KE
6" & larger	Check - Wafer type	275500 KE
½" to 2"	Ball - 800 lb firesafe BW ends reinforced TFE seats. Anti-static ball and stem devices. Blowout-proof stem. Overall length 400 mm. (See note 5)	375804 KE

SC 15778

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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CUMMUS

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS A2HA
150 lb RF MONEL

NO. JL 8056
H-328

DATE I-11-77

MAINTENANCE JOINTS: All - Flanges

PIPE JOINTS: All - Buttweld

ORIFICE TAPPINGS: Orifice flanges 2" to 12" - ½" screwed API ½" Sch 80S nipples, flange with gate valve to spec.

TEMPERATURE CONNECTIONS: 1½" flanged in accordance with APS 13-2. Modules Nos. TW/007, TW/507, TW/707 and TW/807.

PRESSURE CONNECTIONS: ¾" flange and gate valve to spec. Module PT-0A0.

VENT & DRAIN:

¾" Hydrostatic Vent	Module	VT-0Z0
¾" Valved Vent	Module	VV-0A3
¾" Valved Drain	Module	DV-0A3

BRANCH CONNECTIONS:

Header	Branch	Connection
All sizes	Reducing	Weldolets (see note 2)
	Equal	Tee

15779

SC

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	I-11	X	III-25	VI-16	X	XI-7				

CE LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS A2HA 150 lb RF MONEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 4

NOTES:

1. Fabrication Requirements

   (a) Preheat - Not required, but must ensure a dry start.
   (b) Postheat - None required.
   (c) Radiography - 100% radiography required excluding fillet welds. All completed welds to be 100% Dye penetrant tested. All inspection and tests to ASME Code Section VIII Division 1 and in accordance with H 338.

2. Weldolets to be used if obtainable. Alternative reinforcement welded stub-in branches specifically approved by the piping stress analyst.

3. Gate valves shall be used in in-line service.

4. Gate valves shall be used in vents, drains, instrument connections etc.

(5)

SC 15780

LAM024584

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977		II-11	III-25	X	IX-7	X				

LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS B2HA 300 lb RF MONEL	NO. JL 8056 H-328
DATE II-11-77		PAGE 1

SERVICE: PEB. Scrubber pump discharge.

PRESSURE/TEMPERATURE LIMITS: 35 Bars at 30°C Maximum temperature 200°C. (Temperature limitation based on maximum valve working temperature/pressure).

CORROSION ALLOWANCE: Nil.

PIPE: Monel to ASTM B 165 Seamless Annealed

½" & ¾" - Sch 40S Bevel Ends
1" to 12" - Sch 10S Bevel Ends

NIPPLES: Monel to ASTM B 165 Seamless Annealed

½" & ¾" - Sch 80S

FLANGES: 300 lb RF
All - Lap joints
Lap joint backing flange dimensions to BS 1560
Material - BS 1503 - 161 Grade 28A
Stub end dimensions to BS 1640 part 2
Material - ASTM B 366 Grade WPNC.
Blind and Figure '8' flanges ½" to 2" in Monel 400 B 164
2½" & larger - carbon steel with monel liner.

FITTINGS: All - buttweld dimensions to BS 1640
Schedule to match pipe
Material - ASTM B 366 Grade WPNC
or ASTM B 366 Grade WPNCW
(See note 2).

GASKETS: All - 5 mm thick monel spiral wound with CAF filler
3 mm thick carbon steel centering ring
Dimensions to BS 3381 Table 1.

BOLTING: All - Stud bolts with two hexagonal nuts
Studs to BS 4882 Grade B7
Nuts to BS 4882 Grade 2H
Threads unified coarse (UNC) to BS 4882 Inch series.

SC

15781

JN 2229

LAM024585

VALVE PACKING: TFE also TFE gaskets.

VALVES:

			Commodity No.
		300 lb RF flanged to BS 1560 Material - Monel, cast to ASTM A 296 Grade M35 Monel trim.	
3" & below	Plug	- Monel plug PTFE sleeve wrench operated (see note 4)	275738 KE
4" & above	Plug	- Monel plug PTFE sleeve Gear operated	275739 KE
½" to 6"	Globe	- OS & Y BB loose disc.	275230 KE
½" to 6"	Ball	- 800 lb firesafe. BW ends. reinforced TFE seats. Anti-static ball and stem devices. Blowout-proof stem. Overall length 400 mm. (See note 4).	375804 KE

SC 15782

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	X	II-11	III-25	VI -16	X	X				

ELUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS B2HA 300 lb RF MONEL	NO. JL 8056 H-328
DATE II-11-77		PAGE 3

MAINTENANCE JOINTS: All flanged.

PIPE JOINTS: All buttweld.

ORIFICE TAPPINGS: Orifice flanges 2" to 12" - ½" screwed API - ½" sch 80S nipples, flange with gate valve to spec.

TEMPERATURE CONNECTIONS: 1½" flanged in accordance with APS 13-2. Modules Nos. TW/007, TW/507, TW/707 and TW/807.

