

# Technical references

## Black extra heavy steel pipes (for refrigerant) to AS 1836

nominal size inches mm	diameter (mm)		content L/m	mass empty Kg/m run	surface m <sup>2</sup> /m.run		
	outside	inside			outside	inside	
1/2 3/4 1	15	21.3	14.1	.156	1.60	.067	.044
	20	26.9	18.9	.281	2.29	.085	.059
	25	33.7	24.7	.479	3.23	.107	.079
1 1/4 1 1/2 2	32	42.4	32.6	.837	4.52	.135	.104
	40	48.3	37.5	1.10	5.70	.152	.118
	50	60.3	49.5	1.92	7.28	.190	.156
2 1/2 3	65	76.1	64.3	3.25	10.2	.239	.202
	80	88.9	77.1	4.67	12.0	.279	.242

## Flange comparison tables

Notes to flange comparison tables pages 519 to 526.

1. Standards generally compatible:

AS2129 = AS B52 = BS10

ANSI = ASA

DIN2501 = BS4504

DIN 2501 covers bolting and general matching dimensions only.

Flange types with dimensions such as thickness are covered by various other DIN standards.

2. Bolt diameters M22 M27 M33 and M39 are non preferred sizes in Australia and are not readily available.

The following imperial equivalents may be used:

M22 = 7/8" UNC

M27 = 1" UNC

M33 = 1 1/4" UNC

M39 = 1 1/2" UNC

Alternatively the next bigger metric size should be used.

3. Bolt hole diameters:

up to M24 = bolt dia. + 2mm.

M27 and over = bolt dia. + 3mm.

4. For high temperature applications the applicable codes should be consulted for material selection and other design criteria.

5. JIS and DIN flanges are rated in kg/cm<sup>2</sup>.

ANSI flanges are rated in lb (pounds).

AS ratings refer to rating tables.

## Flange comparison tables

nom pipe size mm	flange standards name	rating	flange dimension mm				thickness	
			out-side dia.	PCD	bolt no. off	dia.	cast iron	steel
25NPS (1in)	JIS	10	125	90	4	M16	18	14
		16	125	90	4	M16	18	14
		20	125	90	4	M16	20	16
	ANSI	125/150	108	79	4	M16	11	14
		300	124	89	4	M16	-	17
	AS2129	A	115	83	4	M12	13	12
		D	115	83	4	M12	13	12
		E	115	83	4	M12	13	12
		F	120	87	4	M16	13	12
		H	120	87	4	M16	19	14
	DIN	6	100	75	4	M10	14	14
		10	115	85	4	M12	16	16
16		115	85	4	M12	16	16	
25		115	85	4	M12	-	-	
40		115	85	4	M12	-	-	
32NPS (1 1/4 in)	JIS	10	135	100	4	M16	20	16
		16	135	100	4	M16	20	16
		20	135	100	4	M16	20	18
	ANSI	125/150	118	89	4	M16	13	16
		300	133	98	4	M16	-	20
	AS2129	A	120	87	4	M12	16	12
		D	120	87	4	M12	16	12
		E	120	87	4	M12	16	12
		F	135	98	4	M16	16	13
		H	135	98	4	M16	22	17
	DIN	6	120	90	4	M12	16	16
		10	140	100	4	M16	18	16
16		140	100	4	M16	18	16	
25		140	100	4	M16	-	-	
40		140	100	4	M16	-	-	
40NPS (1 1/2 in)	JIS	10	140	105	4	M16	20	16
		16	140	105	4	M16	20	16
		20	140	105	4	M16	22	18
	ANSI	125/150	127	98	4	M16	14	18
		300	156	114	4	M20	-	21
	AS2129	A	135	98	4	M12	16	12
		D	135	98	4	M12	16	12
		E	135	98	4	M12	16	12
		F	140	105	4	M16	16	13
		H	140	105	4	M16	22	17
	DIN	6	130	100	4	M12	16	16
		10	150	110	4	M16	18	16
16		150	110	4	M16	18	16	
25		150	110	4	M16	-	-	
40		150	110	4	M16	-	-	

