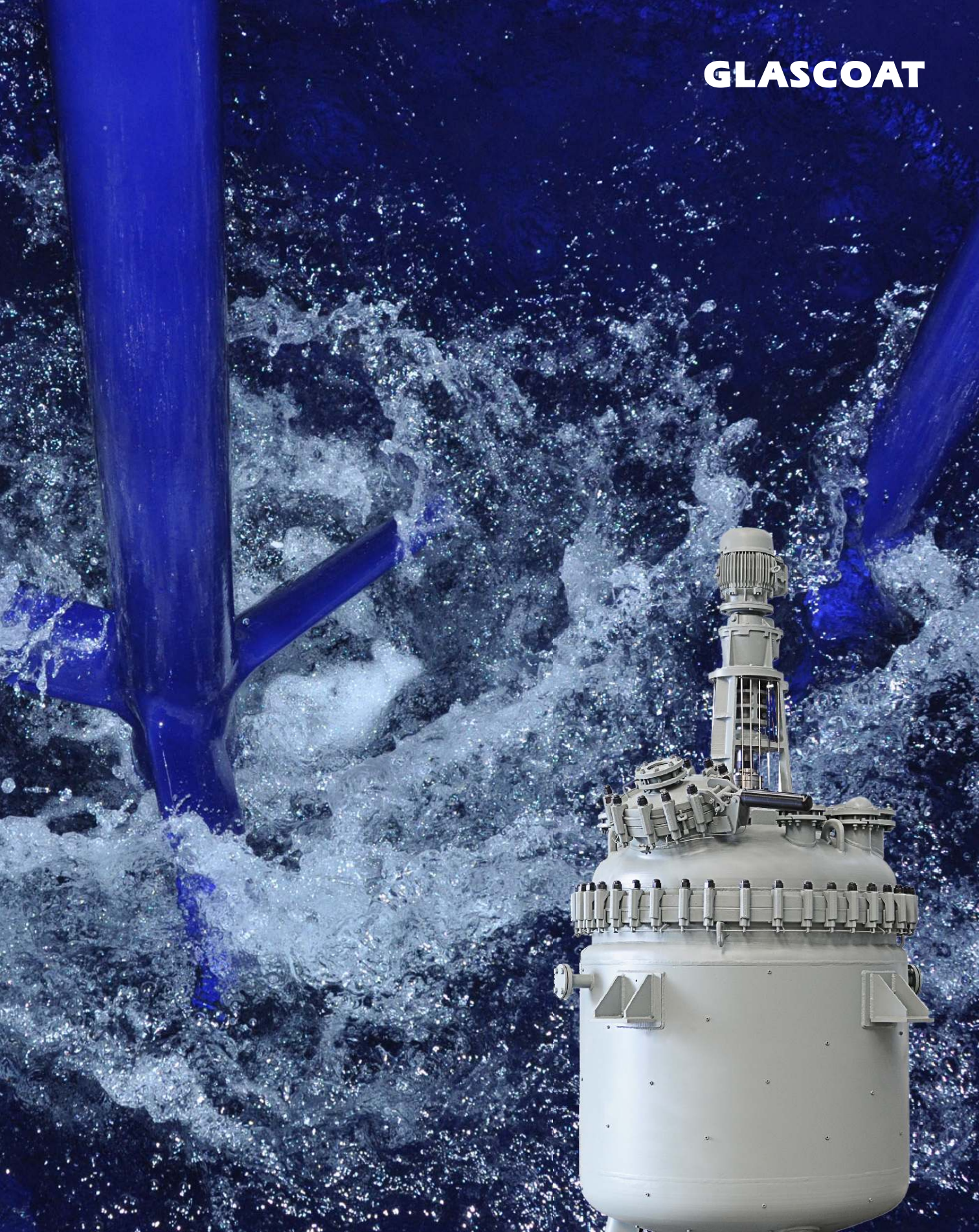


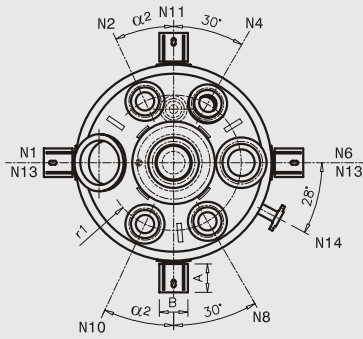
	Index	Page
1	Catalogues (Carbon Steel Glass-lined Equipment) <ul style="list-style-type: none">• Reactors• Heat Exchangers• Rotary Conical Vacuum Dryers (RCVD)• Agitated Nutsche Filters (ANFD)• Valves, Pipes & Fittings	02 10 15 20 26
2	Technical Specifications	33
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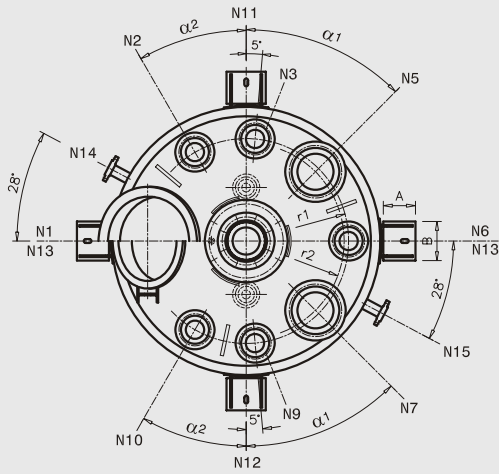


**GLASS-LINED
REACTORS**

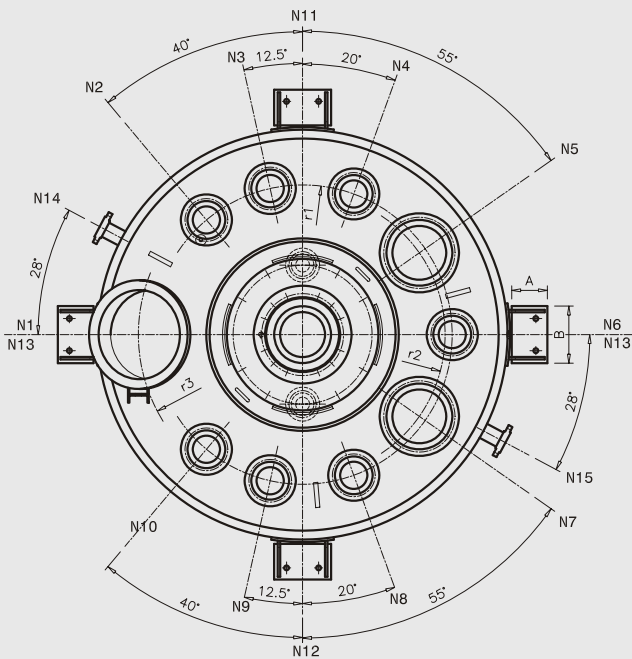
AE SERIES: 63-8000 Ltrs
CE SERIES: 1600-50000 Ltrs



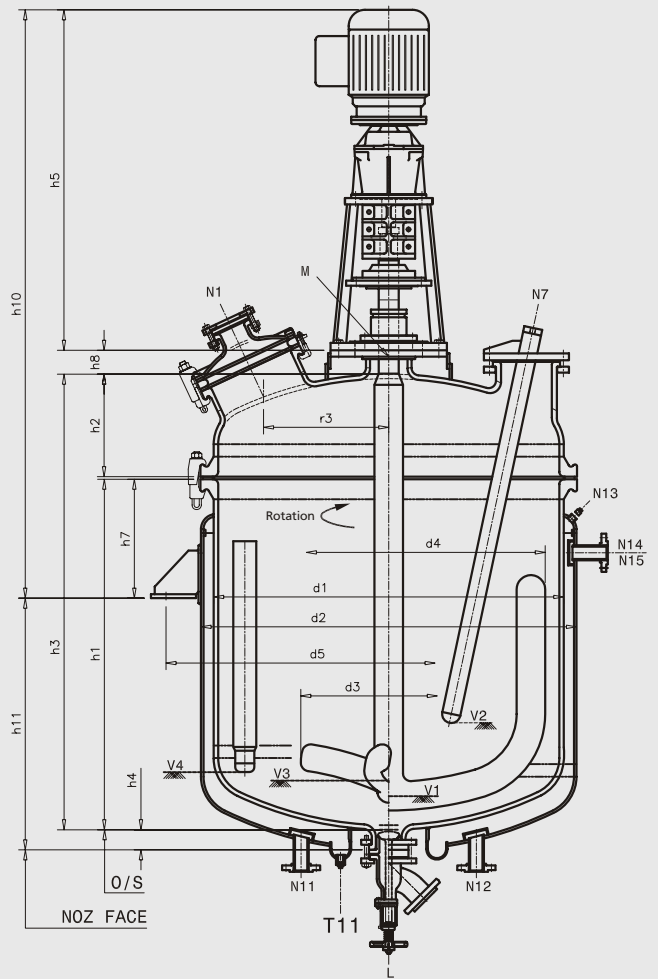
AE 63 - AE 630 Plan View



AE 1000 - AE 6300 Plan View



AE 8000 Plan View

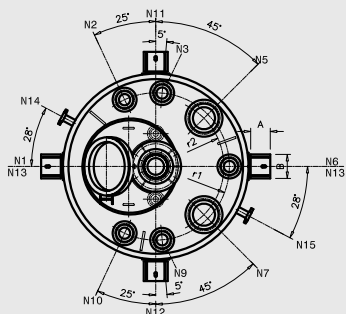


AE GLASS-LINED REACTORS - DIN 28136

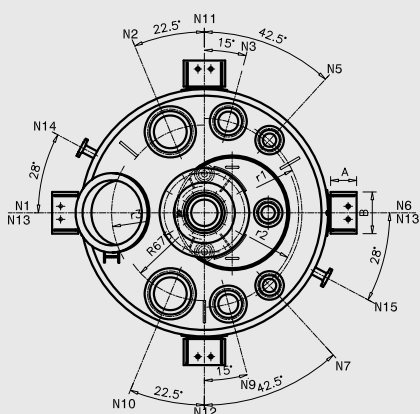
Gross volume (ltrs.)	63	100	160	250	500	630	1000	1600	2000	2500	3000	4000	5000	6300	8000	
Total volume (ltrs.)	93	135	250	340	730	855	1470	2300	2580	3500	3800	5385	6800	8200	10500	
Jacket volume (ltrs.)	22	33	71	95	150	165	210	287	340	375	455	522	560	630	765	
Min. Stirrable volume V1 (with ANC) (ltrs.)	6	6	15	15	32	32	35	60	60	69	69	102	117	158	158	
Min. Sensible volume V2 (with ANC) (ltrs.)	34	34	72	90	204	204	305	465	465	604	634	900	733	1185	1930	
Min. Stirrable volume V3 (with IMP) (ltrs.)	12	12	32	32	62	62	78	150	150	126	126	250	242	242	289	
Min. Sensible volume V4 (with IMP) (ltrs.)	19	19	64	85	87	87	102	215	215	277	282	326	1132	1000	1968	
Approx heat surface Area (sq. mtrs.)	0.6	0.9	1.2	1.8	2.7	3.1	4.6	6.2	7.3	8.3	9.3	11.7	13	16.1	18.5	
D I M E N S I O N S	d1	508	508	800	800	1000	1000	1200	1400	1400	1600	1600	1800	2000	2000	2200
	d2	600	600	900	900	1100	1100	1300	1500	1500	1700	1700	1900	2100	2100	2300
	d3	300	300	480	480	600	600	720	840	840	960	960	1100	1100	1100	1100
	d4	420	420	670	670	880	880	1060	1250	1250	1440	1440	1630	1630	1810	1810
	d5	756	756	1056	1056	1355	1355	1559	1780	1780	1980	1980	2210	2414	2414	2618
	h1	400	600	522	714	845	1000	1200	1400	1600	1600	1755	2000	2000	2500	2620
	h2	180	180	280	280	300	300	350	400	400	460	460	500	550	550	580
	h3	590	790	812	1004	1155	1310	1560	1810	2010	2070	2225	2510	2560	3060	3210
	h4	70	70	70	70	78	78	76	80	80	80	80	80	86	86	86
	h5	828	828	1026	1026	1072	1072	1072	1282	1282	1348	1348	1577	1700	1700	1815
	h7	300	300	320	360	405	435	435	475	475	485	485	630	640	640	700
	h8	70	70	90	90	90	90	90	100	100	100	100	130	130	130	130
	h10	1388	1388	1726	1766	1877	1907	1957	2267	2267	2403	2403	2847	3030	3030	3235
	h11	170	370	272	424	564	689	875	1030	1230	1220	1375	1520	1523	2023	2083
	α1	--	--	--	--	--	--	22.5	30	30	25	25	25	30	30	--
	α2	25	25	30	30	25	25	47.5	45	45	45	45	45	45	45	--
	r1	210	210	310	310	380	380	500	575	575	675	675	725	800	800	840
r2	--	--	--	--	--	--	450	550	550	625	625	675	750	750	800	
r3	210	210	310	310	370	370	440	500	500	580	580	630	700	700	850	
A x B	100x140	100x140	100x140	100x140	160x160	160x160	160x160	180x220	180x220	180x220	180x220	200x320	200x320	200x320	200x320	
Drain valve	80x50	80x50	100x80	100x80	100x80	100x80	100x80	100x80	100x80	100x80	100x80	100x80	150x100	150x100	150x100	
Drive power (hp)	1	1	2	2	3	3	3	5	5	7.5	7.5	10	15	15	20	
Approx. weight (kg)	445	500	935	1038	1532	1630	2122	2835	3014	3631	3801	5572	6190	6924	8500	

N O Z Z L E S	N1	100	100	150	150	250	250	350x450	350x450	350x450	350x450	350x450	500	500	500	500	
	N2,N10	40	40	50	50	100	100	100	100	100	100	100	150	150	150	150	
	N3	--	--	--	--	--	--	100	100	100	100	100	100	150	150	150	150
	N4	80	80	80	80	100	100	--	--	--	--	--	--	--	--	--	150
	N5,N7	--	--	--	--	--	--	200	200	200	200	200	200	250	250	250	300
	N6	80	80	80	80	150	150	100	100	100	100	100	100	150	150	150	150
	N8	50	50	80	80	100	100	--	--	--	--	--	--	--	--	--	150
	N9	--	--	--	--	--	--	100	100	100	100	100	100	150	150	150	150
	L	80	80	100	100	100	100	100	100	100	100	100	100	100	150	150	150
	M	50	50	80	80	125	125	125	150	150	150	150	200	200	200	250	
	N11	40	40	40	40	50	50	50	50	50	50	50	50	50	80	80	80
	N12	--	--	--	--	--	--	--	50	50	50	50	50	50	80	80	80
	N14	40	40	40	40	50	50	50	50	50	50	50	50	50	80	80	80
	N15	--	--	--	--	--	--	--	50	50	50	50	50	50	80	80	80
	N13,T11	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP	½"BSP

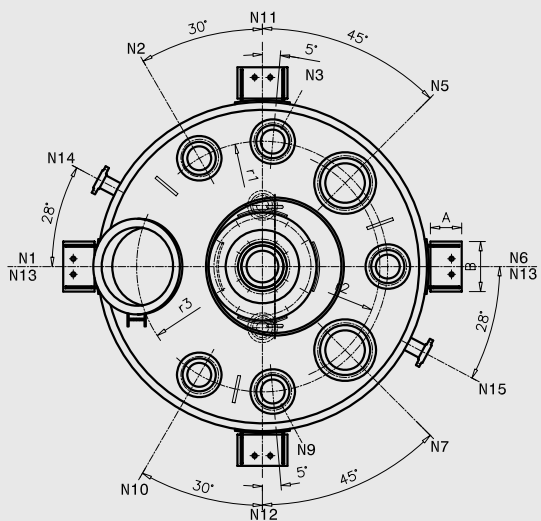
Dimensions and Weights mentioned are for guidelines only. Glascoat reserves the right to modify due to continuing innovation in technology.