PRESSURE CONNECTIONS: ¼" flange and gate valve to spec. Module PT-OAO.

VENT & DRAIN:
¾" Hydrostatic Vent Module VT-OZO
¾" Valved Vent Module VV-OA3
¾" Valved Drain Module DV-OA3

BRANCH CONNECTIONS:

Header	Branch	Connection
All sizes	Reducing Equal	Weldolets see note 2 Tee

SC 15783

LAM024587

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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CUMMUS

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS B2HA
300 lb RF MONEL

NO. JL 8056
H-328

DATE II-11-77

PAGE 4

NOTES:

1. Fabrication Requirements:

   (a) Preheat - Not required but must ensure a dry start.
   (b) Postheat - None required.
   (c) Radiography - 100% radiography required excluding fillet welds. All completed welds to be 100% Dyc penetrant tested. All inspection and tests to ASME Code Section VIII Division I and in accordance with H 338.

2. Weldolets to be used if obtainable. Alternative reinforcement welded stub-in branches specifically approved by the piping stress analyst.

3. Gate valves shall be used in vents, drains, instrument connections etc.

(5)

15784

SC

)N 2229

LAM024588

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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ELLUMMUS

DATE I-11-77

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS S3Y
150 lb RF PTFE OR FEP LINED CARBON STEEL

NO. JL 8056
H-328

PAGE 1

SERVICE: Unwashed Al (contains $AlCl_3$), 12% and 24% $AlCl_3$ solution, $AlCl_3$ recovery system, 1st stage wash emulsion draw off, 1st stage wash overflow, 1st stage wash drain.

PRESSURE/TEMPERATURE LIMITS: 7 BARS Maximum temperature 150°C.
Pressure limitation - ductible iron bodied valves
Temperature limitation - based on maximum allowable for PTFE diaphragm on diaphragm valves.

CORROSION ALLOWANCE: Nil

PIPE: Carbon steel pipe to API 5L Grade A or B or equal with Flouroline - T (PTFE) or Flouroline - F (FEP) lining.

1" to 10" - Sch 40 Flanged.

NIPPLES: None.

FLANGES: 150 lb RF ductile iron supplied with pipe lengths or fittings.

ORIFICE FLANGES: All sizes - use special carrier.

FITTINGS: 1" to 10" - Carbon steel or ductile iron flanged PTFE or FEP lined.

GASKETS: 3 mm thick PTFE ring gaskets.
Gaskets are not required for joining PTFE or FEP lined flange to PTFE or FEP lined flange. They shall be used where PTFE or FEP flanges joins to bare metal flanges.

BOLTING: Hexagon headed machine bolts with hexagon headed nut. Material to BS 1769. Dimensions to APS 8056 - 103. See note 4.

LINING THICKNESS

N.B.	P.T.F.E. WALL	ACTUAL BORE
1"	.094"	0.861"
1½"	.094"	1.422"
2"	.094"	1.879"
3"	.094"	2.880"
4"	.109"	3.808"
6"	.141"	5.783"
8"	.171	7.639"
10"	.171	9.678"

SC 15785

VALVE PACKING: TFE

VALVES:

			Commodity No.
	Plug	- 150 lb RF flanged, FEP lined ductile iron.	
1" to 3"		lever operated (see note 8)	255994 KE
4" to 10"		gear operated	255995 KE
	Butterfly	- 150 lb wafer lug type, ductile iron body and disc fully TFE lined. Disc seals TFE.	
3" & 4"		Lever operated	255607 KE
6" & larger		Gear operated	255617 KE
1" to 4"	Clamp gate	- 150 lb RF flanged, ductile iron with TFE tube.	
1" to 4"	Check vertical	- 150 lb RF flanged, ductile iron, FEP lined with TFE solid ball.	255998 KE
1" to 4"	Check horizontal	- 150 lb RF flanged, ductile iron - FEP lined, PTFE piston.	255988 KE
1" to 6"	Check vertical	- 150 lb RF flanged, ductile iron, PTFE or FEP lined, guided piston.	255987 KE (5)
1" to 8"	Diaphragm	- 150 lb FF Flanged ductile iron glass lined body with TFE diaphragm (Saunders 214/300 or equal.	255951 KE

SC 15786

MAINTENANCE JOINTS: All flanged.

PIPE JOINTS: All flanged.

ORIFICE TAPPINGS: 25 mm, orifice filler, with plug valve to spec.

TEMPERATURE CONNECTIONS: Special thermowell. Commodity No. 695870.

PRESSURE CONNECTIONS: 25 mm flanged with plug valve to spec. Module PT-0C0.

VENT & DRAIN:

1" Hydrostatic Vent	Module	VT-003
1" Valved Vent	Module	VV-0C3
1" Valved Drain	Module	DV-0C3

BRANCH CONNECTIONS: All sizes - Equal and reducing flanged tees.

SC 15787

NOTES:

1. Fabrication Requirements

   (a) Preheat - None.
   (b) Postheat - None.
   (c) Radiography - None.