# Technical references

nom pipe size mm	flange standards		flange dimension mm					
	name	rating	out-side dia.	PCD	bolt no. off	dia.	thickness cast steel iron	
50NPS (2 in)	JIS	5	130	105	4	M12	16 14	
		10	155	120	4	M16	20 16	
		16	155	120	8	M16	20 16	
		20	155	120	8	M16	22 18	
	ANSI	125/150	152	121	4	M16	18 19	
		300	165	127	8	M16	- 22	
	AS2129	A	150	114	4	M16	16 12	
		D	150	114	4	M16	17 12	
		E	150	114	4	M16	19 12	
		F	165	127	4	M16	19 16	
		H	165	127	4	M16	25 19	
		DIN	6	140	110	4	M12	16 16
	65 NPS (2½ in)	JIS	5	155	130	4	M12	18 14
			10	175	140	4	M16	22 18
16			175	140	8	M16	22 18	
20			175	140	8	M16	24 20	
ANSI		125/150	178	140	4	M16	18 22	
		300	191	149	8	M20	- 25	
AS2129		A	165	127	4	M16	17 12	
		D	165	127	4	M16	17 12	
		E	165	127	4	M16	19 12	
		F	185	146	8	M16	19 16	
	H	185	146	8	M16	25 19		
	DIN	6	160	130	4	M12	16 16	
80 NPS (3 in)	JIS	5	180	145	4	M16	18 14	
		10	185	150	4	M16	22 18	
		16	200	160	8	M20	24 20	
		20	200	160	8	M20	26 22	
	ANSI	125/150	191	152	4	M16	19 24	
		300	210	168	8	M20	- 29	
	AS2129	A	185	146	4	M16	17 12	
		D	185	146	4	M16	19 12	
		E	185	146	4	M16	19 12	
		F	205	165	8	M16	19 16	
H		205	165	8	M16	29 22		
DIN		6	190	150	4	M16	18 18	
	DIN	10	200	160	8	M16	22 20	
		16	200	160	8	M16	22 20	
		25	200	160	8	M16		
		40	200	160	8	M16		

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nom pipe size mm	flange standards		flange dimension mm					
	name	rating	out-side dia.	PCD	bolt no. off	dia.	thickness cast steel iron	
90 NPS (3½ in)	JIS	not listed						
		ANSI	125/150	216	178	8	M16	- 24
	300		229	184	8	M20	- 30	
	AS2129	A	205	165	4	M16	- 12	
		D	205	165	4	M16	- 12	
		E	205	165	8	M16	- 12	
		F	215	178	8	M16	- 19	
	DIN	not listed	H	215	178	8	M16	- 22
	100 NPS (4 in)	JIS	5	200	165	8	M16	20 16
			10	210	175	8	M16	24 18
			16	225	185	8	M20	26 22
			20	225	185	8	M20	28 24
		ANSI	125/150	229	191	8	M16	24 24
300			254	200	8	M20	- 16	
AS2129		A	215	178	4	M16	19 12	
		D	215	178	4	M16	19 12	
		E	215	178	8	M16	22 13	
		F	230	191	8	M16	22 19	
		H	230	191	8	M16	32 25	
		DIN	6	210	170	4	M16	18 18
125 NPS (5 in)		JIS	5	235	200	8	M16	20 16
			10	250	210	8	M20	24 20
	16		270	225	8	M22	36 22	
	20		270	225	8	M22	30 26	
	ANSI	125/150	254	216	8	M20	24 24	
		300	279	235	8	M20	- 35	
	AS2129	A	255	210	4	M16	19 13	
		D	255	210	8	M16	21 13	
		E	255	210	8	M16	22 14	
		F	280	235	8	M20	25 22	
H		280	235	8	M20	35 29		
DIN		6	240	200	8	M16	20 20	
	DIN	10	250	210	8	M16	26 22	
		16	250	210	8	M16	26 22	
		25	270	220	8	M24		
		40	270	220	8	M24		