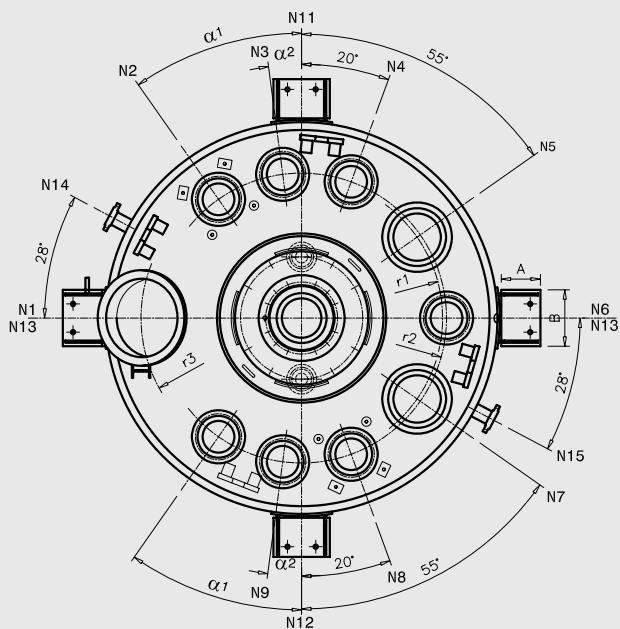
CE 1600 - CE 3000 Plan View



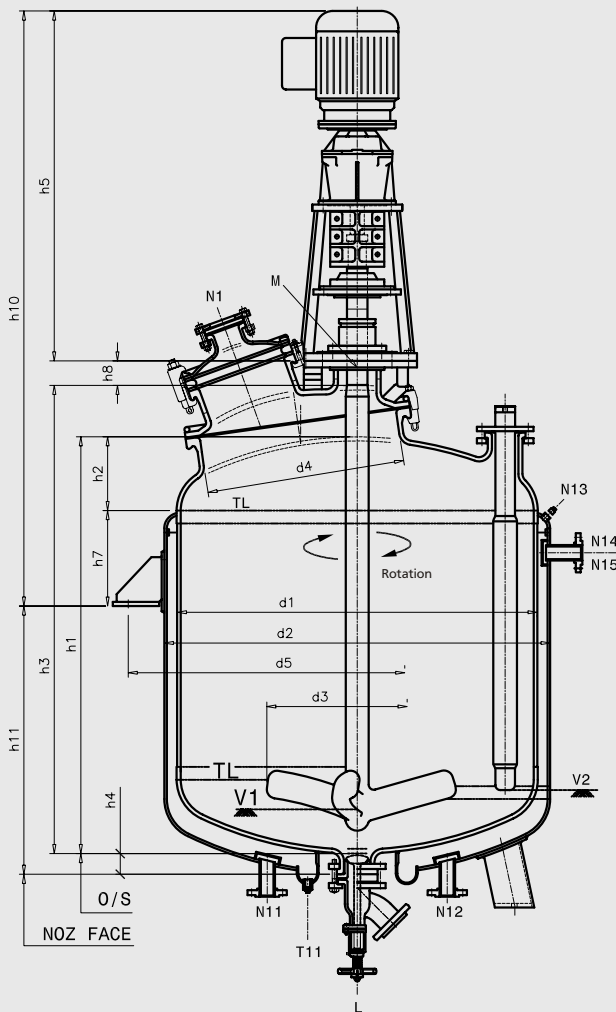
CE 4000 Plan View



CE 5000 - CE 6300 Plan View



CE 8000 - CE 40000 Plan View



CE GLASS-LINED REACTORS - DIN 28136

Gross volume (ltrs.)	1600	2000	2500	3000	4000	5000	6300	8000	10000	12500	16000	20000	25000	32000	40000	50000	
Total volume (ltrs.)	2045	2360	3100	3400	4920	6060	7595	9540	11770	15065	18756	22632	28584	36700	44700	55845	
Jacket volume (ltrs.)	320	355	415	455	570	552	755	847	900	1050	1120	1306	1510	2645	3215	4008	
Min. Stirrable volume V1 (ltrs.)	115	115	195	195	195	210	210	215	345	345	536	536	710	-	-	-	
Min. Sensible volume V2 (ltrs.)	205	205	244	244	337	412	412	798	2043	2043	2653	2653	3146	-	-	-	
Approx. heat surface Area (sq. mtrs.)	6.5	7.5	8.6	10	12	13.4	16.6	18	20.7	25.2	29	34	39.5	45.6	55.4	65.6	
D I M E N S I O N S	d1	1400	1400	1600	1600	1800	2000	2000	2200	2400	2400	2800	2800	3000	3400	3400	3600
	d2	1500	1500	1700	1700	1900	2100	2100	2300	2500	2500	2900	2900	3100	3550	3550	3750
	d3	840	840	960	960	1100	1100	1100	1100	1300	1300	1500	1500	1500	1700	1700	1800
	d4	770	770	770	770	770	770	770	770	965	965	1160	1160	1160	1350	1350	1350
	d5	1780	1780	1980	1980	2210	2414	2414	2618	2918	2918	3200	3200	3604	-	-	-
	h1	1611	1811	1859	2014	2297	2325	2840	3000	3180	3780	3806	4385	4755	4875	5795	6365
	h2	285	285	344	344	372	424	424	574	614	614	732	732	768	913	913	902
	h3	1800	2000	2060	2215	2500	2545	3060	3210	3400	4000	4060	4630	5010	5150	6070	6650
	h4	80	80	80	80	80	86	86	86	84	84	82	82	82	80	80	120
	h5	1315	1315	1383	1383	1497	1580	1580	1580	1810	1810	1883	1883	1922	-	-	-
	h7	380	380	380	380	545	535	535	540	605	605	800	800	840	750	750	1500
	h8	115	115	115	115	130	130	130	130	135	135	135	135	135	135	135	135
	h10	2284	2284	2423	2423	2747	2889	2889	3034	3384	3384	3804	3795	3920	-	-	-
	h11	1026	1226	1215	1370	1460	1452	1967	1972	2045	2645	2356	2935	3229	3292	4212	4083
	α1	-	-	-	-	-	-	-	40	35	35	40	40	40	40	40	-
	α2	-	-	-	-	-	-	-	12.5	7.5	7.5	12.5	12.5	12.5	12.5	12.5	-
	r1	575	575	675	675	750	800	800	840	925	925	1100	1100	1175	1300	1300	1400
r2	550	550	625	625	725	750	750	800	900	900	1000	1000	1075	1200	1200	1300	
r3	-	-	-	-	650	740	740	850	950	950	1150	1150	1200	1250	1250	1350	
A x B	180x220	180x220	180x220	180x220	200x320	200x320	200x320	200x320	250x360	250x360	250x360	250x360	350x500	-	-	-	
Drain valve	100x80	100x80	100x80	100x80	100x80	150x100	150x100	150x100	150x100	150x100	150x100	150x100	150x100	150x100	150x100	150x100	
Drive power (hp)	5	5	7.5	7.5	10	12.5	12.5	15	15	20	25	25	30	-	-	-	
Approx. weight (kg)	2682	2860	3437	3606	5241	5756	6498	7648	9527	10743	13680	15202	18979	28850	33500	37500	

N O Z Z L E S	N1	350x450	350x450	350x450	350x450	500	500	500	500	500	500	500	500	600	600	500	
	N2,N10	-	-	100	100	250	150	150	150	200	200	200	200	200	200	200	
	N3	100	100	100	100	150	150	150	150	200	200	200	200	200	200	200	
	N4	-	-	-	-	-	-	-	150	200	200	200	200	200	250	250	400
	N5,N7	200	200	200	200	100	250	250	300	300	300	300	300	300	400	400	400
	N6	100	100	100	100	100	150	150	150	200	200	200	200	200	200	200	200
	N8	-	-	-	-	-	-	-	150	200	200	200	200	200	200	200	200
	N9	100	100	100	100	150	150	150	150	200	200	200	200	200	200	250	400
	L	100	100	100	100	100	150	150	150	150	150	150	150	150	150	150	150
	M	150	150	150	150	200	200	200	200	250	250	250	250	250	250/300	250/300	250
	N11,N15	50	50	50	50	50	80	80	80	80	80	80	80	80	100	100	100
	N12,N14	50	50	50	50	50	80	80	80	80	80	80	80	80	100	100	100
	N13,T11	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP	½" BSP

Dimensions and Weights mentioned are for guidelines only. Glascoat reserves the right to modify due to continuing innovation in technology.

OUTSTANDING FEATURES



- Our reactors are designed to be user-friendly and offer a long trouble-free service life. They are built in accordance with DIN 28136 standards. Based on requests from several customers we have also developed capacities of Reactors not specified in DIN standard.



- Our versatile, GEL-2200 glass offers resistance against corrosion across the entire pH range as well as excellent thermal shock resistance.

- Baffles and agitators are lined with special GEL-2200 glass, which has significantly higher impact, abrasion and thermal shock resistance.



- Computer-controlled electric furnaces ensure uniform temperature for consistent glass-lining.

- Highly efficient & silent agitator drive seldom needs maintenance. The swing-free agitator with lowest possible run-out at sealing surface has negligible wear on agitator and seal face gland. This is possible because a consistent high vacuum can be achieved without frequent replacement of gland packing.



- An agitator shaft is coupled to the reduction gear by a specially designed two-piece muff coupling with a hanger bolt in between. This arrangement facilitates the replacement of the mechanical seal/gland packing or shaft bearing without disturbing the alignment and shifting of motor or gearbox.

- Each component of the drive is step-mounted making assembly effortless & less time consuming while ensuring the highest level of alignment.



- Glascoat reactors use six types of standard drives over the twenty seven different capacities of reactors from 63 ltrs. to 50,000 ltrs. This allows for the best possible interchangeability of spares and reduces inventory at the user's end.

- A variety of agitators like impeller, anchor, pitch blade and hydro-foil types are available for specific applications. Additionally white bands marking can also be provided on the agitator shaft to facilitate volumetric measurement visually.

- PTFE envelope gaskets with a corrugated stainless steel inserts are provided for leak-free operation.

- Specially glass-lined protection rings cushion manhole contact surfaces from direct impact and abrasion.

- A stainless steel wire rope retains all the c-clamps and prevent them from falling when loosen - a tremendous convenience in maintenance work.

- Spring-loaded manhole cover for safe and easy operation.

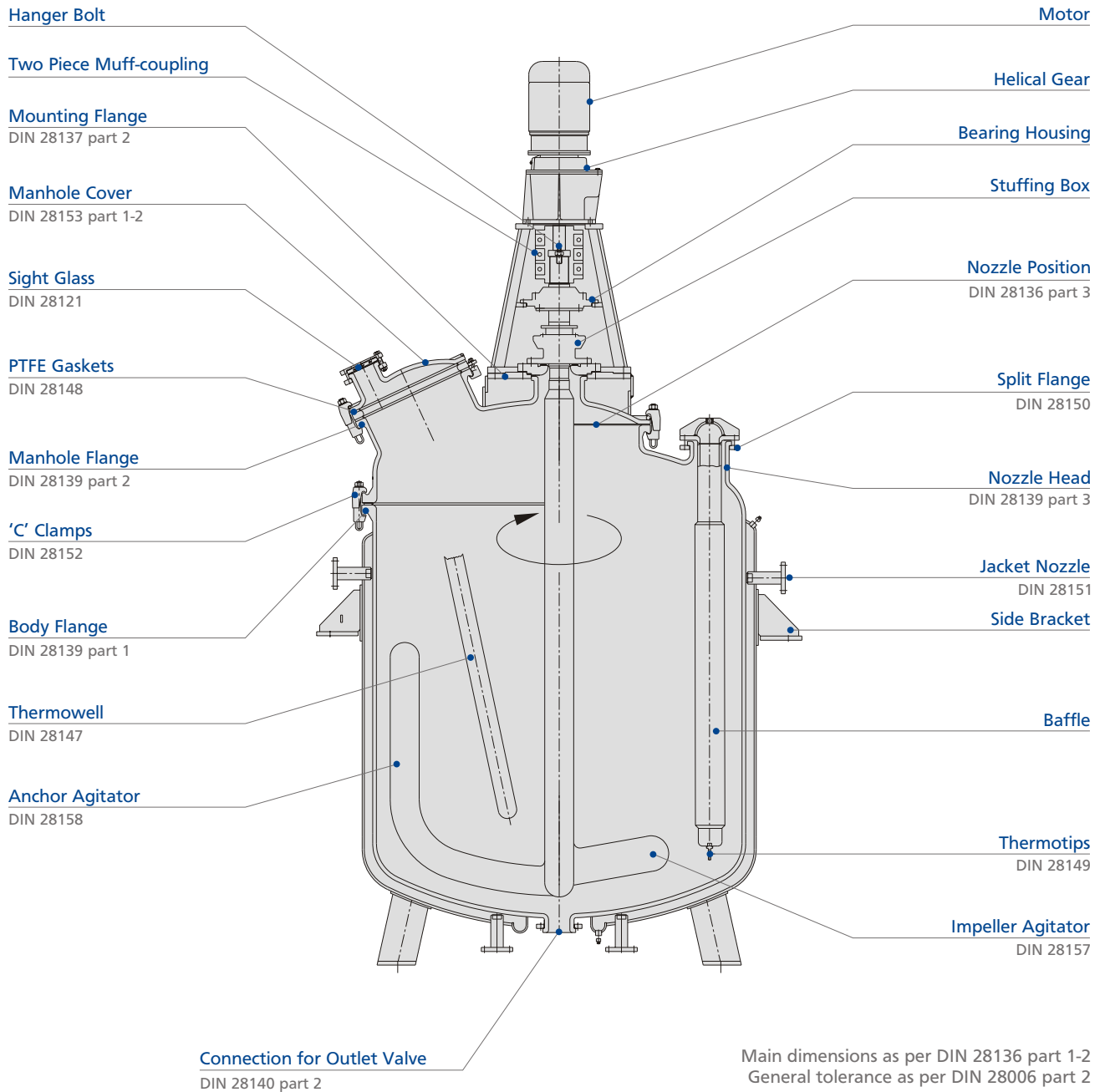


- Narrow-annuals jacketing improves heat transfer and speeds drainage.

- Pre-welded nuts on jacket facilitates quick and easy insulation of reactor.

- Long lasting epoxy zinc-rich primer and polyurethane finish coats protect against severe atmospheric corrosion.

COMPONENT IDENTIFICATION CHART WITH HELICAL GEAR DRIVE UNIT



Standard Sizes

63 ltrs. to 50000 ltrs.

Design Data

Pressure: Full vacuum and 6 kg/cm² internal and jacket

Temperature

-25 / +200°C construction and inspection in accordance with ASME section VIII, division 1.

Glass-lining

High voltage spark test after glass-lining: at 20000V; before shipment: at 10000V as per DIN 28006.

Agitating System

Standard drive with anchor agitator (50 rpm)/impeller (100 rpm) and baffle. As an alternative pitched blade or axial propeller can also be installed for specific needs. Drive unit consists of a synchronous three phase explosion proof/energy efficient direct coupled helical gear unit. Lantern stool housing, self-aligning double ball-bearing and specially designed two piece muff coupling for perfect alignment. Either single or double mechanical seals are provided to suit process conditions.

The drive unit is designed to facilitate easy and quick replacement of components without disturbing alignment or dismantling of major drive components.

Standard Accessories

Glass-lined manhole protection ring sight and light glass, split flanges for operating nozzles, glass-lined bottom outlet valve and spring loaded device for opening manhole cover.

Optional Accessories

Tantalum tip with RTD sensor for temperature measurement, PTFE lined dip pipe/sparger, reducing flange, bellow sealed valve, agitation nozzles on jacket and electronic variable speed drive.