2. No welding of clips, brackets etc. permitted on lined pipe.

3. All pipe and fittings used in this classification will be purchased on a supply and fabricate basis. Design layout will be based on the "MORAF" catalogue. Isometrics will be prepared and issued to supplier "Approved for construction". Supplier will advise on any revision required to suit fabrication and isometric will be revised and re-issued if required.

4. Bolt up as follows:-

   The use of washers under nuts is optional, if used they shall be cadnium plated.

Pipe size	Bolt Torque m-kgs	Pipe size	Bolt Torque m-kgs
1"	1.1-1.4	5" & 6"	4.8- 6.9
1½"	1.2-2.0	8"	6.2- 8.3
2"	2.5-3.5	10"	9.5-11.8
2½" & 3"	3.2-4.2	12"	13.1-15.2
4"	3.7-5.0	14"	13.8-16.6
		16"	16.6-19.4

Torquing of bolts

(a) Grease all bolts and nuts with a suitable grease.
(b) Finger tighten all nuts.
(c) With a torque wrench, using a criss-cross method tighten each bolt until torgue for each bolt falls within range listed above.

After 24-30 hours or a temperature cycle or a pressure cycle, torgue for each bolt shall be checked and those falling below the minimum are to be torqued to the range listed.

Maximum torque valves listed should be exceeded only when necessary to effect a seal.

When connecting to Haveg Vessel nozzles bolt torques to note 9 to be used.

ELUMMUS

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS S3Y
150 lb RF PTFE OR FEP LINE CARBON STEEL

NOTES - Cont/d...

5. Vent holes must not be plugged with paint, insulation cement etc. Covered or insulated systems shall have vent hole extensions welded in position prior to lining.

6. Deleted (5)

7. All flanged ends on pipe lengths, valves and fittings to be fitted with bolted or wired on covers to stop lining damage and lining creep.

8. Bolt torques when connecting Haveg to PTFE lined pipework.

Pipe Size	Bolt Torque m-kgs	Pipe Size	Bolt Torque m-kgs
½"	0.3 - 0.3	4	1.1 - 2.1
¾"	0.3 - 0.4	6	1.7 - 3.6
1 "	0.3 - 0.8	8	2.2 - 4.5
1½"	0.7 - 1.4	10	2.2 - 4.5
2 "	1.1 - 2.1	12	2.8 - 5.6
3 "	1.4 - 3.1		

Method of tightening up bolts to be as in note 4.

SC 15789

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CUMMUS

DATE I-11-77

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS S8Z
150 lb RF HASTELLOY B2

NO. JL 8056
H-328

PAGE 1

SERVICE: Alkylate, Alkylator vent system, Aklylation drains, Catalyst complex (area 100 to CC feed pumps). Catalyst complex (after CC feed pumps).

PRESSURE/TEMPERATURE LIMITS: Maximum pressure 195 PSIG at
Maximum temperature 232°C
(Limits based on maximum operating conditions).

CORROSION ALLOWANCE: Nil

PIPE: Hastelloy B2

¾" & below - Sch 40S Seamless
1" to 8" - Sch 10S EFW
10" to 24" - Sch 10S EFW

NIPPLES: None

FLANGES: 3" & below - 150 lb RF WN to BS 1560 Material hastelloy B2.
4" & above - 150 lb FF lap joint Carbon steel to ASTM A 105.
Seamless hastelloy stub end to MSS Type A.
Blind flanges shall be carbon steel with explosion clad hastelloy B2. See note 3
Smooth finish facing to 125 RMS.

FITTINGS: All sizes - Buttweld dimensions to BS 1640
Schedule to match pipe.
Material Hastelloy B2
Stub ends. Forged and machined to BS 1640 Part 2 dimensions, or plate rings weld to pipe and machined in accordance with APS 8056 - 110.

GASKETS: All sizes - 5 mm thick hastelloy B2 spiral wound with CAF filled, 3 mm hastelloy B2 inner ring and 3 mm Carbon steel centering ring.
Dimensions to BS 3381 Table 1.

BOLTING: All sizes - Stud bolts with four hexagonal nuts.
Studs to BS 4882 Grade B7.
Nuts to BS 4882 Grade 2H.
Threads unified coarse (UNC) to BS 4882 Inch series.
(See note 10).

SC 15790

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	I-11	X	III-25	VI-16	X	XI-7				

LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS S8Z 150 lb RF HASTELLOY B2	NO. JL 8056 H-328
DATE I-11-77		PAGE 2

VALVE PACKING: Packed graphite.

VALVES:		Commodity No
½" & larger see notes 2.5 6 & 7	Gate - 150 lb RF, OS & Y, BB Solid Wedge. Body & trim Hastelloy B	2710000 B
½" to 6" See note 2 & 7	Globe - 150 lb RF, OS & Y, BB integral seat. Body & trim Hastelloy B	2712000 B
½" & larger See note 2 & 7	Check - 150 lb RF swing check, Bolted cap.	2713000 B
½" to 4" See notes 2,5,7	Plug - 150 lb RF non lubricated fire safe Hastelloy B. Level operated.	271708 KE (5
6" to 12" 16" & 18" See note 2,7	Plug - 150 lb RF non lubricated firesafe, Hastelloy B. Gear operated.	271709 KE (5
8" & smaller See note 2 & 7	Flush Bottom - 150 lb RF Hastelloy B disc opens into tank.	271909 KE
½" to 6" See note 2,7	Plug - 150 lb RF non lubricated TFE lined body Hastelloy B or B2 plug. Lever operated.	271707 KE (5

To be indicated on flowsheet when required.

