A FIELD GUIDE FOR MAINTAINING GREAT ARTESIAN BASIN WELLS/BORES

Government of South Australia

About this Publication

This handbook is for water users who have a bore (or well) under their care and control in the SA Arid Lands region.

Water availability and management is a key natural resources management issue in the arid and semi-arid regions of Australia.

Governments and individuals have made significant investment over recent decades in upgrading the infrastructure that delivers Great Artesian Basin water, including rehabilitating bores and installing piped reticulation systems to deliver GAB water efficiently.

This handbook provides guidance on how to protect that investment through best practice maintenance of bores and associated pipelines.

Simple, routine maintenance can extend the life of the infrastructure that is essential for the continued operation of our key industries (tourism, pastoral, mining gas and petroleum) and to meet the needs of our communities and wildlife.

Topics covered here are well head maintenance and minor repair, pipeline maintenance and repair and common problems to look out for in your reticulation systems.

Safety is always an issue when working with hot – above 50°C, high pressure bores; please follow all safety procedures prescribed by equipment manufacturers and your organisation when undertaking any maintenance or repair work and do not attempt any work beyond your technical training or capability.

ACKNOWLEDGEMENTS

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A NOTE ON TERMINOLOGY…

Under the *Natural Resources Management Act 2004*, 'bores' are referred to as 'wells'; both terms may be used interchangeably in this document.

HELPFUL HINTS

WHAT DO I NEED TO THINK ABOUT

- Is the main valve fully open/closed?
- Are there any leaks in the headworks?
- Are there any leaks in the pipelines?
- Are there any leaks at the tanks?
- Are the float valves at tanks and troughs functioning properly?
- What is the condition of the distribution and main valves?
- What is the condition of the manifold?
- When was the last time I checked the operation of the main and distribution valves?
- When was the last time I conducted an inspection of the bores on my property?
- When conducting the well inspection, list repairs that could not be affected.
- When was the last time a well maintenance sheet was completed for each bore?

WHEN WORKING ON WELL HEADWORKS

If maintenance is to be carried out on a well head, OHS&W policy issues come into effect. Listed below are some points to consider.

- Adequate personal protective equipment.
- Clear and adequate work space.
- Adequate drainage.
- Escape plan.
- Correct components and tools.
- Prior to undertaking any maintenance works on the well head ensure main valve is closed.
- Ensure that your flange patterns match and that you have the correct bolt sizes.
- Appropriate first aid equipment.
- Do not work alone if the water temperature is hot.

PRESSURE MEASUREMENTS

The pressure of an artesian bore may be measured by the use of a pressure transducer, a test quality pressure gauge or if the pressure is very small by a water tube.

Pressure can be measured as either **flowing** or **shut-in**, it is important that a consistent methodology is applied to ensure that results are meaningful.

Pressure monitoring ball valve

Measuring flowing pressure

- Install fitting to monitoring port on well, install pressure instrument into fitting, opening valve slightly before tightening the instrument to bleed out any air trapped between the instrument and fitting.
- Turn on the monitoring port valve and measure and record pressure.
- Record the elapsed time between when the reading was taken and when the last distribution valve was closed.

Measuring shut in pressure

- Use a permanent marker to mark the position of the distribution valves in relation to a point on the headworks.
- Install fitting to monitoring port on well, install pressure instrument into fitting, opening valve slightly before tightening the instrument to bleed out any air trapped between the instrument and fitting.
- Count the number of turns it takes to shut the valve down (arrows on valve handle indicate direction of movement) by counting full turns past the witness mark you have put on the headworks and record number next to/or on valve.
- Use caution when closing valve as you may cause water hammer.
- Repeat step 1 and 2 until all distribution valves on the headworks are shut.
- Once all valves are closed, turn on monitoring port valve and measure and record pressure at intervals of 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, 20 minutes and then 5 minute intervals until the pressure stabilises or decreases due to the column of water in the well cooling.
- Check main valve is operational by shutting and opening while the well is controlled.
- Collect water sample from the well after pressure shut in test is completed to ensure it does not affect the pressure readings.
- Open valves slowly to original position to avoid water hammer in pipeline which may cause the pipeline or fitting to split.