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GLASCOAT



**GLASS-LINED
HEAT EXCHANGERS**

TECHNICAL SPECIFICATIONS

Design Data

Description	Main Vessel	Jacket
Design & Manufacturing Code	Generally as per ASME Sec. VIII Div. I	
Design Pressure	2 Kg/cm ² (g)/F.V.	6 Kg/cm ² (g)
Design Temperature	-25°C to 200°C	-25°C to 200°C
Maximum Allowable Working Pressure	2 Kg/cm ² (g)/F.V.	6 Kg/cm ² (g)
Minimum Design Metal Temperature	- 25°C	- 25°C
Hydro Test Pressure (After G.L.)	2 Kg/cm ² (g)	6 Kg/cm ² (g)
Corrosion Allowance (Wetted/Non-wetted/G.L.)	1.0/0/0 (mm)	1.0/0 (mm)
Heat Treatment	YES (During Glass-lining Process)	-
Radiography	SPOT (T+10%)	NIL

Material Specifications

Plate for Shell & Formed Head	SA 516M GR. 380
Glass-lined Nozzles & Flanges	SA 836M
Split Flanges	SA 216M Gr. WCB
Jacket Nozzles	SA 105M
Gaskets for Main Flanges	Rubber with PTFE envelope
Gaskets for Nozzles	PTFE envelope CAF with SS corrugated ring insert
Clamping Studs	SA 193M Gr. B7
All Fasteners	IS 1367 Cl. 4/4.6

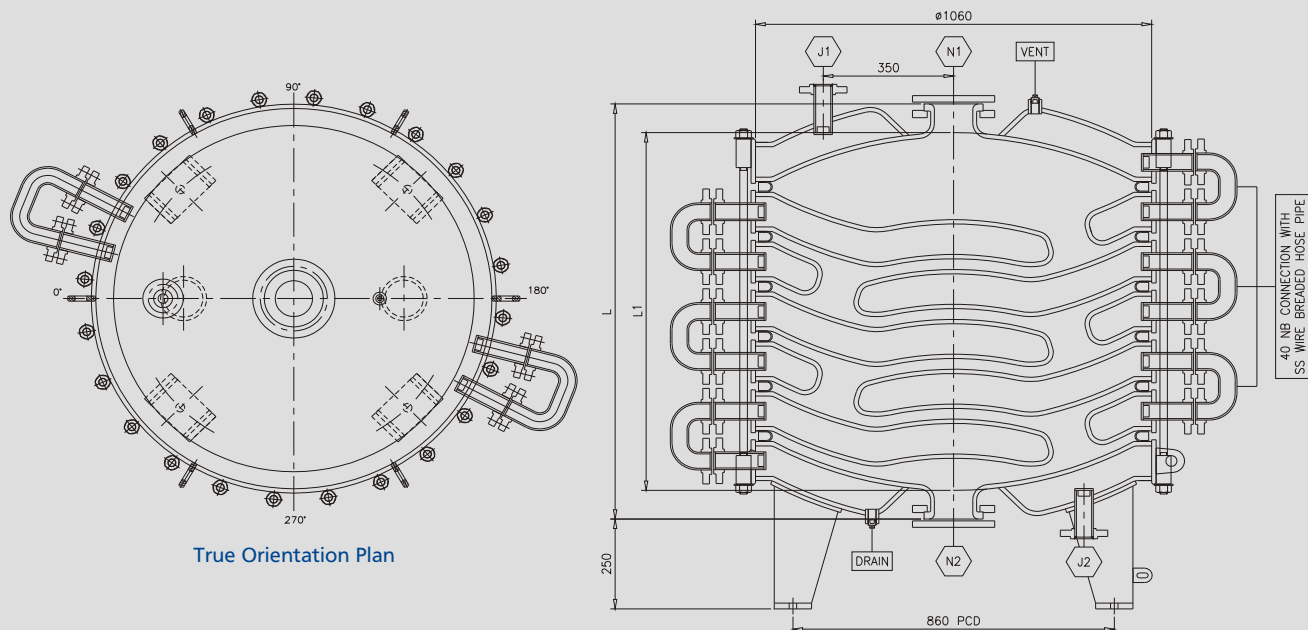
QUALITY ASSURANCE AND ACCEPTANCE CRITERIA

- 1 Stagewise inspection conducted by internal Q.C. as per approved quality plan & final inspection by TPI or client.
- 2 General tolerance as per DIN 28006, final dimensions may vary by ± 15 mm, due to multiple heat treatment cycle during glass-lining process.
- 3 Hydrostatic Test shall be carried out as per the approved Q.A. plan.
- 4 Spark Test for glass-lining check shall be carried out once while lining process at 20,000 Volts and after hydrotest at 10,000 Volts.
- 5 Glass-lining thickness shall range from 1.0 to 2.2 mm.
- 6 Bought out components as per manufacturing standards.

GENERAL NOTES

- 1 All dimensions are in mm unless otherwise specified.
- 2 The dimensions described herein are for guidelines only. We reserve the right to modify due to continuing innovations in technology.

GLASS-LINED HEAT EXCHANGERS



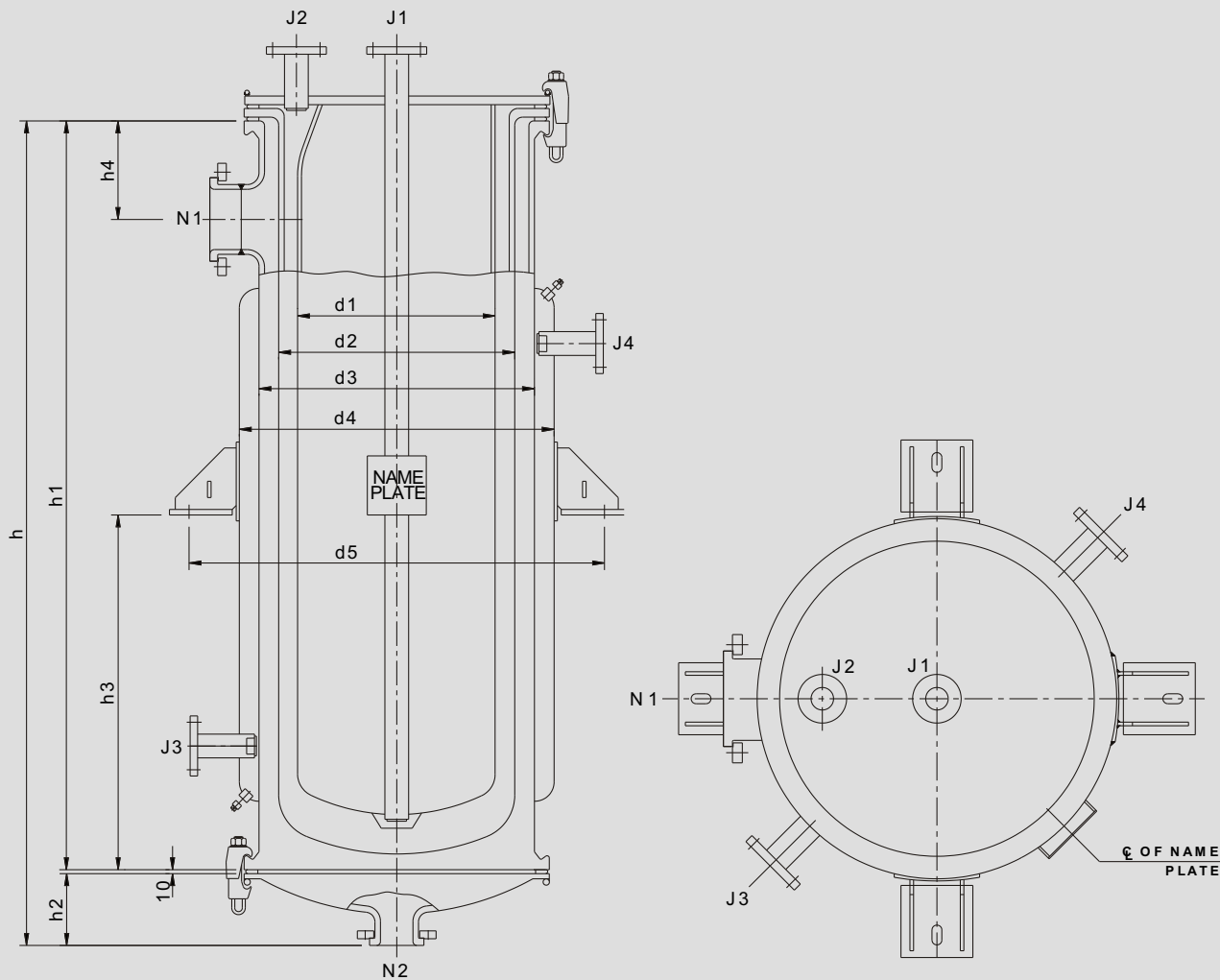
DIMENSIONAL DETAILS

Model No.	Unit	4 M ²	6 M ²	8 M ²	10 M ²	14 M ²
Full Volume in Main Vessel	M ³	0.159	0.181	0.203	0.225	0.304
Full Volume in Jacket	M ³	0.28	0.352	0.424	0.496	0.718
Heat Transfer Area	sq.mt	4.5	6	8	9.8	14
Dimensions	L	740	879	1018	1157	1574
	L1	580	719	858	997	1414

NOZZLE DETAILS

Steam Inlet	N1	100	100	100	100	100
Condensate Outlet	N2	100	100	100	100	100
Jacket Outlet	J1	40	40	40	40	40
Jacket Inlet	J2	40	40	40	40	40
Jacket Vent	-	½" BSPT	½" BSPT	½" BSPT	½" BSPT	½" BSPT
Jacket Drain	-	½" BSPT	½" BSPT	½" BSPT	½" BSPT	½" BSPT

GLASS-LINED SHELL IN SHELL TYPE HEAT EXCHANGERS



DIMENSIONAL DETAILS

Area (sq. mtr.)	D I M E N S I O N S										N O Z Z L E S						Approx. Weight kg.
	d1	d2	d3	d4	d5	h1	h2	h3	h4	h	N1	N2	J1	J2	J3	J4	
2	219.1	323.8	406.4	508	674	1150	140	450	200	1300	100	50	25	25	25	25	550
4	400	500	600	700	956	1600	160	850	250	1770	150	50	25	25	25	25	1000
6	500	600	700	800	1055	1900	182	900	250	2092	150	80	40	40	40	40	1500
8	650	750	850	950	1230	2050	200	1050	275	2260	200	80	50	50	50	50	2010
10	650	750	850	950	1230	2450	200	1450	275	2660	200	80	50	50	50	50	2330
12	800	900	1000	1100	1380	2485	225	1300	325	2720	250	80	50	50	50	50	3190
14	900	1000	1100	1200	1480	2500	235	1300	325	2745	250	80	50	50	50	50	3700
16	1000	1100	1200	1300	1580	2700	265	1400	325	2975	250	80	50	50	50	50	4070
20	1100	1200	1300	1400	1680	3010	300	1400	375	3320	300	100	50	50	50	50	5500



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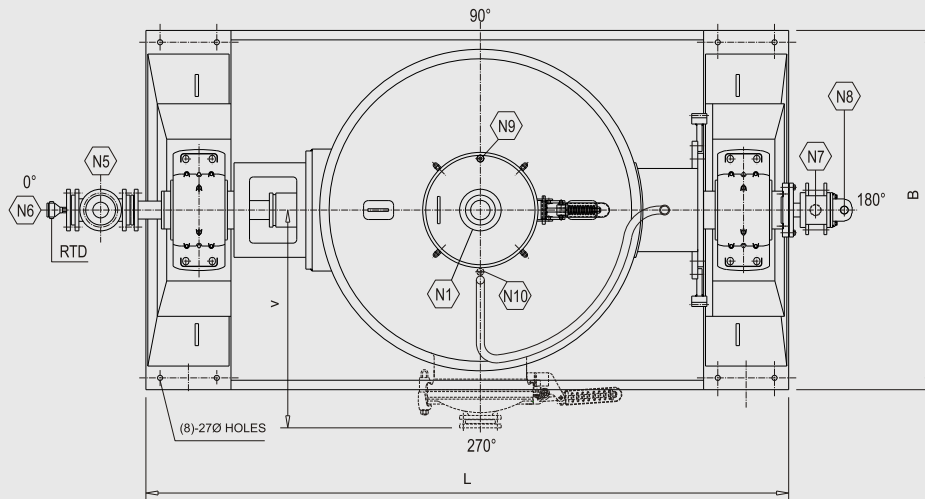
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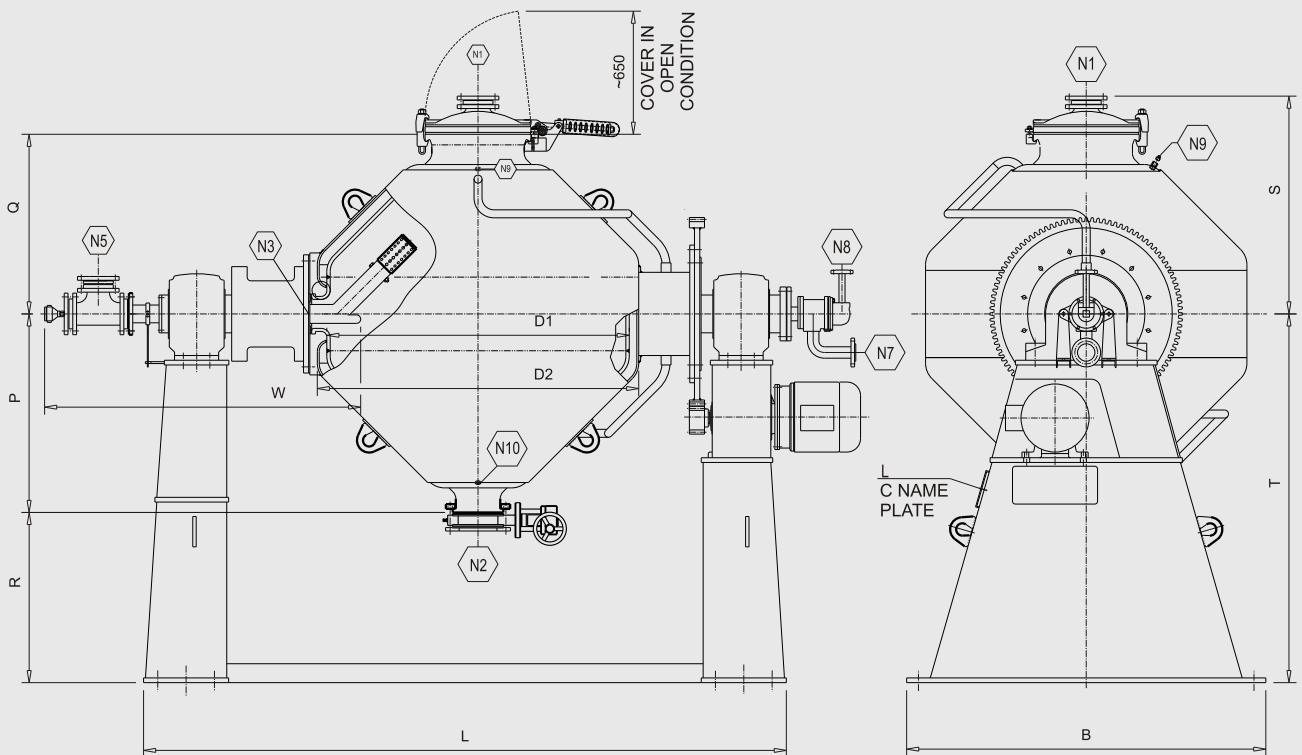


**GLASS LINED
ROTARY CONICAL VACUUM DRYERS (RCVD)**

GLASS-LINED ROTARY CONICAL VACUUM DRYERS (RCVD)



Top View



Elevation

Side View

DIMENSIONAL DETAILS

Model No.		RVD-100	RVD-250	RVD-500	RVD-1000	RVD-2000	RVD-3000	RVD-4500
Gross Volume	ltrs.	120	260	630	1180	2030	3400	4550
Working Volume [Ref. G.Note 3]	ltrs.	72	156	310	630	1230	1800	2200
Jacket Volume	ltrs.	55	68	90	230	325	425	644
Heating Surface Area	sq. mt.	1.15	2.0	3.2	5.6	7.8	9.5	13.3
D I M E N S I O N S	D1	600	728	1000	1300	1600	1800	2100
	D2	700	820	1100	1400	1700	1900	2200
	P	440	535	730	872	1050	1310	1350
	Q	440	535	650	770	950	1215	1275
	R	635	600	600	650	900	900	925
	S	790	915	1230	1395	1600	1930	1977
	T	1075	1135	1330	1522	1950	2210	2275
	V	563	658	732	960	1130	1360	1462
	W	1035	1105	1150	1420	1570	1845	1670
	B	955	1060	1350	1500	1900	1800	2430
L	1835	1920	2450	2850	3400	4000	4185	

NOZZLE DETAILS

Manhole	N1	250	250	400	450	450	450	500
Outlet	N2	250	250	200	200	200	250	250
Suction Nozzle	N3	50	80	125	150	150	150	200
Vacuum Line	N5	40	50	50	80	100	100	125
Temperature Probe Conn.	N6	40	50	50	80	100	100	125
Condensate Outlet	N7	25	32	32	50	50	50	50
Steam/Hot Water Inlet	N8	25	32	32	32	32	32	32
Vent	N9	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
Drain	N10	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"

OTHER DETAILS

Suction Pipe Size	od	40	50	60	80	100	100	125
Rotational Speed	rpm	5-15	5-15	5-10	5-10	5-10	5-10	2-8
Motor H.P.	hp	2	3	5	7.5	10	10	15
Approximate Wt.	kg	700	1600	1750	3500	4950	5600	6320

GENERAL NOTES

- All dimensions are in mm unless otherwise specified.
- The dimensions & weights described herein are for guidelines only. We reserve the right to modify due to continuing innovations in technology.
- Depending on product data, the working capacity of dryer is to be 50-60% of total volume.
- Electronic Speed Variator provided upon request.
- Temperature sensing probe is provided in vacuum pipe assembly.
- The perforated end of hastelloy vacuum pipe inside the dryer is covered by PP cloth (sieve size 5 microns) and clamped by PTFE clamps with hastelloy bolts and nuts.
- Sealing at the vacuum pipe entry in the dryer is provided by single mechanical seal assembly.
- Optionally glasswool insulation with SS cladding will be provided.