SC 15791

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	I-11	X	III-25	VI-16	X	X				

LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS S8Z 150 lb RF HASTELLOY B2	NO. JL 8056 H-328
DATE I-11-77		PAGE 3

MAINTENANCE JOINTS: All flanged.

PIPE JOINTS: All buttweld.

ORIFICE TAPPINGS: Use carrier rings, tappings to have plug valves.

TEMPERATURE CONNECTIONS: 1½" flanged in accordance with APS 13-2. Modules Nos. TW/007, and TW/907

PRESSURE CONNECTIONS: 1" pipe weld neck flange and gate valve to spec. PT-0A0.

VENT & DRAIN:

1" Hydrostatic Vent	Module VT-003
1" Valved Vent	Module VV-0A3
1" Valved Drain	Module DV-0A3

Vents & drains to have gate valves.

BRANCH CONNECTIONS:

Header	Branch	Connection
2" & below	Equal size	Equal Tee
2" & below	Reducing size	Reducing Tee
3" & above	Reducing size	Reducing Tee
3" & above	Equal size	Equal Tee

All branch welds to be 100% reinforced.
All 1" & below sized branches on lines 3" and above shall have Weldolets.
All vents, drains, PI and TI connections on lines 3" and above to have weldolets.

SC 15792

NOTES:

1. Fabrication Requirements

   (a) Preheat - All welds temperature 5°C required and a dry start.
   (b) Postheat - After welding is not required. Fabricated fittings involving forming and welding will however require solution heat treatment as a final operation.
   (c) Radiography - 100% of all welds.

2. All forged and rolled Hastelloy B2 material shall conform and be fabricated in accordance with Engineering Specification for Hastelloy B2 Fabrication (Forming, welding and Heat Treatment) D-331.

3. Carbon steel lap-joint flanges are used for back-up flanges on Hastelloy B2 Stub Ends.

4. When additional strength is required on lines subject to vibration the required wall thickness shall be noted on the applicable flow diagram.

5. Gate valves shall be used in in-line service.

6. Gate valves shall be used as first block valves at Alkylator and Transalkylator.

7. All castings shall be Hastelloy B in accordance with Appendix II of this specification.

10. Bolt up as follows:-

Pipe size	Bolt Torque m-kgs	Pipe size	Bolt Torque m-kgs
up to 1½"	4.2	10" & 12"	22.2
2" to 4"	8.3	14" & 16"	33.9
5" to 8"	13.9	18" & 20"	49.2

Torquing of bolts:-

(a) Grease all bolts and nuts with Crane Packing Thred-Guard.
(b) Finger tighten all nuts.

NOTES - Cont'd...

(c) With a torque wrench, using a criss-cross method tighten each bolt until torque for each bolt falls within range listed above.

After 24-30 hours or a temperature cycle or a pressure cycle, torque for each bolt shall be checked and thos falling below the minimum are to be torqued to the range listed.

Maximum torque valves listed should be exceed only when necessary to effect a seal.

11. Temporary strainers to be carbon steel and replaced immediately af after water batching with hastelloy B2 spacer plate.

SC 15794

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	X	X	X	X	IX-7	XI-7				

LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS S9Z SPECIAL RATING RF HASTELLOY B2 (5)	NO. JL 8056 H-328
DATE IX-7-77		PAGE 1

SERVICE: Alkylate and Alkylator circulating loop.

PRESSURE/TEMPERATURE LIMITS: (5)
Maximum pressure 280 PSIG at
Maximum temperature 232°C
(Limits based on maximum operating conditions).

CORROSION ALLOWANCE: Nil

PIPE: Hastelloy B2

¼" & below - Sch 40S Seamless
1" to 8" - Sch 10S EFW
10" to 24" - Sch 10S EFW

NIPPLES: None

FLANGES:
3" & below - 150 lb RF WN to BS 1560 Material hastelloy B2.
4" & above - Special FF lap joint Carbon steel to ASTM A 105.
Seamless hastelloy stub end to MSS Type A.
Blind flanges shall be carbon steel with explosion clad hastelloy B2. See note 3 (5
150 lb drilling to BS 1560. Smooth finish facing to 125 RMS

FITTINGS: All sizes - Buttweld dimensions to BS 1640
Schedule to match pipe.
Material Hastelloy B2
Stub ends. Forged and machined to BS 1640 Part 2 dimensions, or plate rings weld to pipe and machined in accordance with APS 8056 - 110.

GASKETS: All sizes - 5 mm thick hastelloy B2 spiral wound with CAF filled, 3 mm hastelloy B2 inner ring and 3 mm Carbon steel centering ring.
Dimensions to BS 3381 Table 1.