The Department has a time stamped record of shut-in pressures and times available for each well for information and as a comparison against elapsed time.

MAIN VALVE

- Operation of main valve should be tested at least every three months by closing and re-opening the valve a number of times.

Notes

1. Ensure valve is fully open when in operation.
2. Valve may develop a slow leak through the gland after testing. Tighten the nuts on gland housing, ensuring not to over tighten.

DISTRIBUTION VALVES

- Operation of the distribution valve should be tested regularly following a similar procedure to the main valve.

Note

1. Observe set position of valve prior to testing and return valve to set position. (NB mark position and count number of turns).

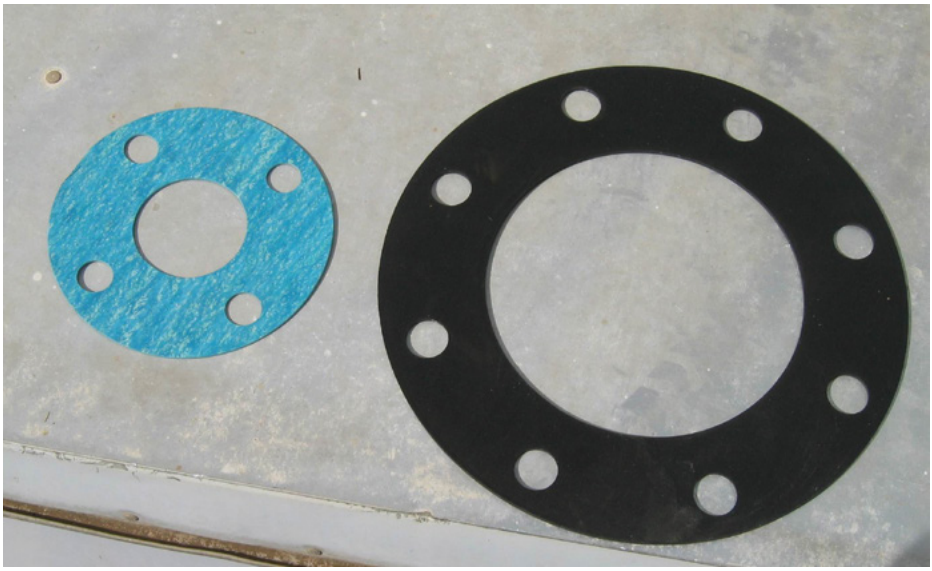
CLOSING VALVES ON THE HEADWORKS

- There is a requirement for closing the main valve to provide safe working conditions for maintenance on the headworks or distribution valves.
- When undertaking pressure readings ONLY close the distribution valves to allow access to the pressure monitoring port (refer to page 4).
- The closing of any valve (main valve and distribution valves) on the wellhead must be undertaken gradually.
- It is advised that the auxiliary valves be closed first, if possible, then close the main valve.
- All valves create a line of resistance as they close and this resistance will increase as the valve nears the fully closed position. It is at this point that care must be taken to ensure that the valve is not closed too quickly producing water hammer, which may damage the well or wellhead.

1. Rule of thumb when closing a valve– close valve until an audible noise is produced (this is caused by water resistance against the gate), then slowly close the valve ¼ to ½ turn at a time until it is fully closed.

FLANGES AND GASKETS

- When replacing valves ensure flange faces are clean, new gaskets are installed and all bolts are 316 SS. Certain composite gaskets will require that bolt tension be checked on a regular basis.
- All threaded bolts on the well head and main valve should have an anti-seize compound applied.
- When using dissimilar materials (e.g. poly and steel) ensure that the sealant is suitable for both materials.
- It is cheaper to repair a leak than replace the well head / main valve.
- Additional caution should be used when tightening bolts on PVC or FRP flanges to prevent causing damage. Ideally a backing ring should be used.
- The stated poly pipe diameters are the OD (external).
- The stated steel pipe diameters are the ID (internal).