TECHNICAL SPECIFICATIONS

Design Data

Description	Main Vessel	Jacket
Design & Manufacturing Code	Generally as per ASME Sec. VIII Div. I	
Design Pressure	6 kg/cm ² (g)/F.V.	6 kg/cm ² (g)
Design Temperature	-25°C to 200°C	-25°C to 200°C
Maximum Allowable Working Pressure	6 kg/cm ² (g)/F.V.	6 kg/cm ² (g)
Minimum Design Metal Temperature	-25°C	-25°C
Hydrotest Pressure (After G.L.)	3 kg/cm ² (g)	6 kg/cm ² (g)
Corrosion Allowance [Wetted/ Non-wetted/G.L.]	1.5/0/0 (mm)	1.5/0 (mm)
Heat Treatment	Yes (During glass-lining process)	-
Radiography	Spot (T+10%)	NIL

Material Specification

Plate for Shell & Conical Head	SA 516M GR. 380
Glass-lined Nozzles & Flanges	SA 836M CL 1 OR SA 181 CL 60
Vacuum Pipe	HASTELLOY - C
Driven Side Trunion	MS EQVT. IS 2062
Drive Side Trunion	MS EQVT. IS 2062
Filter Cloth	PP [5 microns]
Rotary Joint	ULNARQ model
Pad Plate for Mech. Seal Mounting	SA 836M CL 1 OR SA 181 CL 60
Base Plate for Pad Plate and Driven Side Trunion	MS EQVT. IS 2062
Flange for Jacket Nozzle	SA 105M
Sealing	Single dry mechanical seal
Bearing with Plummer Block	As per Mfg. Standard
Gasket for G.L. Nozzle	PTFE envelope CAF with SS corrugated ring insert
Gear Wheel & Pinion	IS 2707 C.S. GR.-1
Split Flanges	SA 216M GR. WCB
C-clamp and J-clamp	SA 105M
Fasteners	IS 1367 CL. 4/4.6
Supports	MS EQVT. IS 2062
Glass-lining	GEL- 2200
Painting	Final coat of polyurethane paint

QUALITY ASSURANCE AND ACCEPTANCE CRITERIA

- 1 Stage-wise inspection conducted by internal Q.C. as per approved quality plan & final inspection by TPI or client.
- 2 General tolerance as per DIN 28006, final dimensions may vary by ± 15 mm, due to multiple heat treatment cycle for glass-lining process.
- 3 Hydrostatic Test & Vacuum Hold Test & Pneumatic Test shall be carried out as per the approved Q.A. Plan.
- 4 Spark test for glass-lining check shall be carried out once while lining process at 20,000 Volts and after hydrotest at 10,000 Volts.
- 5 Glass-lining thickness shall range from 1.0 to 2.2 mm.
- 6 Bought out components as per manufacturing standards.



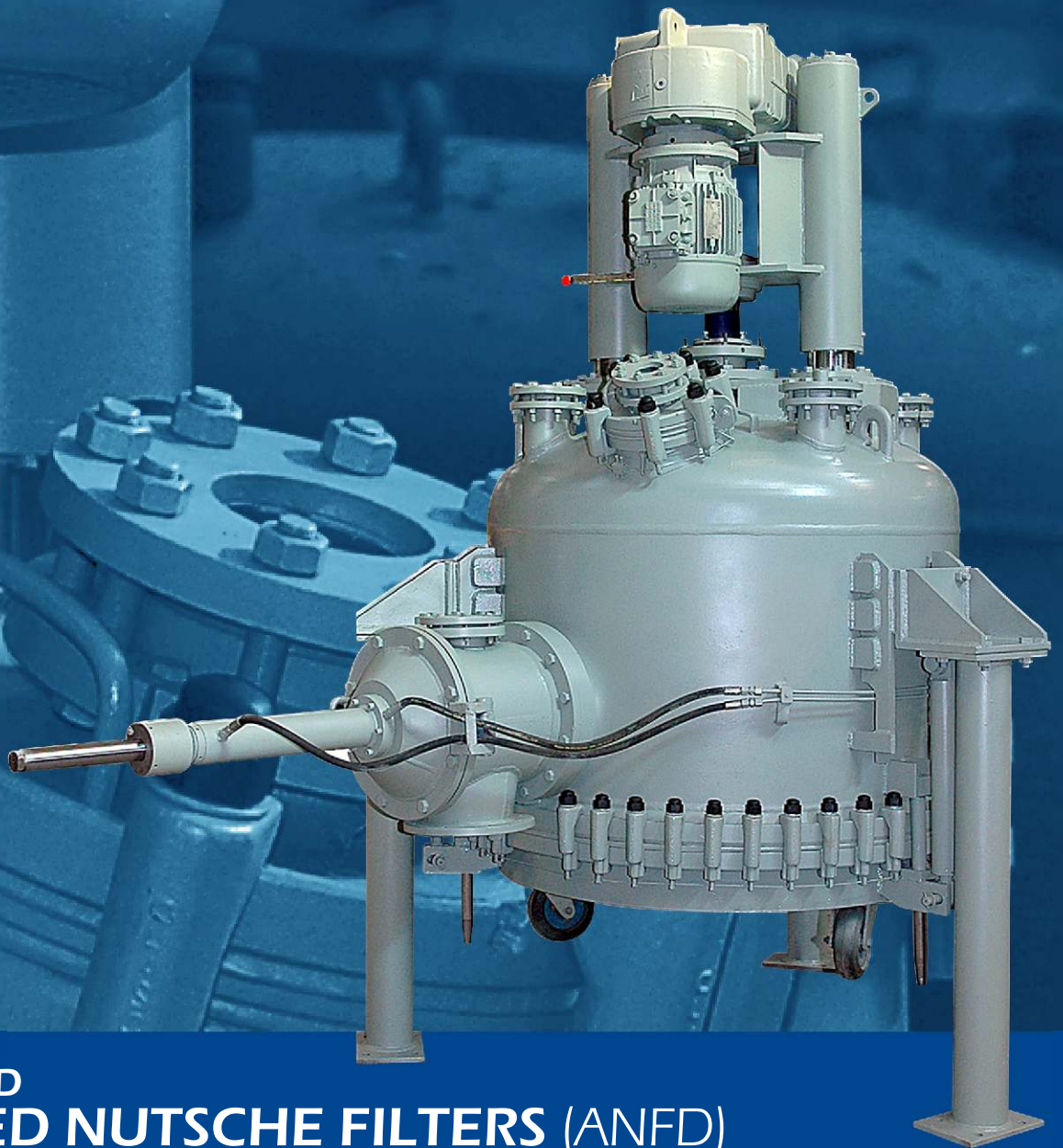
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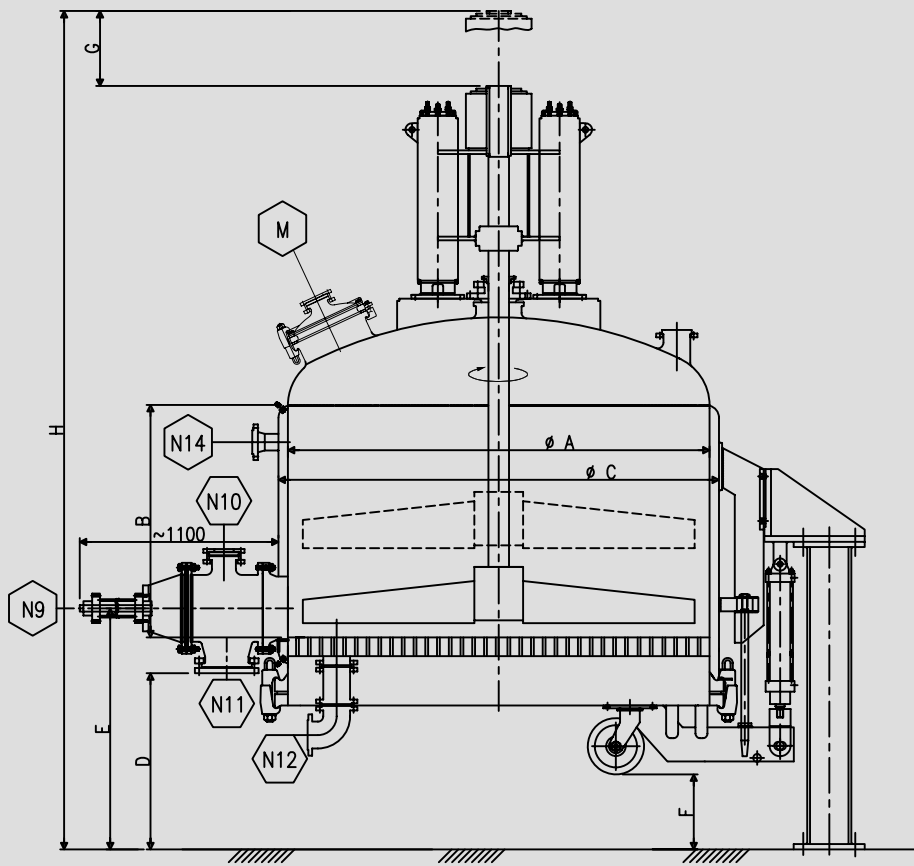
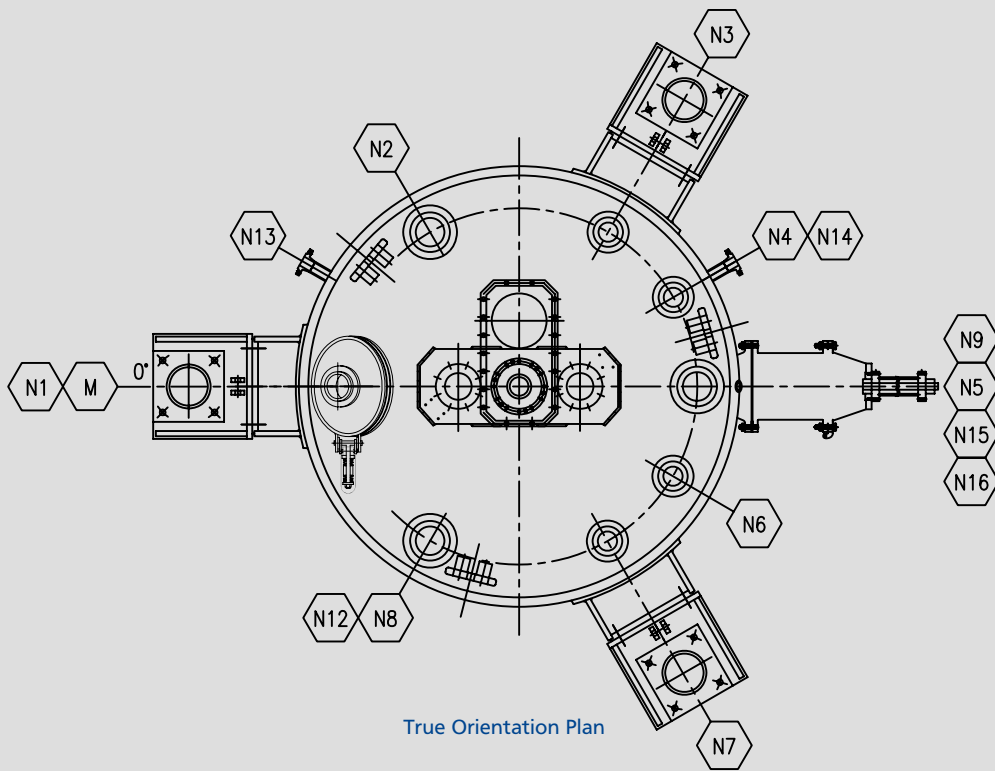
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**GLASS-LINED
AGITATED NUTSCHE FILTERS (ANFD)**

GLASS-LINED AGITATED NUTSCHE FILTERS (ANFD)



DIMENSIONAL DETAILS

Model No.		GNF500	GNF850	GNF1200	GNF1500	GNF2500	GNF3100	GNF3800	GNF4500
Working Volume	Ltrs.	450	800	1100	1400	2400	2800	3600	4300
Jacket Volume	Ltrs.	75	105	116	185	215	220	245	289
Jacket Heating Surface Area	Sq. M	1.9	2.7	2.9	4.5	5.5	7.5	7.8	8.2
Filter Area	Sq. M	0.75	1.1	1.4	2	2.5	3.1	3.6	4.3
Max. Cake Volume	Ltrs.	200	400	550	700	1000	1400	1700	2000
D I M E N S I O N S	A	1000	1200	1400	1600	1800	2000	2200	2400
	B	650	750	750	750	1000	1000	1000	1000
	C	1100	1300	1500	1700	1900	2100	2300	2500
	D	800	800	800	800	800	900	900	900
	E	1100	1100	1100	1100	1100	1200	1200	1200
	F	350	350	350	350	350	400	400	400
	G	400	400	400	400	400	450	450	450
	H	3250	3350	3450	3550	4100	4300	4500	4700
Motor Power	HP	5	7.5	7.5	10	10	15	15/20	15/20
RPM		22	22	22	20	13	13	13	13

NOZZLE DETAILS

Agitator Nozzle	M	200	200	200	200	200	250	250	250
Manhole/Hanhole	N1	150	250	250	350 x 450	350 x 450	350 x 450	350 x 450	350 x 450
Process	N2	100	100	100	100	100	100	100	100
Process	N3	80	80	100	100	100	100	100	100
Process	N4	80	80	80	100	100	100	100	100
Process	N5	-	-	80	100	100	100	100	100
Process	N6	-	-	80	100	100	100	100	100
Process	N7	-	-	100	100	100	100	100	100
Process	N8	-	-	-	-	-	150	150	150
Discharge	N9	300	300	300	300	300	350	350	350
View Glass	N10	100	100	100	100	100	100	100	100
Outlet	N11	200	200	200	200	200	200	200	200
Liquid Out	N12	50	50	50	80	80	100	100	100
Jacket Inlet	N13	50	50	50	50	50	50	50	50
Jacket Outlet	N14	50	50	50	50	50	50	50	50
Vent	N15	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
Drain	N16	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"

GENERAL NOTES

1 All dimensions are in mm unless otherwise specified.

2 The dimensions described herein are for guidelines only. We reserve the right to modify due to continuing innovations in technology.