BOLTING: All sizes - Stud bolts with four hexagonal nuts.
Studs to BS 4882 Grade B7.
Nuts to BS 4882 Grade 2H.
Threads unified coarse (UNC) to BS 4882 Inch series.
(See note 8).

SC 15795

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	X	X	X	X	IX-7	XI-7				

LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS S9Z SPECIAL RATING RF HASTELLOY B2 (5)	NO. JL 8056 H-328
DATE IX-7-77		PAGE 2

VALVE PACKING: Packed graphite

VALVES:		Commodity No.
½" & larger see notes 2, 5 6 & 7	Gate - 150 lb RF, OS & Y, BB Solid Wedge. Body & trim Hastelloy B	271030 KE
½" to 6" See notes 2 & 7	Globe - 150 lb RF, OS & Y, BB integral seat. Body & trim Hastelloy B	271230 KE
½" & larger See notes 2 & 8	Check - 150 lb RF swing check, Bolted cap.	271330 KE
½" to 4" see note 2, 5, 7 & 8	Plug - 150 lb RF non lubricated fire safe Hastelloy B. Level operated.	271738 KE
6" to 12" 16" & 18" See notes 2, 7 & 8	Plug - 150 lb RF non lubricated firesafe, Hastelloy B. Gear operated.	271739 KE

SC 15796

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
DATE 1977	X	X	X	X	IX-7	XI-7				

ELLUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS S9Z SPECIAL RATING RF HASTELLOY B2 (5)	NO. JL 8056 H-328
DATE IX-7-77		PAGE 3

MAINTENANCE JOINTS: All flanged.

PIPE JOINTS: All buttweld.

ORIFICE TAPPINGS: Use carrier rings, tappings to have plug valves.

TEMPERATURE CONNECTIONS: 1½" flanged in accordance with APS 13-2. Modules Nos. TW/007, and TW/907.

PRESSURE CONNECTIONS: 1" pipe weld neck flange and gate valve to spec. PT-0A0.

VENT & DRAIN:

1" Hydrostatic Vent	Module	VT-003
1" Valved Vent	Module	VV-0A3
1" Valved Drain	Module	DV-0A3

Vents & drains to have gate valves.

BRANCH CONNECTIONS:

Header	Branch	Connection
2" & below	Equal size	Equal Tee
2" & below	Reducing size	Reducing Tee
3" & above	Reducing size	Reducing Tee
3" & above	Equal size	Equal Tee

All branch welds to be 100% reinforced.

All 1" and below sized branches on lines 3" and above shall have weldolets.

All vents, drains, PI and TI connections on lines 3" and above to have weldolets.

SC 15797

NOTES:

1. Fabrication Requirements

   (a) Preheat - All welds temperature 5°C required and a dry start.
   (b) Postheat - After welding is not required. Fabricated fittings involving forming and welding will however require solution heat treatment as a final operation.
   (c) Radiography - 100% of all welds.

2. All forged and rolled Hastelloy B2 material shall conform and be fabricated in accordance with Engineering Specification for Hastelloy B2 Fabrication (Forming, welding and Heat Treatment) D-331.

3. Carbon steel lap-joint flanges are used for back-up flanges on Hastelloy B2 Stub Ends.

4. When additional strength is required on lines subject to vibration the required wall thickness shall be noted on the applicable flow diagram.

5. Gate valves shall be used in in-line service.

6. Gate valves shall be used as first block valves at Alkylator and Transalkylator.

7. All castings shall be Hastelloy B in accordance with Appendix II of this specification.

8. Bolt up as follows:-

Pipe Size	Bolt Torque m-kgs	Pipe Size	Bolt Torque m-kgs
½"	4.3	8"	24.1
¾" to 1¼" & 2	8.6	10"	36.1
1½" & 2½" to 6"	15.4	12" & 14"	52.4
		16" to 20"	73.9

SC 15798

Torquing of bolts:-

(a) Grease all bolts and nuts with Crane Packing Thred-Guard.
(b) Finger tighten all nuts.

NOTES - Cont'd...

(c) With a torque wrench, using a criss-cross method tighten each bolt until torque for each bolt falls within range listed above.

After 24-30 hours or a temperature cycle or a pressure cycle, torque for each bolt shall be checked and thos falling below the minimum are to be torqued to the range listed.

Maximum torque valves listed should be exceed only when necessary to effect a seal.

9. Temporary strainers to be carbon steel and replaced immediately after water batching with hastelloy B2 spacer plate.

SC 15799

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DATE 1977	I-11	II-11	III-25							

LUMMUS

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS H1X
150 lb GALVANISED CARBON STEEL

NO. JL 8056
H-328

DATE I-11-77

PAGE 1

SERVICE: Instrument air.

PRESSURE/TEMPERATURE LIMITS: 7 BARS at 65°C.
(Pressure and temperature limitation due to diaphragm valves).

CORROSION ALLOWANCE: Nil.