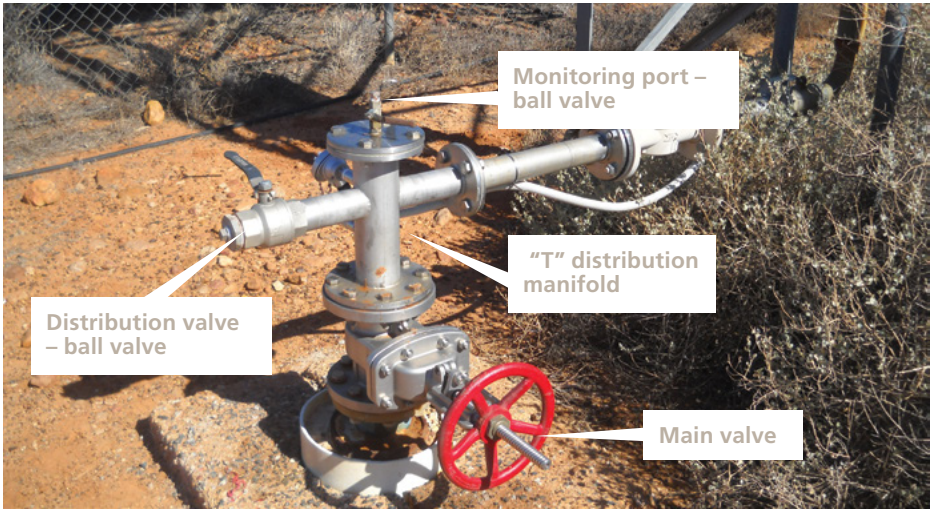


	3000 series Blueguard Gasket	**Neoprene Rubber Gasket**
Material	Aramid fibre with nitrile binder	Neoprene 50 or 60 duro
Temperature range	-40°C to 370°C	-18°C to 93°C
Continuous operating temperature	205°C	76°C
		Note – do not use when temperature exceeds 50°C

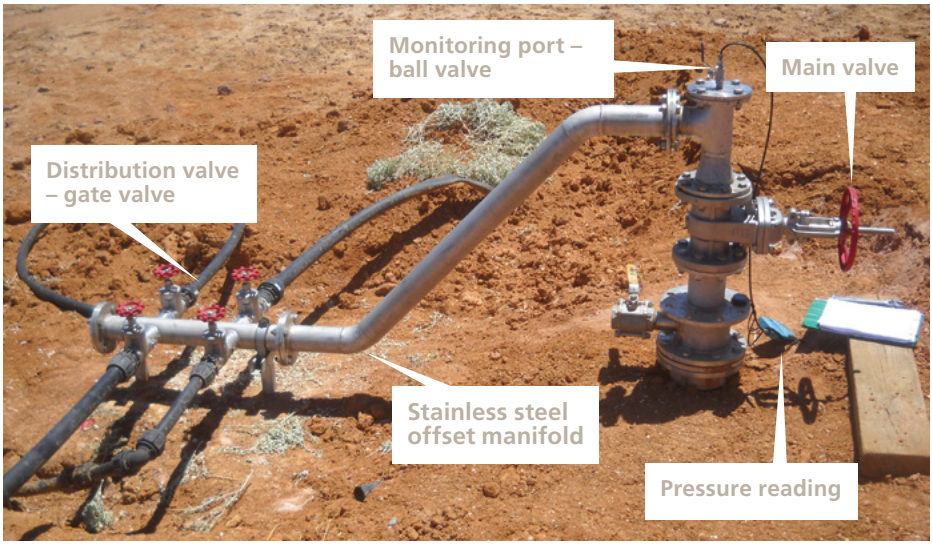
WELL HEADWORKS

Headworks traditionally have a "T" distribution manifold attached above the main valve. Use of offset distribution systems is consider best practice as it reduces the likelihood of well head corrosion and incidental damage from leakages. Installation of fencing further protect the wells, wellheads and distribution systems from damage by livestock.