TECHNICAL SPECIFICATIONS

Design Data

Description	Main Vessel	Jacket
Design & Manufacturing Code	Generally as per ASME Sec. VIII Div. I	
Design Pressure	3 kg/cm ² (g) / F.V.	6 kg/cm ² (g)
Design Temperature	-25°C to 200°C	-25°C to 200°C
Maximum Allowable Working Pressure	3 kg/cm ² (g) / F.V.	6 kg/cm ² (g)
Minimum Design Metal Temperature	-25°C	- 25°C
Hydro test Pressure (After G.L.)	3 kg/cm ² (g)	6 kg/cm ² (g)
Corrosion Allowance (Wetted/Non-wetted/G.L.)	1.5/0/0 (mm)	1.5/0 (mm)
Heat Treatment	Yes (During Glass-lining Process)	-
Radiography	SPOT (T+10%)	NIL
Agitator Up/Down Stroke	350 to 450 mm	

Material Specifications

Innver Vessel	CS (SA 516 GR. 380) + Glass-lined
Jacket	CS (SA 516 GR. 380)
Filter Base	CS + Hastelloy-C Cladding
Filter Plate	100% PTFE
Filter Cloth	Polypropylene (10 Microns)
Shaft & Blade (One Piece Construction)	CS + Hastelloy-C Cladding
Supports and Structure	MS equivalent to IS 2062
O-rings	Neoprene Rubber
Side Discharge Valve	CS + TEFZEL Coating / PFA / FEP
Side Discharge Plug	CS + Hastelloy-C Cladding
Stuffing Box	CS + Glass-lined
Stuffing Box Gland	Graphite + PTFE (50+50)
All Fasteners	IS 1367 CL 4/4.6
External Finish	Grit Blasting + Base coat of Epoxy Red Oxide Primer Top coat of Acrylic Aliphatic Polyurethane Paint

QUALITY ASSURANCE AND ACCEPTANCE CRITERIA

- 1 Stagewise inspection conducted by internal Q.C. as per approved quality plan & final inspection by TPI or client
- 2 General tolerance as per DIN 28006, final dimensions may vary by ± 15 mm, due to glass-lining process
- 3 Hydrostatic test shall be carried out as per the approved Q.A. Plan
- 4 Spark test for glass-lining check shall be carried out once while lining process at 20,000 volts and after hydrotest at 10,000 volts
- 5 Glass-lining thickness shall range from 1.0 to 2.2 mm
- 6 Bought out components as per manufacturing standards

SCOPE OF SUPPLY

1 Main Vessel in Two Piece Construction

2 Detachable Filter Base

- a PTFE Perforated Filter Plate
 - b PP Filter Cloth (10 micron)
 - c Nylon Castor Wheel for Mobility
 - d Detachable Filter Base
-

3 S - Type Agitator in Single Piece Construction with or without Heating Arrangement

4 Side Discharge Valve

5 Drive System including:

- a Mechanical or Stuffing Box for Agitator Shaft sealing
 - b Hollow Shaft Helical Gearbox for Agitator
 - c Two Pillar Drive Unit
-

6 Hydraulic System for the following:

- a Filter base raising and lowering
 - b Agitator Up & Down
 - c Side Discharge Valve Opening & Closing
-

7 Optional PTFE Spray Ball (Make Lechler)

8 Flame Proof Control Panel includes following functions:

- a Main Supply On/Off
 - b Agitator Motor Power On/Off
 - c Hyd. Power Pack Motor On/Off
 - d Agitator Up/Down
 - e Bottom Cover Up/Down
 - f Valve Open/Close
 - g Agitator Reverse/Forward
 - h Volt Meter
 - i RPM Meter
 - j RPM Pot (Regulator)
 - k R. Y. B. (V.S.S.)
-

9 Documentation

- a As Built Drawing
 - b Electrical Wiring Diagram for Control Panel
 - c PQ/DQ
 - d Maintenance and Operational Manual
-

SAFETY FEATURES

1 Hydraulic & Mechanical lock for Side Discharge Valve

2 Pressure Relief Valve for Hydraulic Power Pack

3 Limit Switch Agitator Vertical Travel



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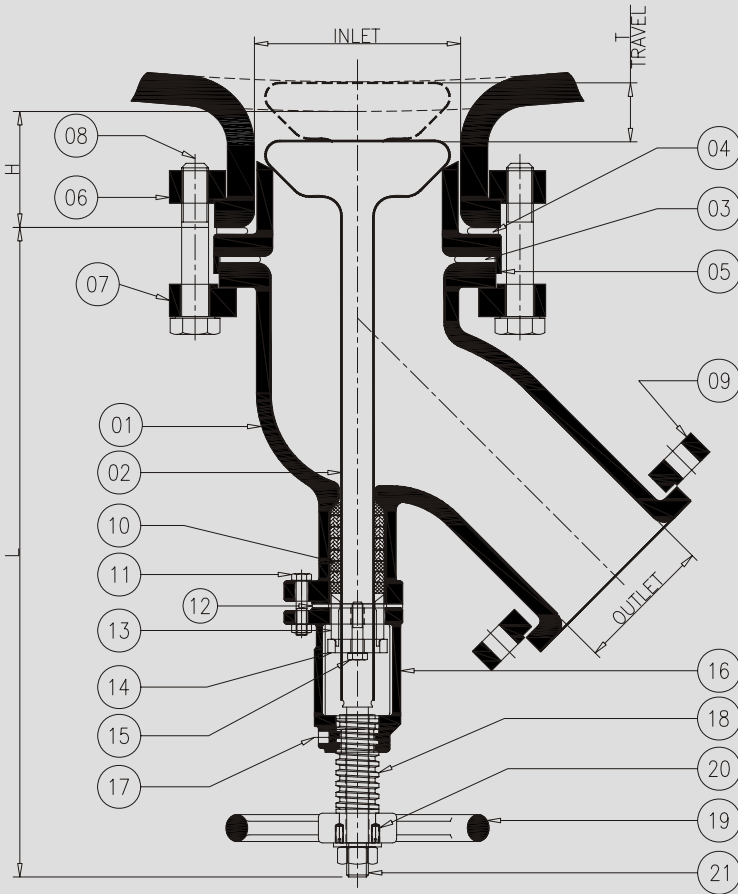
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**GLASS-LINED
VALVES & FITTINGS**

G.I. FLUSH BOTTOM OUTLET VALVE



1 G.I. Valve Body

2 G.I. Spindle

3 PTFE Envelope Gasket

4 PTFE Envelope Gasket

5 Valve Seat

6 Split Flange on Vessel Nozzle

7 Split Flange on Valve Body

8 Bolt

9 Split Flange on Valve Body

10 Gland

11 Bolt with Nut

12 Gasket

13 Packing Sleeve

14 Packing Sleeve Flange (Pusher)

15 Bolt For Gland Plsher

16 Valve Bonnet

17 Greese Nipple

18 Screw

19 Hand Wheel

20 Gub Screw

21 Lock Nut

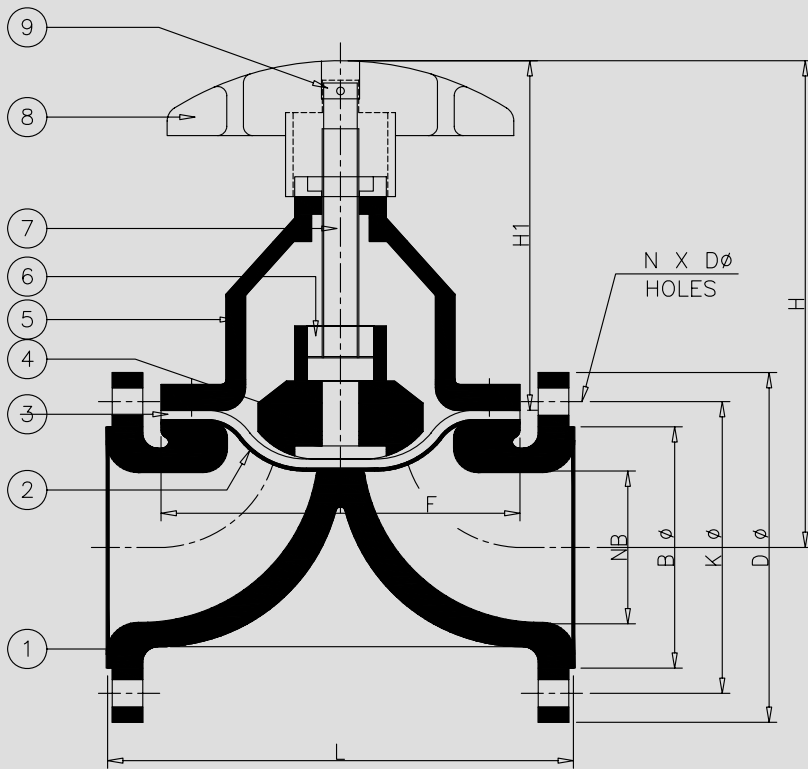
DIMENSIONAL DETAILS

Valve Size (mm.)	Inlet Size	Outlet Size	H	L	T
80 / 50	80	50	70	406	38
100 / 80	100	80	80	427	43
150 / 100	150	100	86	482	43

NOTE

- All dimensions are in mm unless otherwise specified.
- Operating temp -25°C to 200°C and operation pressure -1 to $+6$ kg/cm² g.
- Hydrostatic Test 6 kg/cm² g.
- Glass-lining Thickness: 1.0 to 2.0 mm.
- Glass type: gel 2200.
- Spark test: Internal 10 KV and External 05 KV.
- Optional features: • Pnuematically Operated Actuated Valve • Tantalum Tip with RTD Sensor • SS Glass-lined Valve.

G.L. DIAPHRAGM VALVE



- | | | |
|----------------------|----------|----------------------|
| 1 G.L. Valve Body | 4 Piston | 7 Spindle |
| 2 Pin Type Diaphragm | 5 Bonnet | 8 Handwheel |
| 3 Cushioning Pad | 6 Nut | 9 Pin for Hand Wheel |

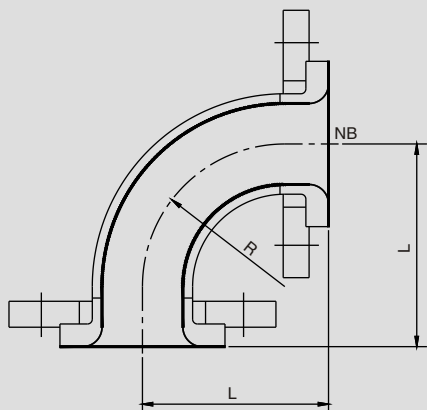
DIMENSIONAL DETAILS

NB	D Ø		K Ø		B Ø		N x D Ø		F	L	H1	H
	PN-10	ASA-150	PN-10	ASA-150	PN-10	ASA-150	PN-10	ASA-150				
25	115	108	85	79.5	-	-	4 x 14	4 x 15	74 x 78	127	-	105
40	150	127	110	98.5	88	80	4 x 18	4 x 15	96 x 100	159	95	140
50	165	152	125	121	100	100	4 x 18	4 x 19	108 x 125	191	135	171
80	200	191	160	152	138	130	8 x 18	4 x 19	184 x 156	254	189	238
100	220	229	180	191	158	158	8 x 18	8 x 19	230 Ø	305	228	318
150	285	279	240	241	212	212	8 x 23	8 x 23	310 Ø	406	270	357

NOTE

- All Dimensions are in mm unless specified.
- Design Pressure: 6 kg/cm².
- Design Temperature: -25°C to 200°C.
- Flange dimension & drilling as per ANSI 150 B, 16.5.
- Testing: • Spark Test Internal: 10,000 V • External: 5,000 V
- Hydro Test at 6 kg/cm².
- Glass-lining Thickness: 1.0 To 2.2 mm.

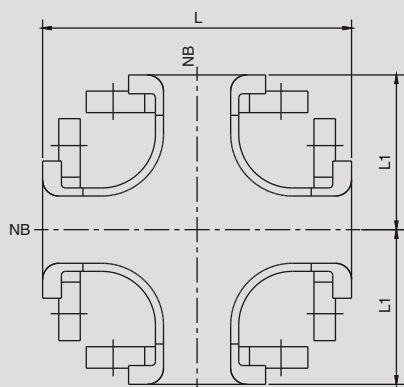
FLANGED ELBOWS 90°



NB	mm	25	32	40	50	65	80	100	125	150	200	250	300	400	500
	inch	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	16"	20"
L		90	100	105	115	120	135	155	175	195	260	315	350	450	550
R		63	73	78	88	95	115	101	127	152	203	255	305	406	508



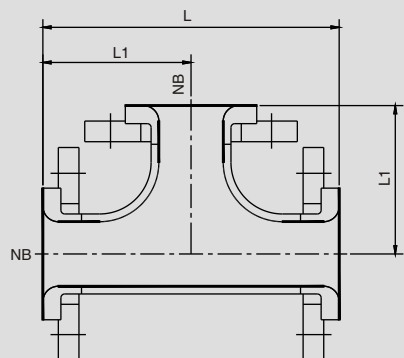
FLANGED CROSSES



NB	mm	25	32	40	50	65	80	100	125	150	200	250	300	400	500
	inch	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	16"	20"
L		180	200	210	230	240	270	310	350	390	520	630	700	900	1100
L1		90	100	105	115	120	135	155	175	195	260	315	350	450	550



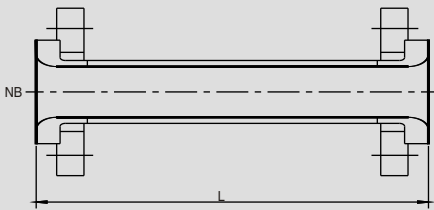
FLANGED T - PIECES



NB	mm	25	32	40	50	65	80	100	125	150	200	250	300	400	500
	inch	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	16"	20"
L		180	200	210	230	240	270	310	350	390	520	630	700	900	1100
L1		90	100	105	115	120	135	155	175	195	260	315	350	450	550



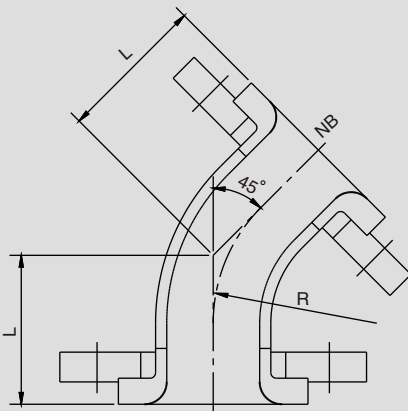
FLANGED PIPES



NB	mm	25	32	40	50	65	80	100	125	150	200	250	300	400	500	
	inch	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	16"	20"	
L		100-500	100-600	100-500	100-700	100-800	100-1000	100-1000	150-1500	150-1500	150-2000	150-2000	150-2000	150-2000	150-2000	150-2000



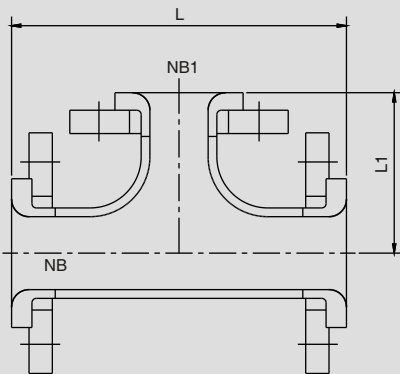
FLANGED ELBOWS 450



NB	mm	25	32	40	50	65	80	100	125	150	200	250	300	400	500
	inch	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	16"	20"
L		60	65	70	80	85	95	105	125	150	180	220	260	300	360
R		63	73	78	88	95	115	152	190	228	305	381	457	610	762



FLANGED T - PIECES WITH REDUCED CONNECTION



NB		L	NB1	25	32	40	50	65	80	100	125	150	200	250	
mm	inch			1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	
32	1 1/4"	200	↑	95											
40	1 1/2"	210		95	100										
50	2"	230		100	105	110									
65	2 1/2"	240		105	110	115	120								
80	3"	270		115	120	125	130	135							
100	4"	310		125	130	135	140	145	150						
125	5"	350	L1	140	145	150	155	160	165	170					
150	6"	390		155	160	165	170	175	180	185	190				
200	8"	520		185	190	195	200	205	210	215	220	225			
250	10"	630		230	235	240	245	250	255	260	265	270	275		
300	12"	700		220	225	230	235	240	245	255	260	270	310	330	
400	16"	900		270	275	280	285	290	295	305	310	320	360	380	
500	20"	1100	↓	320	325	330	335	340	345	355	360	370	410	430	