PIPE: API 5L Grade A or B Seamless Hot dipped galvanised

2" & below - Sch 80 Screwed Ends
3" - Sch 40 Screwed Ends

API 5L Grade A or B Seamless

4" - Sch 40 Bevel Ends
(see note 3)

NIPPLES: API 5L Grade A or B Seamless Hot dipped galvanised

1½" & below - Sch 160 Screwed Ends

FLANGES: 150 lb FF, dimensions to BS 1560
3" & below - Screwed
Material - BS 1503 - 161 Grade 28A
hot dipped galvanised

4" - Slip-on
Material - BS 1503 - 161 Grade 28A
(see note 3)

FITTINGS: 3" & below - Screwed. 3000 lbs dimensions to BS 3799
Material - BS 1503 - 161 Grade 32A
hot dipped galvanised

4" - Buttweld dimensions to BS 1640
Schedule to match pipe.
Material - BS 1640 Grade WPB
(see note 3)

GASKETS: All sizes - 1.5 mm thick full face
Material - compressed asbestos fibre to BS 1832

SC

15800

BOLTING: All sizes - Hexagon headed machine bolts with one hexagon nut (full bearing type)
Material - BS 1769
Threads unified coarse (UNC) to BS 4882 Inch series (see note 2)

VALVE PACKING: To be manufacturers standard.

VALVES:

			Commodity No.
	150 lb screwed to BS 2995 Material - Bronze to BS 1400 LG2-C Trim - Bronze to BS 1400 LG2-C		
2" & below	Globe	- Inside screw, rising stem, Union bonnet.	4602000 B
¼" & below	Gate	- Inside screw, rising stem, Union bonnet. (For instrument connection only)	4600000 B
2" & below	Check	- 200 lb, swing type screwed bonnet.	4603000 B
	150 lb Flat Face Flanged to BS 1560 Material - BS 1504 - 161 Grade B		

SC 15801

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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CE LUMMUS

DATE I-11-77

ENGINEERING SPECIFICATION

PIPING MATERIALS
CLASS H1X
150 lb GALVANISED CARBON STEEL

NO. JL 8056
H-328

MAINTENANCE JOINTS: 2" & below - Unions 3000 lb.
3" & above - Flanged.

PIPE JOINTS: 3" & Below - Screwed couplings
4" & above - Flanged.

ORIFICE TAPPINGS Orifice flanges all - ½" screwed API
½" Sch 160 nipples with gate valves to spec.

TEMPERATURE CONNECTIONS: 1" screwed API connection in accordance with APS 13-1 Module TW/000.

PRESSURE CONNECTIONS: ¼" Sch 160 nipple with gate valve to spec. Module PT-010.

VENT & DRAIN:

¾" Hydrostatic Vent	Module	VT-002
¾" Valved Vent	Module	VV-012
¾" Valved Drain	Module	DV-012

BRANCH CONNECTIONS

Header	Branch	Connection
3" & below	Reducing size	Reducing Tee
	Equal size	Equal Tee
4"	Reducing size	Scrd half coupling
	Equal size	Equal Tee

SC 15802

LAM024606

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CE LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS H1X 150 lb GALVANISED CARBON STEEL	NO. JL 8056 H-328
DATE I-11-77		PAGE 4

NOTES:

1. Fabrication Requirements

   (a) Preheat - 4" size and above temperature 5°C required and a dry start.
   (b) Postheat - None required.
   (c) Radiography - 4" size, spot - 5% in accordance with BS 3351.

2. For bolt lengths see drg. No. 8056 - 103.

3. All lines 4" & above to be hot dipped galvanised after fabrication, no welding allowed after galvanising.

4. All galvanised pipework to be painted with a fire resistant epoxy paint in accordance with Engineering Specification for Painting O-318.

SC 15803

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CE LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS S1K STAINLESS STEEL	NO. JL 8056 H-328
DATE VI-16-77		PAGE 1

SERVICE: Steam tracing.
(Pressure/Temperature limits due to carbon steel limitation).

PRESSURE/TEMPERATURE LIMITS: See BS 1560 Table PE-1. Maximum temp. 399°C.

CORROSION ALLOWANCE: Nil.

PIPE: ASTM A 269 TP 304 Seamless, soft annealed.
½" OD 0.035" WT Plain Ends

NIPPLES: None.

FLANGES: None.

FITTINGS: ½" OD - Compression fittings.
Material - Stainless steel.
90 Deg. ELL, EQUAL TEE, UNION.
Male and female stud couplings.

GASKETS: NONE.

BOLTING: NONE.

SC 15804

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CUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS S1K STAINLESS STEEL	NO. JL 8056 H-328
DATE VI-16-77		PAGE 2

NOTES:

1. PIPE JOINTS TO BE UNIONS. Unions to be used at line flange joints, valves etc. UNIONS TO BE LOCATED OUTSIDE OF THE PIPE LAGGING.

2. Material for lead lines from steam header to tracer including valves to be as steam spec. A7A. Condensate return from tracer to condensate header to be as condensate spec. A7A.