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# Technical references

nom pipe size mm	flange standards		flange dimension mm						
	name	rating	out-side dia.	PCD	bolt no. off	dia.	thickness cast iron	steel	
150 NPS (6 in)	JIS	5	265	230	8	M16	22	18	
		10	280	240	8	M20	26	22	
		16	305	260	12	M22	28	24	
		20	305	260	12	M22	32	28	
	ANSI	125/150	279	241	8	M20	25	25	
		300	318	270	12	M20	-	37	
	AS2129	A	280	235	4	M16	21	13	
		D	280	235	8	M16	21	13	
		E	280	235	8	M20	22	17	
		F	305	260	12	M20	25	22	
		H	305	260	12	M20	35	29	
		DIN	6	265	225	8	M16	20	20
	200 NPS (8 in)	JIS	5	320	280	8	M20	24	20
			10	330	290	12	M20	26	22
16			350	305	12	M22	30	26	
20			350	305	12	M22	34	30	
ANSI		125/150	343	299	8	M20	29	29	
		300	381	330	12	M22	-	41	
AS2129		A	335	292	8	M16	22	13	
		D	335	292	8	M16	22	13	
	E	335	292	8	M20	25	19		
	F	370	324	12	M20	29	25		
	H	370	324	12	M20	38	32		
	DIN	6	320	280	8	M16	22	22	
250 NPS (10 in)	JIS	5	385	345	12	M20	26	22	
		10	400	355	12	M22	30	24	
		16	430	380	12	M24	34	28	
		20	430	380	12	M24	38	34	
	ANSI	125/150	406	362	12	M22	30	30	
		300	445	387	16	M27	-	48	
	AS2129	A	405	356	8	M20	24	16	
		D	405	356	8	M20	25	16	
		E	405	356	12	M20	25	22	
		F	430	381	12	M24	29	29	
H		430	381	12	M24	41	35		
DIN		6	375	335	12	M16	24	24	
400 NPS (16 in)	JIS	5	540	495	16	M22	30	24	
		10	560	510	16	M24	36	28	
		16	605	540	16	M30	42	28	
		20	605	540	16	M30	50	46	
	ANSI	125/150	597	540	16	M27	37	37	
		300	648	572	20	M33	-	57	
AS2129	A	580	521	12	M24	27	22		
	D	580	521	12	M24	29	22		
	E	580	521	12	M24	32	32		
	F	610	552	20	M27	35	41		
	H	610	552	20	M27	51	54		

## Flange comparison tables

nom pipe size mm	flange standards		flange dimension mm						
	name	rating	out-side dia.	PCD	bolt no. off	dia.	thickness cast iron	steel	
300NPS (12 in)	JIS	5	430	390	12	M20	28	22	
		10	445	400	16	M22	32	24	
		16	480	430	16	M24	36	30	
		20	480	430	16	M24	40	36	
	ANSI	125/150	483	432	12	M22	32	32	
		300	521	451	16	M27	-	51	
	AS2129	A	455	406	8	M20	24	19	
		D	455	406	12	M20	25	19	
		E	455	406	12	M24	29	25	
		F	490	438	16	M24	32	32	
		H	490	438	16	M24	44	41	
		DIN	6	440	395	12	M20	24	24
	350 NPS (14 in)	JIS	5	480	435	12	M22	30	24
			10	490	445	16	M22	34	26
16			540	480	16	M30	38	34	
20			540	480	16	M30	44	40	
ANSI		125/150	533	476	12	M27	35	35	
		300	584	514	20	M27	-	54	
AS2129		A	525	470	8	M24	25	22	
		D	525	470	12	M24	29	22	
		E	525	470	12	M24	32	29	
		F	550	495	16	M27	35	35	
	H	550	495	16	M27	48	48		
	DIN	6	490	445	12	M20	26	26	
400 NPS (16 in)	JIS	5	540	495	16	M22	30	24	
		10	560	510	16	M24	36	28	
		16	605	540	16	M30	42	28	
		20	605	540	16	M30	50	46	
	ANSI	125/150	597	540	16	M27	37	37	
		300	648	572	20	M33	-	57	
	AS2129	A	580	521	12	M24	27	22	
		D	580	521	12	M24	29	22	
		E	580	521	12	M24	32	32	
		F	610	552	20	M27	35	41	
H		610	552	20	M27	51	54		