Example Well Head with "T" distribution manifold



Example of a Well Head with offset distribution manifold

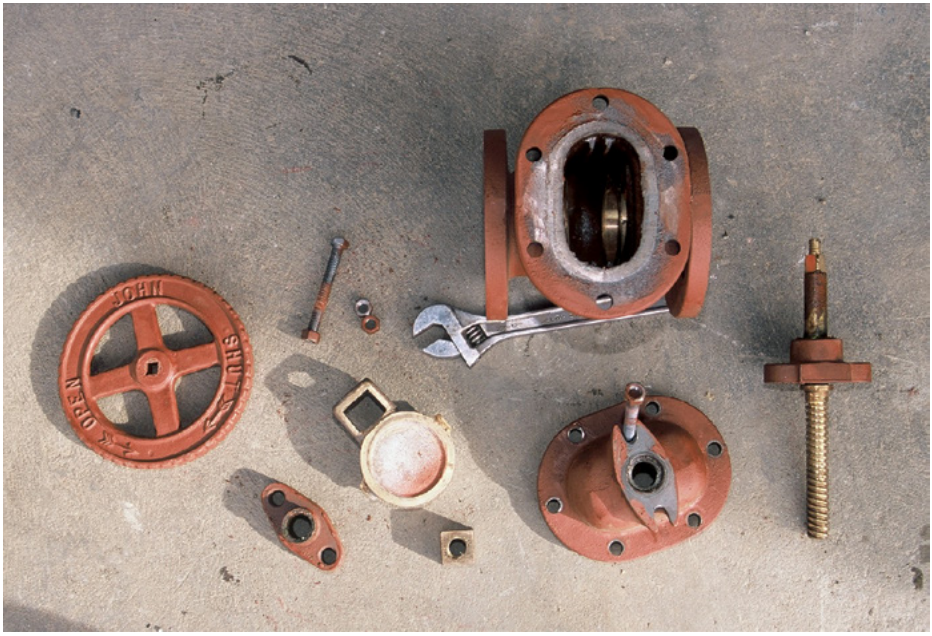


Valve Type	Recommended Use	Construction Material
Flanged gate valve	Main valve	Stainless steel
Threaded gate valve	Flow line valve	Stainless steel Bronze
Ball valve (Full bore)	Flow line valve	Stainless steel Bronze
Ball valve (Reduced bore)	Monitoring valve	Stainless steel Bronze
Butterfly valve	Flow line valve	Stainless Steel Cast iron

Notes

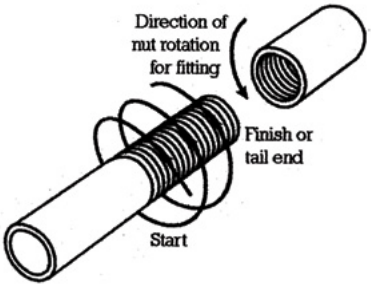
- The western side of the GAB is more corrosive than the eastern side, which also has higher pressures and temperatures, so care should be taken when selecting the type of valve and the material it is constructed from.
- Stainless steel has become the material of choice for valve and headwork construction due to the lower level of maintenance required.
- Advances in epoxy coatings and electroplating has allowed materials like cast iron and bronze to compete in areas that traditionally have required a higher level of maintenance.

Components of a Main Valve – Cast Iron Gate Valve



Wellhead Manifold Design (example)

PIPE THREADS



SPECIFICATIONS

Composition	100% Teflon PTFE
Colour	White
Density, apparent	0.8g/cm³
Elongation	>100%
Temperature range	-450 to +500°F/-268 to +260°C

Teflon PTFE is completely stable up to +500°F or +26-°C. Decomposition is slow up to 750°F or +400°C. Although decomposition will occur on contact with naked flame.

Instructions

Clean male and female threads thoroughly.