SC 15805

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CUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS S2U COPPER TUBING	NO. JL 8056 H-328
DATE III-25-77		PAGE 1

SERVICE: Potable water.

PRESSURE/TEMPERATURE LIMITS: 14 Bars and 205°C.
(Pressure/temperature limits due to copper tube and fittings).

CORROSION ALLOWANCE: Nil.

PIPE: Copper Tube to BS 1172 - C 106 Condition O
phosphorous de-oxidized non-arsenical copper
seamless solid drawn.

½" NB 15 mm O.D. 0.80 mm wall thickness
¾" NB 22 mm O.D. 0.80 mm wall thickness
1" NB 28 mm O.D. 0.80 mm wall thickness
1½" NB 42 mm O.D. 1.5 mm wall thickness
2" NB 54 mm O.D. 2.0 mm wall thickness

FITTINGS: 2" NB & below - Flareless compression type.
Material brass to BS 2051 Part 1.
(use of compression fitting to be kept to a minimum. Bends to be used where possible).

VALVES:

150 lb screwed to BS 2995
Material - Bronze to BS 1400 - LG2-C
Trim bronze to BS 1400 - LG2-C

		Commodity No.
2" NB & below	Globe - Inside screw, rising stem, union bonnet.	4602000 B

SC 15806

)N 2229

LAM024610

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CUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS CLASS S2U COPPER TUBING	NO. JL 8056 H-328
DATE III-25-77		PAGE 2

NOTES:

1. All pipe joints to be compression type couplings.
2. Safety shower and eyebath to be to BP Chemicals Drg MISC 142 and Commodity No. 800700 KE.
3. All buried copper pipe and fitting to be coated and wrapped to Specification H-318.
4. Eyebath and shower unit to be supplied complete with shower/ eyebath sign and one zone 2 overhead indicator lamp, colour green, pipework galvanized carbon steel. Unit to be to BP Chem. Drg. MISC 142. Commodity No. 816700CE. Electric tracing of unit by LCL electrical dept.

SC 15807

LAM024611

APPENDIX I

Differences between 6284 & 8056 piping classes as at 9.3.77

Class A1A Pipe 18" ¼ above
6284 - API 5L Gr B EFW Sub arc welded.
8056 - ASTM A155 Grade C55 class 2 EFW Sub arc welded.

Class A2A Pipe 18" & above as A1A
Ball valves up to 6" 6284 - chrome plated ball
8056 - s.s. ball

Temperature Connections.
6284 - 1" screwed API to APS 13-1
8056 - 1½" flanged to APS 13-2.

Class A4A Pipe 18" & above as A1A
Globe - 2" to 8" added from 6284

Class A7A Pipe 18" & above as A1A
Temperature Connections
6284 - 1" screwed API to APS 13-1
8056 - 1½" flanged to APS 13-2

Class A9A Pipe 18" & above as A1A

pipe	1½" NB	8056	Sch 80	6284 - Sch 160
	2 " NB	8056	Sch 80	6284 - Sch 160
	3" & 4 " NB	8056	Sch 40	6284 - Sch 160
	6 " NB	8056	Sch 40	6284 - Sch XS
	8" to 16 " NB	8056	Sch 30	6284 - Sch XS
	18 " NB	8056	Sch Std Wt	6284 - Calculate

Temperature Connections.

6284 - 1" screwed API to APS 13-1
8056 - 1½" flanged to APS 13-2.

Class B1A pipe above 18" as A1A
Maintenance joints - 6284 - 1½" & below 3000 lb unions
8056 - All flanged

Temperature Connection - 6284 - 1" screwed API to APS 13-1
8056 - 1½" flanged to APS 13-2

SC 15808

Class B2A Service - defined
Pipe above 18" as A1A
Gasket 6284 - Profile soft iron
8056 - Compressed asbestos fibre.

Class H1X Pipework 6284 - Pipework 4" size galvanised, screwed joints.
8056 - Pipework 4" and above - fabricated then galvanised.

Class S1U Tubing - 6284 - 1" and below - Seamless 18 SWG to BS 2017 Bright annealed
8056 - 15 mm old seamless 0.80 mm thick to BS 1172 - C106 Condition O.

SC 15809

APPENDIX II

A. All castings shall be Hastelloy B(Otto Junker) specification base ASTM A-494 class N-12M-1.

B. All castings shall be subjected to careful visual inspection by inspectors experienced in quality control of high alloy castings. All suspect areas shall be ground smooth to remove the 'as cost' surface and shall then be dye penetrant tested.

Linear type surface defects such as cracks, hot tears, folds etc., regardless of length, will be reason for rejection of castings. Such defects in areas not to be machined may, however, be removed by grinding, blending and checked by subsequent dye penetrant testing provided:-

a) the section thickness is not reduced by more than 10% of the actual cost thickness and,

b) the pressure envelope minimum design thickness is maintained. Other linear defects that are unacceptable may be repaired by chipping, grinding and subsequent weld repair prior to solution annealing.