# Technical references

nom pipe size mm	flange standards		flange dimension mm					
	name	rating	out-side dia.	PCD	bolt no. off	dia.	thickness cast steel iron	
DIN		6	540	495	16	M20	28 28	
		10	565	515	16	M24	32 32	
		16	580	525	16	M27	38 36	
450 NPS (18 in)	JIS	2	605	555	16	M20	28 22	
		5	605	555	16	M22	30 24	
		10	620	565	20	M24	38 30	
		16	675	605	20	M30	46 40	
		20	675	605	20	M30	- 48	
		ANSI	125/150	635	578	16	M27	40 40
	AS2129	300	711	629	24	M33	- 60	
		A	640	584	12	M24	27 22	
		D	640	584	12	M24	32 25	
		E	640	584	16	M24	35 35	
		F	675	610	20	M30	38 44	
		H	675	610	20	M30	54 60	
DIN		6	595	550	16	M20	- -	
		10	615	565	20	M24	32 36	
		16	640	585	20	M27	- -	
500 NPS (20 in)	JIS	2	655	605	20	M20	28 22	
		5	655	605	20	M22	32 24	
		10	675	620	20	M24	40 30	
		16	730	660	20	M30	50 42	
		20	730	660	20	M30	- 50	
		ANSI	125/150	699	635	20	M27	43 43
	AS2129	300	775	686	24	M33	- 64	
		A	705	641	12	M24	29 25	
		D	705	641	16	M24	32 29	
		E	705	641	16	M24	38 38	
		F	735	673	24	M30	41 51	
		H	735	673	24	M30	57 67	
DIN		6	645	600	20	M20	30 30	
		10	670	620	20	M24	34 38	
		16	715	650	20	M30	42 44	
550 NPS (22 in)	JIS	2	720	665	20	M22	30 24	
		5	720	665	20	M24	32 26	
		10	745	680	20	M30	42 32	
		16	795	720	20	M36	54 44	
		ANSI	not listed					
		AS2129	A	760	699	12	M27	30 25
	D		760	699	16	M27	35 29	
	E		760	699	16	M27	38 44	
	F		785	724	24	M30	41 54	
	H		785	724	24	M30	60 70	
	DIN		not listed					

## Flange comparison tables

nom pipe size mm	flange standards		flange dimension mm					
	name	rating	out-side dia.	PCD	bolt no. off	dia.	thickness cast steel iron	
600 NPS (24 in)	JIS	2	770	715	20	M22	30 24	
		5	770	715	20	M24	32 26	
		10	795	730	24	M30	44 32	
		16	845	770	24	M36	58 46	
		20	845	770	24	M36	1 54	
		ANSI	125/150	813	749	20	M33	48 48
	AS2129	300	914	813	24	M39	- 70	
		A	825	756	12	M27	30 25	
		D	825	756	16	M27	35 32	
		E	825	756	16	M30	41 48	
		F	850	781	24	M33	44 57	
		H	850	781	24	M33	64 76	
DIN		6	755	705	20	M24	30 32	
		10	780	725	20	M27	36 42	
		16	840	770	20	M33	48 52	
650 NPS (26 in)	JIS	2	825	770	24	M22	30 24	
		5	825	770	24	M24	34 26	
		10	845	780	24	M30	46 34	
		ANSI	not listed					
	AS2129	A	845	781	16	M27	32 25	
		D	not listed					
		E	not listed					
	DIN	not listed						
	700 NPS (28 in)	JIS	2	875	820	24	M22	30 24
			5	875	820	24	M24	34 26
10			905	840	24	M30	48 34	
ANSI			not listed					
AS2129		A	870	806	16	M27	32 25	
		D	910	845	20	M27	38 35	
		E	910	845	20	M30	44 51	
DIN			6	860	810	24	M24	32 34
			10	895	840	24	M27	40 46
			16	910	840	24	M33	54 58
750 NPS (30 in)	JIS	2	945	880	20	M24	33 24	
		5	945	880	20	M30	36 28	
		10	970	900	20	M30	50 35	
		ANSI	125/150	984	915	28	M33	- -
	AS2129	300	-	997	28	M45	- -	
		A	945	883	20	M27	32 25	
		D	995	927	20	M30	41 41	
	DIN		E	995	927	20	M33	48 54
			not listed					
			not listed					