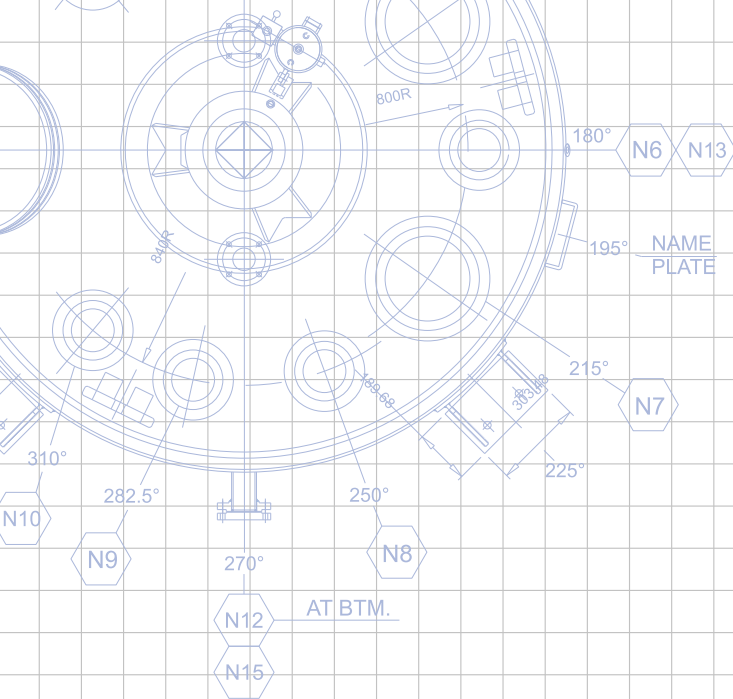


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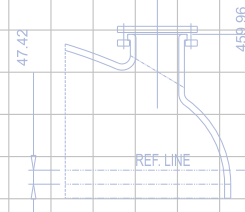
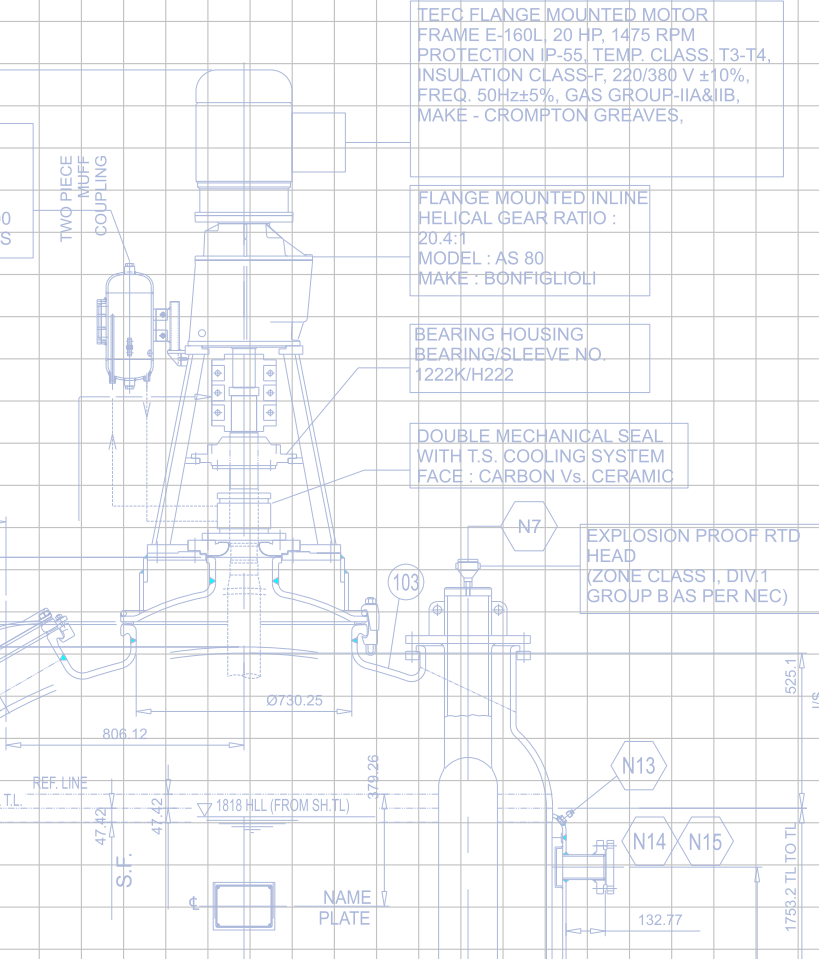
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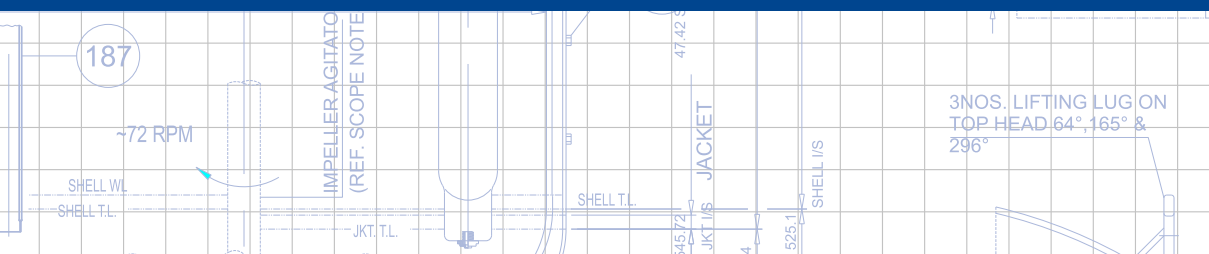
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UTRUE ORIENTATION PLAN



TECHNICAL SPECIFICATIONS



SCOPE OF MANUFACTURING

1	M.S. Glass-lined Reaction Vessels	63 ltrs. to 50,000 ltrs.
2	M.S. Glass-lined Storage Tanks	63 ltrs to 80000 ltrs.
3	Distillation Columns & Towers	150-2500 mm. Diameter.
4	M.S. Glass-lined Filtration Vessels	0.75 to 4.5 square meter.
5	M.S. Glass-lined Heat Exchanger	
	• Shell in Shell Type	2 to 40 m ²
	• Plate Type	3 to 14 m ²
6	M.S. Glass-lined Conical Vacuum Dryers	150 ltrs to 4500 ltrs.
7	M.S. Glass-lined Agitating Systems	Turbine, Anchor, Pitch Blade, Axial Propeller, Hydrofoil etc.
8	M.S. Glass-lined Valves	Diaphragm and Flush Bottom Outlet Valves with or without Pneumatic Actuator.
9	M.S. Glass-lined Pipes and Fittings	Flanged Elbows, Crosses, T-Pieces, Reducing Flanges, Reducers etc.

CODES AND STANDARDS

Glass-lined equipment are manufactured to the highest quality standards of workmanship and material. The reactors are generally as per DIN 28136 standards and manufactured in accordance with ASME code for unfired pressure vessels, section VIII division I. All clamps and flanges comply with ANSI/ DIN standard. Equipment are also specially designed and constructed to the client's own specifications.

DESIGN DATA

Description	Inner Vessel	Jacket
Design Pressure	6 kg/cm ² /F.V	6 kg/cm ²
Design Temperature	-25°C to 200°C	-25°C to 200°C
Allowable Operating Pressure	6 kg/cm ² /F.V	6 kg/cm ²
Final Hydrostatic Test	6 kg/cm ²	6 kg/cm ²
Radiography Shell / Head	Spot/Full	Nil/Full
Joint Efficiency	0.85/1.0	0.70/1
Corrosion Allowance	1.0/0.0/0.0	1.0/0.0/-

(wetted/Not wetted/GL)

MATERIAL AND GRADES

1	Main Shell, Heads, Blind Flange, Manhole Covers & Center Opening Cover (COC)	Enamel quality steel A 516M GR. 380
2	Manhole (MH), Main Shell & COC Body Flange, Main Shell Nozzles, MH Protection Ring, Spindle	Enamel quality forging SA 836M Class I or SA 181M CI 60
3	Pad Plate, Agitator Connecting Head, Reducing Flange	Enamel quality forging SA 836M Class I / SA 181M CI 60
4	Agitator & Baffle Pipes	Enamel quality pipe SA 106 GR.B
5	Nozzle Backing Flange (Split Flange)	SA 216M GR. WCB or SA 516M GR. 380/415/485
6	'C' Clamp & 'J' Bolts	A 193M GR. B7/SA 194M GR. 2H or equivalent
7	Gasket	PTFE enveloped gasket CAF or Asbestos free with S.S. corrugated ring insert
8	Nozzle Bolt & Nuts	IS 1367 CL 4/4.6
9	Jacket Shell, Heads & Closer Ring	SA 516M GR. 380
10	Jacket Nozzle Necks	SA 106M GR.B
11	WNRF/SORF Flange for Jacket Nozzle	SA 105M
12	Drive Unit Components	Carbon steel equivalent to IS 2062 / CI IS 210 GR.150 or equivalent
13	Valves (Flush & Diaphragm Type)	IS 210 GR. 150 or equivalent
14	Fittings (Bend, Tee, Reducer etc.)	IS 210 GR.150 or SA 234M GR. WPB

ADDING SPIRIT TO THE SUBSTANCE

The history of fortifying storage or process equipment with one thing or the other, for different usages, is more than 100 years old. There use to be some specific ways to maintain the ease of process, stability of quality and momentum of function. Glass-lining is one of the best ways that aptly serves the purpose due to its insuperable characteristics and exclusive nature. Glass and steel together offer chemical inertness and absence of catalytic effect and contamination at higher operational temperature and pressure.

Basically, there are three applications where glass-lined equipment is used:

- 1 Those involving highly corrosive acids and bases;**
- 2 High-purity process where cleanliness is important, for the ability to clean as well as to minimize the risk of metal contamination;**
- 3 In polymerisation, to prevent polymers from sticking on vessels.**

Glascoat offers a product range that leads on all fronts!

The Glascoat range consists of both ready-made (for standard requirement) and custom-built (for unique requirement) equipment and accessories of versatile nature. This includes an impressive array of Glass-lined Reactors, Process Tanks, Evaporation Vessels, Distillation Columns, Mixers and Agitators, Heat Exchangers, Dryers, Blenders, Agitated Filters, Pipes, Valves & Fittings and other paraphernalia.

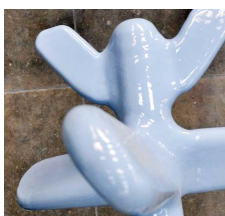
Over the years Glascoat has developed various glass formulations to suit most demanding process requirements.

PRODUCT RANGE



GEL 2200 (BLUE GLASS)

This glass offers complete protection against corrosion across the entire pH range, with excellent resistance to radii spiraling, allowing easy and safe application on curved and complex surfaces. It also has unique combination of having higher impact, wear resistance with higher thermal conductivity.



GEL 2201 (LIGHT BLUE GLASS)

This glass formulation is a specially developed for pharmaceutical industry. Over and above the standard blue glass this has some outstanding features as under:

- Light blue colour to improve optical monitoring by increased contrast with process fluids.
- Excellent hydrophilic surface finish due to its siliceous ionic structure which also facilitates ease in inter-batch cleaning.
- Heavy metal free glass to keep up purity of active ingredients.
- Improved resistance to alkalis.



GEL 2202 (WHITE GLASS)

White glass specially developed for photochemical reactions for observing and monitoring changes in fluid colour during reactions.



GEL 2203 (GREEN GLASS)

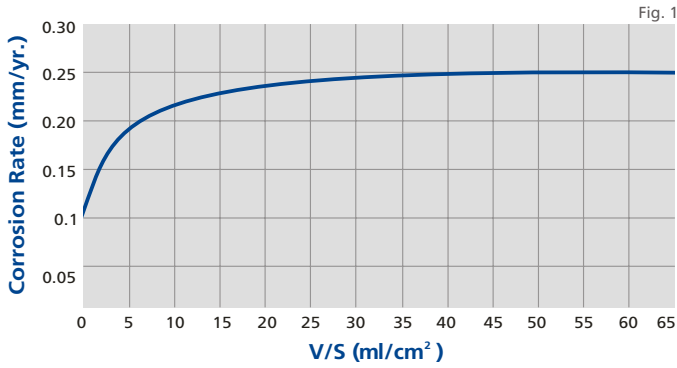
A glass formulation that provides exceptional resistance to extraordinary high temperatures. Suitable for operating temperature up to 270°C

DIN - ISO TEST FOR GLASS SERIES

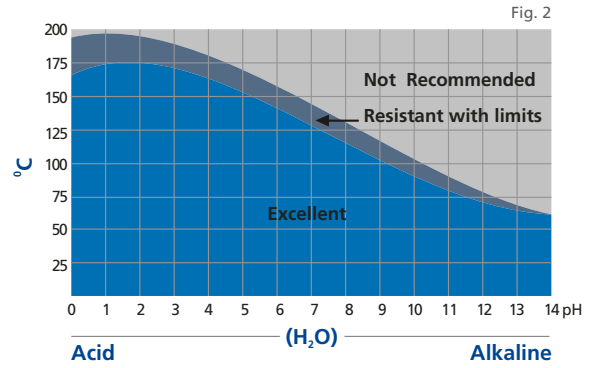
Table 1

STANDARD	LIQUID PHASE	VAPOUR PHASE
DIN - 51157/ISO 2743 Hydrochloric Acid	0.01 mm/year	0.04 mm/year
DIN - 51156/ISO 2745 Sodium Hydroxide	0.21 mm/year	--
DIN-51156/ISO 2744 Water	0.008 mm/year	0.013 mm/year
DIN - 51167	Temperature of Failure 260°C Statiflux surface cracks	--
Abrasion Porcelain Enamel Institute, Ohio U.S.A.	3.5 mg/min	--

EFFECT OF VOLUME TO SURFACE AREA RATIO (V/S) ON CORROSION RATE

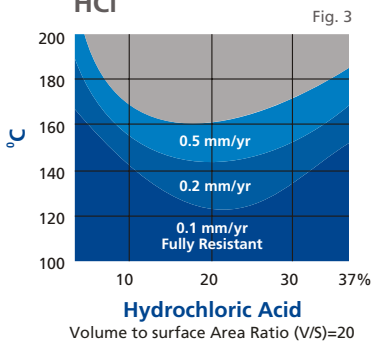


CORROSION RESISTANCE

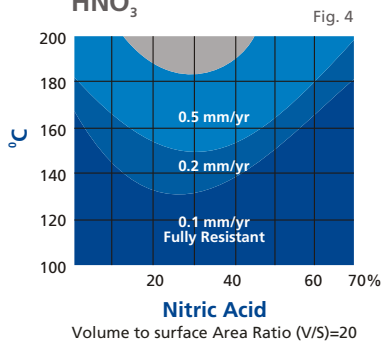


ACIDS

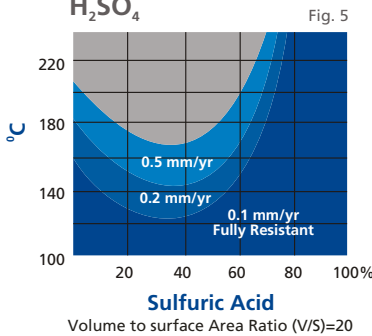
HCl



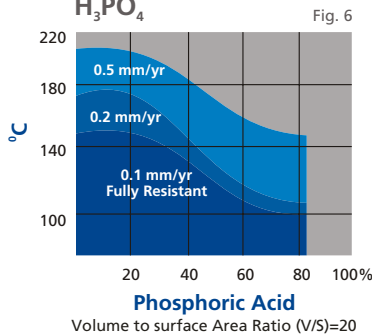
HNO₃



H₂SO₄



H₃PO₄

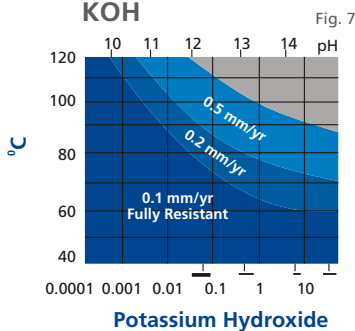


Glascoat's GEL Series of glass has excellent resistance to all acids - organic and inorganic, oxidizing and reducing. The iso-corrosion curves are established for most common acids. Reagent grade acids are used in laboratory test which are bases of these curves. In actual practice other factors such as velocity, phase type, chemical grade etc. can affect the corrosion rate.