C. All pressure containing castings shall be radiographed in the critical regions. Critical regions shall be defined on the basis of casting difficulty (changes of section thickness) and/or regions of the pressure envelope which are highly stressed. To this end the foundry shall submit detailed shooting sketches which shall show the number of radiographs, the direction of radiography in relation to the geometry of the casting, source size and strength. These shall be agreed to by Lummus prior to placemennt of order with foundry. Radiography will be carried out in accordance with ASTM E-446. The defect acceptance level II shall be applied to Category A, B & C defects. No category D, E or F defects shall be permitted. Non-pressure containing castings may be subject to radiography. The extent of this radiography shall be agreed with Lummus prior to placement of order with foundry. For non-pressure containing castings the defect acceptance level III shall be applied to category A, B & C defect. No category D, E or F defects shall be permitted.

D. Defects revealed by radiographic examination may be repaired by welding to the extent authorized by ASTMA 494 and Lummus.

E. After proof machining on all surfaces to be finish machined, the machined surfaces shall be dye penetrant tested in accordance with ASTM E-433. Cracks or tears in stressed areas will not be acceptable. Isolated small linear defects in any area (e.g. refering to small inclusions which may be on the outside surface but not on a machine face, i.e. flange face) will not necessarily be unacceptable. Subject only to the function of the machined surface (e.g. not generally acceptable on valve seats) isolated small non-linear defects will be acceptable. Unacceptable defects may be repaired by welding.

F. Any permitted repair shall be radiographed to the same standard as the casting following grinding and dye penetrant testing. Any crack or crack-like defect shall be removed by grinding. If contained within weld metal then re-welding will be permitted. If crack has propogated into the casting, one further weld repair is permitted.

G. All castings should be solution annealed in accordance with the foundry's practice. The practice shall be submitted to Lummus for approval. Solution annealing shall be carried out after all weld repairs have been performed.

H. After final machining all machined surfaces shall be dye penetrant tested, in accordance with ASTM E-433. No linear defects such as cracks or tears shall be acceptable.

J. All castings will be hydrotested at not less than 1½ times design pressure.

SC

15811

SC 15812

ISSUE NUMBER	0	1	2	3	4	5	6	7	8	9
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LUMMUS	**ENGINEERING SPECIFICATION** PIPING MATERIALS HASTELLOY B CASTING REQUIREMENTS	NO. JL 8056 H-328
DATE VI-16-77		PAGE 1

APPENDIX III

1. All castings shall be Hastelloy B (Langley Alloys), the material specification base is ASTM A494- Class N-12M-1.

2. All castings shall be subjected to careful visual inspection by inspectors experienced in quality control of high alloy castings. All suspect areas shall be ground smooth to remove the 'as cast' surface and shall then be dye penetrant tested.

   Linear type surface defects such as cracks, hot tears, folds, etc., regardless of length, will be reason for rejection of castings. Such defects in areas not to be machined may, however, be removed by grinding, blending and checked by subsequent dye penetrant testing provided.

   (a) the section thickness is not reduced by more than 10% of the actual cast thickness, and

   (b) the pressure envolope minimum design thickness is maintained. Other linear defects that are unacceptable may be repaired by chipping, grinding and subsequent weld repair prior to solution annealing.

3. All pressure containing castings shall be radiographed in the critical regions. Critical regions shall be defined on the basis of casting difficulty (changes of section thickness) and/or regions of the pressure envelope which are highly stressed. To this end the foundry shall submit detailed shooting sketches which shall show the number of radiographs, the direction of radiography in relation to the geometry of the castings, source size and strength. These shall be agreed to by Lummus prior to placement of order with foundry. Radiography will be carried out in accordance with ASTM E-446. The defect acceptance level II shall be applied to Category A, B & C defects. No Category D, E or F defects shall be permitted. Non-pressure containing castings may be subject to radiography. The extent of this radiography shall be agreed with Lummus prior to placement of order with foundry. For non pressure containing castings the defect acceptance level III shall be applied to Category A, B & C defects. No Category D, E or F defects shall be permitted.

4. Defects revealed by radiographic examination may be repaired by welding to the extent authorized by ASTM A-494 and Lummus.

5. Any permitted repair shall be radiographed to the same standard as the casting following grinding and dye penetrant testing. Any crack or crack-like defect shall be removed by grinding. If contained within weld metal then re-welding will be permitted. If crack has propagated into the casting, one further weld repair is permitted.

6. All castings should be solution annealed in accordance with the foundry's practice. The practice shall be submitted to Lummus for approval. Solution annealing shall be carried out after all weld repairs have been performed.

7. After machining, the machined surfaces shall be dye penetrant tested in accordance with ASTM E-433. Cracks or tears in stressed areas will not be acceptable. Isolated small linear defects in any area (e.g. refering to small inclusion which may be on the outside surface but not on a machine face, i.e. flange face) will not necessarily be unacceptable. Subject only to the function of the machined surface (e.g. not generally acceptable on valve seats) isolated small non-linear defects will be acceptable.

8. All castings will be hydrostested at not less than 1-½ times design pressure.

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JL 8056

LFB 263

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SC 15814