# Technical references

nom pipe size mm	flange standards		flange dimension mm						
	name	rating	out-side dia.	PCD	bolt no. off	bolt dia.	thickness cast iron	steel	
800 NPS (32 in)	JIS	2	995	930	24	M24	32	24	
		5	995	930	24	M30	36	28	
		10	1020	950	28	M30	52	36	
	ANSI	not listed							
	AS2129	A	1005	940	20	M27	32	25	
		D	1060	984	20	M33	41	41	
		E	1060	984	20	M33	48	54	
	DIN	6	975	920	24	M27	34	38	
		10	1015	950	24	M30	44	52	
		16	1025	950	24	M36	58	64	
850 NPS (34 in)	JIS	2	1045	980	24	M24	32	24	
		5	1045	980	24	M30	38	28	
		10	1070	1000	28	M30	52	36	
	AS2129	A	1030	965	20	M27	32	29	
		D	1090	1016	20	M33	41	44	
		E	1090	1016	20	M33	51	57	
	DIN	ANSI	not listed						
		6	1095	1030	24	M24	32	24	
		10	1095	1030	24	M30	38	30	
	900 NPS (36 in)	JIS	2	1095	1030	24	M24	32	24
5			1095	1030	24	M30	38	30	
10			1120	1050	28	M30	54	38	
ANSI		125/150	1168	1086	32	M39	-	-	
AS2129		A	1105	1041	24	M27	35	29	
		D	1175	1092	24	M33	44	48	
		E	1175	1092	24	M33	51	64	
DIN		6	1075	1020	24	M27	36	42	
		10	1115	1050	28	M30	46	56	
		16	1125	1050	28	M36	62	72	
1000 NPS (40 in)	JIS	2	1195	1130	28	M24	34	26	
		5	1195	1130	28	M30	40	34	
		10	1235	1160	28	M36	58	40	
	ANSI	not listed							
	AS2129	A	1180	1118	24	M27	35	29	
		D	1255	1175	24	M33	44	51	
		E	1255	1175	24	M36	54	67	
	DIN	6	1175	1120	28	M27	35	46	
		10	1230	1160	28	M33	50	62	
		16	1255	1170	28	M39	66	78	
1200 NPS (48 in)	JIS	2	1420	1350	32	M24	36	26	
		5	1420	1350	32	M30	46	34	
		10	1465	1380	32	M36	66	46	
	ANSI	125/150	1511	1422	44	M39	-	-	
	AS2129	A	1415	1353	28	M27	38	32	
		D	1490	1410	32	M33	51	60	
		E	1490	1410	32	M36	60	79	
	DIN	2.5	1375	1320	32	M27	30	36	
		6	1405	1340	32	M30	40	56	
		10	1455	1380	32	M36	56	74	

## Specific gravity and specific heat

	specific gravity at 18° to 20°C	specific heat at 20°C kJ/kg°C
alcohol, ethyl, 95%	0.81	2.51
aluminium	2.64	0.90
ammonia 100%	0.77	4.73
asphalt	1.00	0.92
benzene	0.84	1.72
brine—calcium chloride 25%	1.23	2.88
brine—sodium chloride 25%	1.19	3.29
carbon tetrachloride	1.58	0.88
coal tars at 40°C	1.20	1.46
copper	8.82	0.42
Dowtherm A	0.99	2.64
glycerol	1.26	2.43
hydrochloric acid 35%	1.15	2.51
lead	11.34	0.13
linseed oil	0.93	1.84
meat, fresh, average		2.93
nitric acid 95%	1.50	2.09
nitric acid 10%	1.05	3.77
kerosene	0.81	1.97
34° API mid-continent crude	0.85	1.84
paraffin, melted	0.90	2.89
sea water	1.03	3.94
sodium hydroxide 50%	1.53	3.27
steel, mild @ 21°C	7.90	0.46
sugar	1.66	1.26
sulphuric acid 98%	1.84	1.47
sulphuric acid 20%	1.14	3.52
wool	1.32	1.36
<b>gases</b>		
air	1.00	1.00
carbon dioxide	1.44	0.88
chlorine	3.00	0.49
ethylene	1.16	1.88
Freon 12		0.67
hydrogen	0.0828	14.3
hydrogen sulphide	1.44	1.05
methane	0.66	2.51
nitrogen	1.164	1.06
oxygen	1.32	0.94
propane	1.80	1.93
sulphur dioxide		0.68