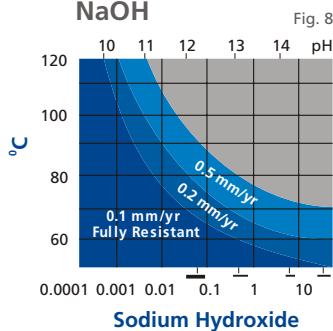
Only hydrofluoric acid damages glass-lining at all concentrations. When phosphoric acid concentration is increased, it becomes more destructive. Maximum operating temperature is 95°C at highest concentration (85%).

BASES

KOH



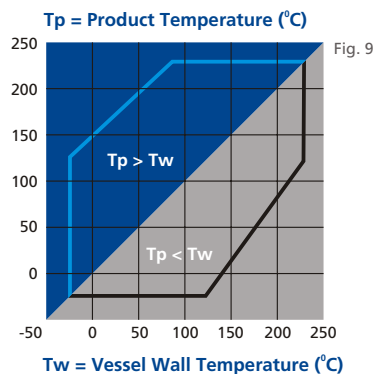
NaOH



Bases are more corrosive in nature than acids. As concentration & temperature increases rate of corrosion also increases.

An increase of 10°C doubles the chances of damage on glass-lining. Therefore, one needs to be cautious while using hot alkalies.

THERMAL SHOCK EXAMPLES



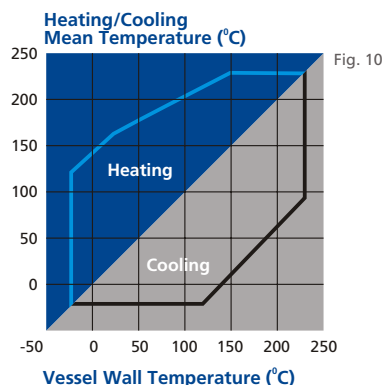
GLASS-LINED SIDE

When $T_p > T_w$

A vessel with a wall temperature of 0°C should not be filled with process fluid above the temperature of 148°C.

When $T_p < T_w$

A vessel with a wall temperature of 150°C should not be filled with process fluid below the temperature of 15°C.



JACKET SIDE

When Heating

Temperature of heating media should be below 190°C when process fluid is at 75°C.

When Cooling

Temperature of cooling media should not be below 60°C when temperature of process fluid is at 200°C.

THERMAL CONDUCTIVITY

Table 2

Steel allows the glass-lining to be kept relatively thin compared to self-supporting glass equipment. Thus, the low thermal conductivity of the glass is counter-balanced by the high heat transfer coefficient of the steel.

Due to the chemical bond between glass and steel, no inter-face heat transfer resistance needs to be taken into account.

Chart gives the values of overall heat transfer coefficient for various heating and cooling conditions.

OVERALL HEAT TRANSFER COEFFICIENT (U) W/m²K

	Fluid in Jacket	Fluid in Vessel	U
Heating	Steam	Organic Liquid	345 ~ 469
		Aqueous Liquid	403 ~ 520
Heating	Oil	Organic Liquid	192 ~ 269
		Aqueous Liquid	278 ~ 315
Condensing	Water	Organic Vapor	155 ~ 180
		Water Vapor	178 ~ 219
Cooling	Water	Organic Liquid	113 ~ 187
		Aqueous Liquid	123 ~ 178
	Brine	Aqueous Liquid	74 ~ 145

PHYSICAL CHARACTERISTICS

Thickness	1-2.2 mm
Specific Weight	2.5 g/cm ³
Tensile Strength	70 N/mm ²
Compressive Strength	800 N/mm ²
Hardness HV	700 kg/mm ²
Coefficient of Thermal Conductivity	1.2 K/mk
Specific Heat	0.82 KJ/kg K
Electric Resistivity	1013 Ω/cm at ambient temperature
Dielectric Strength	20-30 kV/mm
Modulus of Elasticity	75000 N/mm ²
Elongation	0.1%
Abrasion	3.5 mg/min
Flexibility	Lined glass bends with the base metal until the latter reaches permanent deformation.
Chipping Tendency	None, under normal conditions.
Surface	Exceptionally smooth, hence easier to clean, excellent resistance to wear, impermeability to gases, prevents sticking and the growth of micro-flora. Biologically sterilisable easily.
Chemical Resistance	Highly resistant to almost all substances. Insensitive to the action of oxidizing or reducing agents. No catalytic effect. No product contamination. (i.e. colour, smell, taste, etc.).
Structural	Dielectric in nature, hence no electrochemical corrosion. It does not age as it is amorphous in structure and does not weather.

Corrosion Resistance of Glass-lining with chemicals at different temperatures

Agent	50°C	100°C	150°C	200°C
Acetaldehyde	A	A	A	A
Acetic Acid	A	A	A	A
Acetic Anhydride	A	A	A	A
Acetone	A	A	A	A
Acrylic Acid	A	A	A	A
Aluminum Acetate	A	A	A	A
Aluminum Chlorate	A	A	A	B
Aluminum Chloride	A	A	A	A
Aluminum Chloride (10% a.s.)	A	A	A	C
Aluminum Chloride (h.s.)	A	A	B	B
Aluminum Potassium Sulphate (50% a.s.)	A	A	B	B
Amino Ethanol	A	A	A	B
Aminophenol	A	A	A	B
Aminophenol Sulfonic Acid	A	A	A	B
Ammonia	A	A	A	B
Ammonium Carbonate (a.s.) (B.P.)	A	A	B	C
Ammonium Chloride (10%)	A	A	A	B
Ammonium Nitrate (a.s.)	A	A	A	B
Ammonium Phosphate(a.s.)	A	A	A	A
Ammonium Sulphate	A	A	A	A
Ammonium Sulphate(a.s.)	A	A	A	A
Ammonium Sulphide	A	A	C	C
Aniline	A	A	A	A
Aniline (184°C - B.P.)	A	A	A	B
Antimony (III) Chloride (223.6°C - B.P.)	A	A	A	A
Antimony (V) Chloride	A	A	B	B
Aqua Regia	A	A	A	A
Barium Hydroxide	A	B	B	C
Barium Sulphate	A	A	A	B
Benzaldehyde	A	A	A	B
Benzene	A	A	A	A
Benzoic Acid	A	A	A	A
Benzyl Chloride (179°C - B.P.)	A	A	A	B
Boric Acid	A	A	A	B
Boron Trifluoride Ether Complex	A	B	C	C
Bromine	A	A	A	A
Bromine (58.8°C - B.P.)	A	A	B	B
Butanol (99.5°C - B.P.)	A	A	A	B
Calcium Chloride (Free of CaO)	A	A	B	B
Carbon Disulphide	A	A	A	A
Carbon Dioxide	A	A	A	A
Carbon Dioxide (a.s.)	A	A	A	-
Carbon Monoxide	A	A	A	A
Carbon Tetrachloride	A	A	A	A
Chloride Bleaching Agent (a.s.)	A	A	A	B
Chlorinated Paraffin	A	A	A	A
Chloride Gas	A	A	A	A
Chloride Water	A	A	A	A
Chloroform	A	A	A	A
Chloropropionic Acid	A	A	A	A
Chlorosulfonic Acid	A	A	A	B

Agent	50°C	100°C	150°C	200°C
Chromic Acid (30% a.s.)	A	A	B	B
Chromic Acid (a.s.)	A	A	A	B
Chromic Sulphonic Acid	A	A	A	A
Citric Acid (h.s.) (10%)	A	A	A	B
Cupric Chloride (5% a.s.)	A	A	A	B
Cupric Nitrate (50% a.s.)	A	A	B	C
Cupric Sulphate (a.s.)	A	A	A	B
Cyano Acetic Acid	A	A	B	B
Cyanoacetamide	A	A	B	B
Dibromoethylene	A	A	A	A
Dichloroacetic Acid	A	A	B	B
Dichlorobenzene	A	A	A	A
Dichloro-propionic acid	A	A	A	A
Diethyl Ether	A	A	B	B
Diethylamine	A	A	B	B
Diethylamino-propanol	A	A	A	B
Dimethyl Sulphate	A	A	A	A
Dimethylamino-propanol	A	A	A	B
Ethanol	A	A	A	A
Ethyl Acetate	A	A	A	A
Ethyl Diamine (98% a.s.)	A	A	B	C
Ethylene Glycol	A	A	A	A
Fatty Acid Diethanolamide	A	A	B	B
Fatty Acids	A	A	A	A
Ferric (III) Chloride	A	A	A	B
Ferric (II) Chloride	A	A	A	B
Ferric Chloride (10%)	A	A	A	A
Fluoride in aq. acid sol'n	C	C	C	C
Formaldehyde	A	A	A	A
Formic Acid (h.s.)	A	A	A	B
Fumaric Acid	A	A	A	B
Gallic Acid	A	A	B	B
Glutamic Acid	A	B	B	C
Glycerin	A	A	A	A
Glycol	A	A	A	B
Glycolic Acid (57%)	A	A	A	B
Hydrobromic Acid (h.s.)	A	A	B	B
Hydrazine Hydrate (40% a.s.)	A	B	B	C
Hydrazine Hydrate (80% a.s.)	A	A	C	C
Hydrazine Sulphate (10% a.s.)	A	B	C	C
Hydrochloric Acid	See Fig. 3			
Hydrofluoric Acid (h.s.)	C	C	C	C
Hydrogen Peroxide (30% a.s.)	A	A	B	C
Hydrogen Sulphide (a.s.)	A	A	A	B
Hydroiodic Acid (20%)	A	A	A	B
Hydroiodic Acid (60%)	A	A	A	B
Iodine	A	A	A	A
Iron Chloride (h.s.)	A	A	B	B
Iron Sulphate (a.s.)	A	A	A	B
Isoamyl Alcohol	A	A	A	B
Isopropanol	A	A	A	A

Corrosion resistance of Glass-lining with chemicals at different temperatures

Agent	50°C	100°C	150°C	200°C
Isopropyl Alcohol	A	A	A	B
Lactic Acid (95%)	A	A	A	B
Lead Acetate	A	A	A	A
Lithium Chloride (4% a.s.)	A	A	C	C
Lithium Chloride (30%)	A@B.P.			
Lithium Hydroxide Conc.	B	C	C	C
Magnesium Carbonate	A	A	B	C
Magnesium Chloride (30% a.s.)	A	A	B	B
Magnesium Sulphate (a.s.)	A	A	A	B
Maleic Acid	A	A	A	A
Methanol	A	A	A	A
Methyl Acetate	A	A	A	A
Methyl Ester of O-hydroxy-benzoic acid	A	A	A	B
Monochloroacetic Acid (h.s.)	A	A	B	B
Naphthalene	A	A	A	A
Naphthalene Sulfinic Acid	A	A	A	A
Nitric Acid	See Fig. 4			
Nitric Oxides	A	A	A	A
Nitrobenzene	A	A	A	A
Nitrous Acid (h.s.)	A	A	A	B
Octanol	A	A	A	B
O-Hydroxy-benzoic Acid	A	A	A	B
Oleum (10% SO ₂)	A	A	A	B
Organic Chlorides	A	A	A	A
Ortho Chloro-benzoic Acid (a.s.)	A	A	A	A
Oxalic Acid (h.s.)	A	A	A	B
Perchloric Acid (h.s.)	A	A	A	B
Perfluorocyclic Ether (a.s.)	A	A	B	C
Phenol	A	A	A	A
Phenolphalein	A	A	B	C
Phosphoric Acid	See Fig. 6			
Phosphoric Acid (h.s.) (50%)	See Fig. 6			
Phosphoric Ethyl Ester	A	A	C	C
Phosphorous Acid	A	B	C	C
Phosphorous Oxychloride (F-free)	A	A	B	C
Phosphorous Trichloride (F-free)	A	A	B	C
Picric Acid	A	A	A	B
Polyphosphoric Acid	A	A	A	B
Potassium Bisulphate	A	A	A	A
Potassium Bromide (a.s.)	A@B.P.			
Potassium Chloride (h.s.)	A	B	B	C
Potassium Hydroxide	See Fig. 7			
Pthalicanhydride	A	A	A	A
Pthalicanhydride (F-free)	A	A	A	A
Pyridine	A	A	A	A
Pyridine Chloride (h.s.)	A	A	A	B
Pyridine Hydrochloride	A	A	A	B
Pyrogallic Acid (5% a.s.)	A@B.P.			
Pyrrolidine	A	A	B	C
Sodium Bicarbonate (a.s.)	B@B.P.			
Sodium Bicarbonate (1N a.s.)	A	A	B	C

Agent	50°C	100°C	150°C	200°C
Sodium Biphosphate (50%)	A@B.P.			
Sodium Bisulphite	A	A	A	A
Sodium Bisulphate (2% a.s.)	A	A	A	B
Sodium Carbonate	A	A		
Sodium Chlorate (a.s.)	A	A	B	C
Sodium Chloride (a.s.)	A@B.P.			
Sodium Ethylate	A@B.P.			
Sodium Fluoride	A	A	B	C
Sodium Glutamate	A	A	A	B
Sodium Hydroxide	See Fig. 8			
Sodium Hypochloride (a.s.)	A	A	B	C
Sodium Methylate	A	A	B	B
Sodium Nitrate	A	A	A	A
Sodium Polysulphide	A	A	B	C
Sodium Sulphide (4% a.s.)	A	A	C	C
Stearic Acid	A	A	A	B
Succinic Acid (35%)	A	A	A	B
Succinic Acid (sat. sol)	A	A	A	B
Sulphur	A	A	A	B
Sulphur Dioxide	A	A	A	A
Sulphuric Acid	See Fig. 5			
Sulphur Trioxide	A	A	A	A
Sulphuric Acid (Oleum)	A	A	A	A
Tannic Acid	A	A	A	B
Tartaric Acid	A	A	A	B
Tin Chloride	A	A	A	A
Toluene	A	A	A	A
Trichloroacetic Acid (h.s.)	A	A	A	B
Trichloroethylene	A	A	A	A
Triethanolamine	A	A	A	A
Triethylamine	A	C	C	C
Triethylamine (30% a.s.)	A	A	B	C
Trifluoroacetic Acid (anhydrous)	A	B	C	C
Trisodium Phosphate (5% a.s.)	B@B.P.			
Trisodium Phosphate (50% a.s.)	A	A	B	B
Urea	A	A	A	A
Water	A@B.P.			
Zinc Bromide (a.s.)	A@B.P.			

- A** High Resistance
B Resistance variable as a function of concentration
C No Resistance
h.s. Hydrate solution
a.s. Aqueous solution
B.P. Boiling Point

**THE NATIONAL BOARD
OF
BOILER & PRESSURE VESSEL INSPECTORS**

Certificate of Authorization



This is to certify that

**SWISS GLASCOAT EQUIPMENTS LIMITED
H-106, GUJARAT INDUSTRIAL DEVELOPMENT
CORPORATION, VITTHAL UDYOGNAGAR
ANAND, GUJARAT, 388121
INDIA**

*is authorized to use the "R" SYMBOL in accordance with the
provisions of the National Board.*

The scope of Authorization is limited as follows:

***METALLIC REPAIRS AND/OR ALTERATIONS AT THE
ABOVE LOCATION***

CERTIFICATE NUMBER: R-6823

ISSUE DATE: JANUARY 27, 2012

EXPIRATION DATE: FEBRUARY 3, 2015



Executive Director

A handwritten signature in black ink, appearing to be 'D. D. D.' followed by a flourish.