Wrap tape around male thread. Take care to keep the thread tape under tension so the tape moulds into the root of the thread.

Wrap with the thread.

Make sure the thread does not overlap the end of the thread.

Four wraps seal most threads.

NOTE–more than four wraps maybe necessary for poor quality or damaged threads, parallel threads or fitting subject to vibration.

Precautions

Keep tape clean, replace clip on spool after use and store in a clean environment.

PTFE Tape Characteristics

- The higher the density of the tape the better the result.
- Compatible with a broad range of liquids and gases.
- Compatible with a broad range of piping materials.
- No curing time.
- Effective across a broad range of temperatures.
- Acts as a thread lubricant and anti-seize.
- Prevents electrolytic corrosion of threads.
- Non-toxic and non-flammable.
- Unlimited shelf life.

FLOW RESTRICTORS

To assist water distribution system design, flow restriction devices can be used at stock watering points.

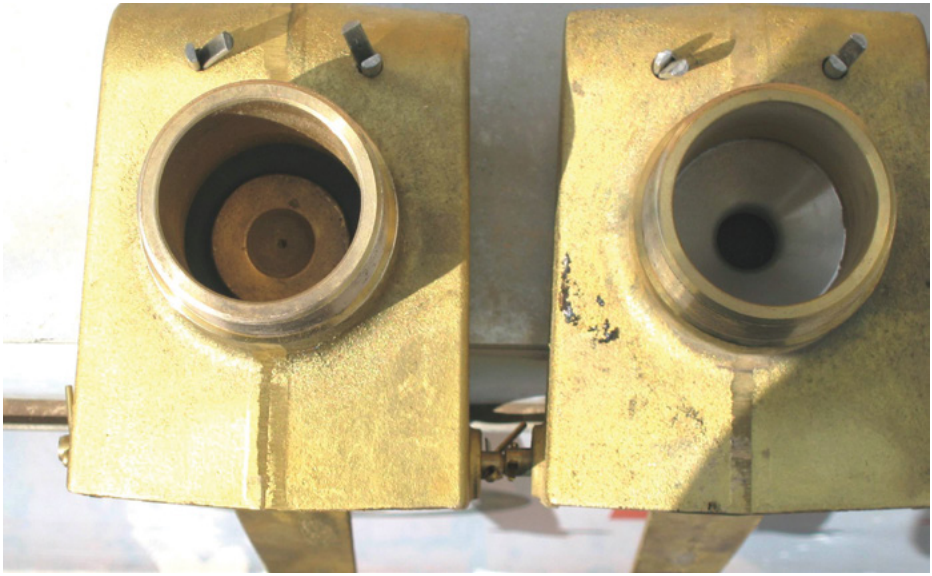
FLOAT VALVES

Float arm – tank or trough

Low-pressure Float Arm

High-pressure Float Arm

Identified by a reduced bore stainless steel orifice.



AIR RELIEF VALVES

Air relief valves (ARVs) should ideally be installed at the top of each rise in the pipeline to release air from a pressured pipeline during filling operations, and also to allow air to enter if the pipeline empties for any reason.

Deposition of calcium carbonate material and corrosion of metal fittings is a common feature of ARVs. In order to alleviate air blockages in the distribution system, isolation valves and ARVs should be maintained in good order.

COOLING PONDS AND GRIDS

Cooling grids have been designed to reduce the water temperature to 40°C for a specified flow rate. Seasonal variations will cause the pond outlet temperature to vary for the same flow rate.

A cooling grid will operate correctly for flow rates less than or equal to the design flow rate, however, for flow rates greater than the design rate the water will exceed 40°C. This will reduce the life expectancy of the piping infrastructure for some distance after the cooling grid outlet manifold. The distance the pipe is affected will be dependant on the water temperature. A temperature drop of 8°C/km can be expected in buried poly pipe.

The use of flow restriction devices will ensure that flow rate does not exceed the design rate.