CERTIFICATE OF AUTHORIZATION

The named company is authorized by the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the certification mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this certification mark shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

**Swiss Glascoat Equipments Limited
H-106, Gujarat Industrial Development Corporation
Vitthal Udyognagar
Anand, Gujarat, 388121
India**

SCOPE:

Manufacture of pressure vessels at the above location only

AUTHORIZED: **December 21, 2011**
EXPIRES: **February 3, 2015**
CERTIFICATE NUMBER: **35,604**

A handwritten signature in black ink, likely belonging to the Vice President of Conformity Assessment.

Vice President
Conformity Assessment

A handwritten signature in black ink, likely belonging to the Director of Accreditation and Certification.

Director, Accreditation and Certification





CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

**Swiss Glasscoat Equipments Limited
H-106, GIDC, Vitthal Udyognagar,
V.V. Nagar - 388 121,
Gujarat,
INDIA**

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standards:

ISO 9001:2008

The Quality Management System is applicable to:

**The design, manufacture and repair of glasslined
equipment and supply of spares.**

Approval
Certificate No: MUM0060226

Original Approval: 22 March 2003

Current Certificate: 01 April 2012

Certificate Expiry: 31 March 2015

Issued by: Lloyd's Register Quality Assurance Limited



001

This certificate replaces and supersedes certificate no.MUM0060226, issue dated 22 April 2010
This document is subject to the provision on the reverse
71 Fenchurch Street, London EC3M 4BS United Kingdom. Registration number 1879370
This approval is carried out in accordance with the LRQA assessment and certification procedures and monitored by LRQA.
The use of the UKAS Accreditation Mark indicates Accreditation in respect of those activities covered by the Accreditation Certificate Number 001
Version Number 15

QUALITY ASSURANCE PLAN

Sr. No. (1)	Inspection Activity (2)	Characteristic (3)	Category (4)	Type/ Method of Check (5)	Extent of Check (6)	Reference Documents (7)	Acceptance Norms (8)	Report Required (9)	Inspection Organisation			Remark (13)
									SGEL (10)	TPI (11)	CLIENT (12)	
1.0 Material												
1.1	Properties (Plates, Pipes, Forgings, Castings, Fitting & Other Pressure Parts)	Chemical and mechanical properties	C	Chemical Analysis & Mechanical Tests	Test Coupon	Approved Drawing / Approved Material Technical Specification (MTS)	ASME Sec.II, Part A and Applicable Material Technical Specification	Manufacturer's/ Lab Test Certificate	H	R	R	Check test if correlatable TC is not available
1.2	Overall dimensions and visual inspection (Plates, Pipes, Forgings, Castings, Fittings & other Pressure Parts)	Dimensions	M	Measurement, Visual and QMS:WI-QCD-01	100%	ASME Sec.II, Part A/ DIN Standard , Purchaser Order and Approved drawing	ASME Sec.II, Part A/ DIN Standard , Purchaser Order and Approved drawing	QMS: F-QCD-09 QMS: F-QCD-18 QMS: F-QCD-20	H	R	R	
1.3	Bought out components like: Mechanical Seal, Electric Motor, Gear Box, RTD Sensors, PTFE Sparger, Rupture Disc	Dimensions, M.O.C.	M	Review Material Test Certificate (MTC) & Visual Check	100%	Approved Drawing, Purchase Order	Approved Drawing, Purchase Order	Test Certificate	H	R	R	
1.4	Identification	Marking / Punching	C	Visual	100%	ASME Sec.II, Part A, Approved Drawing & MTS and Purchase Order	ASME Sec.II, Part A, Approved Drawing & MTS	Manufacturer's T.C.	H	R	R	Check test (If Required)
2.0 Fabrication												
2.1	Marking and stamp transfer (All Pressure Parts)	ASME Sec.II, Part A / DIN / Approved Drawing	M	Visual	100%	ASME Sec.II, Part A Approved Drawing	ASME Sec.II, Part A Approved Drawing	QMS: F-QCD-02	H	R	R	
2.1.1	Dimensional Verification and Surface Defect of formed D'end	I Dimension	M	Measurement	100%	Approved Drawing & ASME Sec.VIII, Div.I	Approved Drawing & ASME Sec.VIII, Div.I	QMS:F-QCD-03	H	R	R	Report Verified of Forming Vendor
		II Surface Defect & Lamination	M	LPT	100%	ASME Sec.V	ASME Sec.V	QMS:F-QCD-11	H			
2.2	Marking for nozzle openings on top and bottom dished ends	Dimension	M	Measurement and Visual	100%	Approved Drawing	Approved Drawing	QMS: F-PRD-03, 04, 05	H	R	R	
2.3	All weld joint setup of Main Shell, Jacket Shell & Dished End and Weld Geometric	Weld Setup and Weld Geometric	M	Measurement	100%	ASME Sec.VIII, Div.I & Approved Weld Plan	Drawing & ASME Sec.VIII, Div.I & Approved Weld Plan	QMS-F-PRD-03, 04, 05, 14	H	R	R	
2.4	Agitator, Baffle, Thermowell, C.O.C. M.W. Cover	Dimension	M	Visual / Measurement	100%	Approved Drg.	Approved Drg.	QMS:F-QCD-06	H	R	R	
3.0 Welding												
3.1	WPS, PQR & WPQ	Qualification Test	C	Mechanical Test / Radiograph	Test coupon	ASME Sec.IX	ASME Sec.IX	Qualification Records (WPQ)	H	R	R	SGEL Records Only
3.2	Out of roundness for Main Shell & Jacket Shell	Dimension	M	Measurement	100%	ASME Sec.VIII, Div.I / Approved Drawing and DIN Standard	ASME Sec.VIII, Div.I / Approved Drawing and DIN Standard	QMS:F-PRD-03 QMS:F-PRD-04 QMS:F-PRD-14	H	R	R	
3.3	Visual inspection for weld bead	Reinforcement	M	Measurement and Visual	100%	ASME Sec.VIII, Div.I and Weld Plan	ASME Sec.VIII, Div.I	QMS:F-QCD-05	H	R	R	

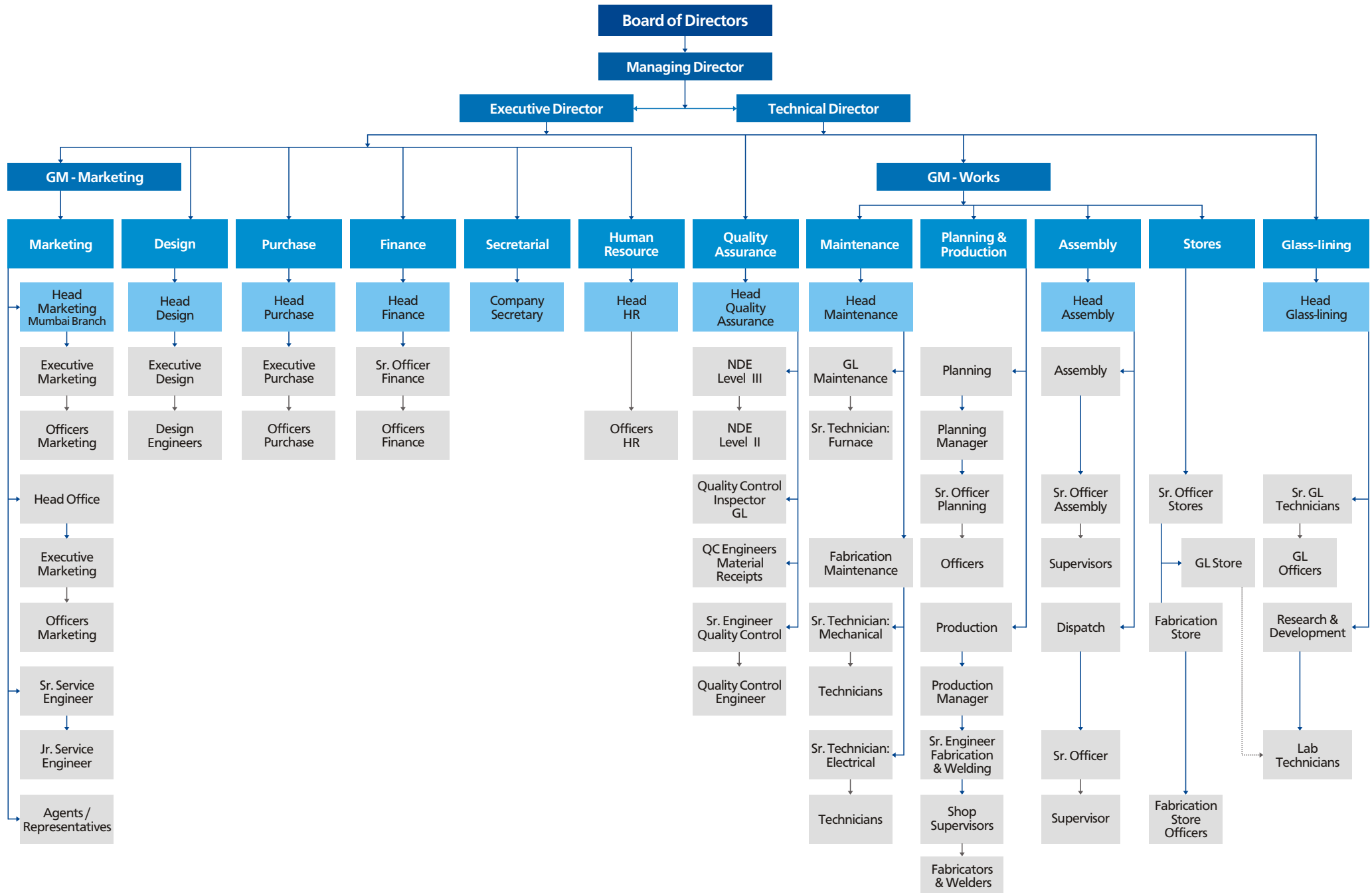
QUALITY ASSURANCE PLAN

Sr. No. (1)	Inspection Activity (2)	Characteristic (3)	Category (4)	Type/ Method of Check (5)	Extent of Check (6)	Reference Documents (7)	Acceptance Norms (8)	Report Required (9)	Inspection Organisation			Remark (13)
									SGEL (10)	TPI (11)	CLIENT (12)	
4.0 N.D.T.												
4.1	Penetrant Test (PT) of Weld Joint	Welding Surface Defect	M	Liquid Penetrate Test	100%	ASME Sec.V & ASME Sec.VIII, Div.I	ASME Sec.V & ASME Sec.VIII, Div.I	QMS: F-QCD-11	H	R	R	
4.2	Ultrasonic Testing (UT) of Weld Joint	Welding Soundness	M	Ultrasonic Testing	100%	ASME Sec.V & ASME Sec.VIII, Div.I	ASME Sec.V, ASME Sec.VIII, Div. I	QMS: F-QCD-12	H	R	R	
4.3	Radiographic Testing (RT) of Weld Joint	Welding Soundness	M	Radiographic (Gamma Rays)	Approved Drawing	ASME Sec.V & ASME Sec.VIII, Div.I	ASME Sec.V, ASME Sec.VIII, Div.I	QMS: F-QCD-13	H	R	R	
5.0 Surface Preparation												
5.1	Grit Blasting	Surface Roughness	M	Visual	100%	SGEL Standard	SGEL Standard	SGEL Internal Record	H	R	R	
6.0	Glass-lining	Surface Finish & Thickness Check	M	Visual / Spark Test at 20 KV	100%	QMS: WI-GLN-04	DIN Standard and SGEL Standard	QMS: F-QCD-26 QMS: F-QCD-27	H	R	R	
7.0 Jacket Fitting												
7.1	Jacket Shell to Main Shell	Setup & Welding	M	Visual	100%	Approved Drg. / Approved Weld Plan	Approved Drg. / Approved Weld Plan	QMS: F-PRD-14	H	R	R	
7.2	Side Bracket Setup with Jacket	Setup & Welding	M	Visual	100%	Approved Drg. / Approved Weld Plan	Approved Drg. / Approved Weld Plan	QMS: F-PRD-14	H	R	R	
8.0 Final Testing												
8.1	Hydrostatic Test for Vessel, Pipes and Fittings	Hydrostatic Test	C	Pressure Test	100%	ASME Sec.VIII, Div.I QMS: WI-QCD-06 & Approved Drawing	ASME Sec.VIII, Div.I & Approved Drawing	QMS: F-QCD-15	P	H	H	QMS: WI-QCD-06
8.2	Run Test at full load	Run out and Power drawn	C	Measurement	100%	QMS: WI-QCD-06	SGEL Standard	QMS: F-QCD-15	P	H	H	
8.3	Glass-lining Test	I Glass-lining Continuity (Spark Test)	C	Integrity	100%	QMS: WI-GLN-07	DIN Standard and SGEL Standard	QMS: F-QCD-15 QMS: F-QCD-16	P	H	H	
		II Glass-lining Thickness	C	Measurement	100%	QMS: WI-GLN-04	DIN Standard and SGEL Standard	QMS: F-QCD-15 QMS: F-QCD-16	P	H	H	
9.0	Final Dimensions & Visual	Dimension & Visual Check	M	Measurement and Visual	100%	Approved Drawing / Internal W.O. or P.O.	Approved Drawing	QMS: F-QCD-5 QMS: F-QCD-15 QMS: F-QCD-16 QMS: F-QCD-21	P	H	H	Dimensions are incorporated in as built drg.
10.0	Final Documentation Review	Review Applicable documents for Compliance to Specification										

Legends

H: Hold | R: Review | P: Perform | C: Critical | M: Major

ORGANIZATIONAL CHART



PARTNERING WITH THE BEST TO LEAD THE PACK

Abhilash Chemicals Pvt. Ltd.	Kiri Industries Ltd.
Alchymars ICM SM Pvt. Ltd.	Lanxess
Alembic Ltd.	Mahavir Synthesis Pvt. Ltd.
Anthem Biosciences Pvt. Ltd.	Maprimed S.A.
Anshul Specialty Molecules Ltd.	Matrix Laboratories Ltd. (Now Mylan Laboratories Ltd.)
Apicore Pharmaceuticals Pvt. Ltd.	Meghmani Group
Arch Pharmed Labs Ltd.	Metrochem API Pvt. Ltd.
Atul Ltd.	Micas Organics Ltd.
Aurobindo Pharma Ltd.	Millenium Chemi Pharma Pvt. Ltd.
Benzo Chem Industries Pvt. Ltd.	Navdeep Chemicals Pvt. Ltd.
Bharat Rasayan Ltd.	Navin Fluorine International Ltd.
Bilag Industries Pvt. Ltd.	Nectar Lifesciences Ltd.
Cadila Pharmaceuticals Ltd.	Nestle
Chemclone Industries	Nivika Chemo Pharma Pvt. Ltd.
Cheminova India Ltd.	Ordnance Factory
Cipla Ltd.	Otsuka Chemical (India) Pvt. Ltd.
Claris Lifesciences Ltd.	Parabolic Drugs Pvt. Ltd.
Colourtex Industries Ltd.	Pidilite Industries Ltd.
Corvine Chemicals & Pharmaceuticals Ltd.	Piramal Healthcare Ltd.
Coromandel International Ltd.	Rakshit Drugs Pvt. Ltd.
Deepak Nitrite Ltd.	Ranbaxy Laboratories Ltd.
Dishman Pharmaceuticals & Chemicals Ltd.	Richter Themis Medicare (India) Pvt. Ltd.
Divi's Laboratories Ltd.	Saurav Chemicals Ltd.
Dr. Reddy's Laboratories Ltd.	Shasun Pharmaceuticals Ltd.
EOC Group	SRF Ltd.
Exemed Pharmaceuticals Ltd.	Syngenta
GSP Crop Science Ltd.	Tagros Chemicals India Ltd.
Gujarat Agrochem Ltd.	Teva API
Gulbrandsen Chemicals Pvt. Ltd.	Transpek Industry Ltd.
Hetero Group	United Phosphorus Ltd.
Hikal Ltd.	V.B. Medicare Pvt. Ltd.
IOL Chemicals & Pharmaceuticals Ltd.	Virchow Chemicals Pvt. Ltd.
ION Exchange (India) Ltd.	Virupaksha Organics Pvt. Ltd.
Jubilant Life Sciences Ltd. (Jubilant Organosys Ltd.)	Vivin Laboratories Pvt. Ltd.