Cooling pond bank vegetation may be beneficial in reducing

- The amount of wind borne material entering the pond;
- May help reduce the nutrient load and subsequent algal growth in the cooling pond;
- Will reduce the wind effect of the pond surface and wave effect on the pond banks.

Cooling Pond and Grid Maintenance

- Ensure that there is an adequate cover of water above the cooling grid. Most cooling ponds have been designed to have 1.3m to 1.8m of water above the cooling grid.
- Ensure vegetation is removed from the cooling pond water surface and cooling grid manifold when it is observed.
- Ensure scaling and algal growth on the cooling grid pipe work is removed on a regular basis. Frequency may vary but should be at least three monthly.

  Notes

  - Good quality rubber gloves will remove most growth if done on a regular basis.
  - Be mindful of the pipe work temperature.
- Any leaks and breaches of the cooling pond banks are to be reported and repaired immediately.
- Ensure anti-erosion device is in place below pond fill outlet.

FLANGE SPECIFICATIONS

Australian Standard Flanges to AS 2129 – Tables D and E

NOMINAL SIZE DN	TABLE D						TABLE E							NOMINAL SIZE DN
	FLANGE			DRILLING			FLANGE				DRILLING			
	OD (mm)	THICKNESS		Bolt Circle Dia. (mm)	No. of Bolts	Dis. of Bolts (mm)	OD (mm)	THICKNESS			Bolt Circle Dia. (mm)	No. of Bolts	Dia. of Bolts (mm)	
		T3 (mm)	**TG (mm)					T10 (mm)	T11 (mm)	**T6 (mm)				
15	95	6	5	67	4	M12	95	6	6	6	67	4	M12	15
20	100	6	5	73	4	M12	100	6	6	6	73	4	M12	20
25	115	8	5	83	4	M12	115	8	8	7	83	4	M12	25
32	120	8	6	87	4	M12	120	8	8	8	87	4	M12	32
40	135	10	6	98	4	M12	135	10	10	9	98	4	M12	10
50	150	10	8	114	4	M16	150	10	10	10	114	4	M16	50
65	165	11	8	127	4	M16	165	11	11	10	127	4	M16	65
80	185	13	10	146	4	M16	185	13	13	11	146	4	M16	80
100	215	16	10	178	4	M16	215	16	16	13	178	8	M16	100
125	255	17	13	210	8	M16	255	17	17	14	210	8	M16	125
150	280	17	13	235	8	M16	280	17	17	17	235	8	M20	150
200	335	19	13	292	8	M16	335	19	20	19	292	8	M20	200
250	405	19	16	356	8	M20	405	22	25	22	356	12	M20	250
300	455	22	19	406	12	M20	455	25	28	25	406	12	M24	300

Australian Standard Flanges to AS 2129 – Table F

NOMINAL SIZE DN	TABLE F							NOMINAL SIZE DN
	FLANGE				DRILLING			
	OD (mm)	THICKNESS			Bolt Circle Dia (mm)	No. of Bolts	Dia. of Bolts (mm)	
		T10 (mm)	T11 (mm)	**T6 (mm)				
15	95	8	8	10	67	4	M12	15
20	100	8	8	10	73	4	M12	20
25	120	10	10	10	87	4	M16	25
32	135	10	10	13	98	4	M16	32
40	140	11	11	13	105	4	M16	10
50	165	11	12	16	127	4	M16	50
65	185	13	13	16	146	8	M16	65
80	205	14	15	16	165	8	M16	80
100	230	17	17	19	191	8	M16	100
125	280	19	20	22	235	8	M20	125
150	305	22	23	22	260	12	M20	150
200	370	25	28	25	324	12	M20	200
250	430	25	32	29	381	12	M24	250
300	490	29	37	32	438	16	M24	300

Australian Standard Flange – Bolt Sizes – AS2129

NOMINAL FLANGE SIZE DN	TABLE D		TABLE E		TABLE F		NOMINAL FLANGE SIZE DN
	No. Bolts per Flange	XOX Bolt & Nut Dia x Lgth(mm)	No. Bolts per Flange	XOX Bolt & Nut Dia x Lgth(mm)	No. Bolts per Flange	XOX Bolt & Nut Dia x Lgth(mm)	
15	4	M12 x 40*	4	M12 x 40*	4	M12 x 40*	15
20	4	M12 x 40*	4	M12 x 40*	4	M12 x 40*	20
25	4	M12 x 40*	4	M12 x 40*	4	M12 x 40*	25
32	4	M12 x 40*	4	M12 x 40*	4	M12 x 40*	32
40	4	M12 x 40*	4	M12 x 40*	4	M12 x 40*	40
50	4	M16 x 45*	4	M16 x 45*	4	M16 x 50*	50
65	4	M16 x 45*	4	M16 x 45*	8	M16 x 50*	65
80	4	M16 x 45*	4	M16 x 45*	8	M16 x 50*	80
100	4	M16 x 45*	8	M16 x 45*	8	M16 x 60*	100
125	8	M16 x 45*	8	M16 x 50*	8	M20 x 70*	125
150	8	M16 x 45*	8	M20 x 60*	12	M20 x 70*	150
200	8	M16 x 45*	8	M20 x 60*	12	M20 x 75*	200
250	8	M20 x 55*	12	M20 x 70*	12	M24 x 85*	250
300	12	M20 x 60*	12	M24 x 80*	16	M24 x 100*	300

Australian Standard Flanges – Temperature/Pressure Ratings

TEMPERATURE/PRESSURE RATINGS FOR CARBON STEEL FLANGES AS.2129 – 1982				
TEMPERATURE IN°C	WORKING PRESSURE IN kPa BY TABLES (for approximate PSI divide by 7)			
	C	D	E	F
-18 to 120	1200			
-50 to 232		700	1400	2100

American Standard (ANSI) Flanges

Nomical Size		PN20 (CLASS 150)							PN50 (CLASS 300)							Nomical Size	
		Dia. of Fig. Min.	Thick-ness of Fig. Min.	Length Thru Hub		Dia. of Bolt Circle	Dia. of Bolt Holes	No. of Bolts	Dia. of Fig. Min.	Thick-ness of Fig. Min.	Length Thru Hub		Dia. of Bolt Circle	Dia. of Bolt Holes	No. of Bolts		
¤ DN	◊ NPS			Thrd. Slip-On Soc/ Weld	Weld Neck						Thrd. Slip-On Soc/ Weld	Weld Neck				¤ DN	◊ NPS
		O	C(1)*	Y(1)*	Y(1)*				O	C(1)*	Y(1)*	Y(1)*					
15	½	90	11.5	16	48	60.5	16	4	95	14.5	22	52	66.5	16	4	15	½
20	¾	100	13.0	16	52	70.0	16	4	120	16.0	25	57	82.5	20	4	20	¾
25	1	110	14.5	17	56	79.5	16	4	125	17.5	27	62	89.0	20	4	25	1
32	1¼	120	16.0	21	57	89.0	16	4	135	19.5	27	65	98.5	20	4	32	1¼
40	1½	127	17.5	22	62	98.5	16	4	155	21.0	30	68	114.5	22	4	40	1½
50	2	150	19.5	25	64	120.5	20	4	165	22.5	33	70	127.0	20	8	50	2
65	2½	180	22.5	29	70	139.5	20	4	190	25.5	38	76	149.0	22	8	65	2½
80	3	190	24.0	30	70	152.5	20	4	210	29.0	43	79	168.5	22	8	80	3
90	3½	215	24.0	32	71	178.0	20	8	230	30.5	44	81	184.0	22	8	90	3½
100	4	230	24.0	33	76	190.5	20	8	255	32.0	48	86	200.0	22	8	100	4
125	5	255	24.0	36	89	216.0	22	8	280	35.0	51	98	235.0	22	8	125	5
150	6	280	25.5	40	89	241.5	22	8	320	37.0	52	98	270.0	22	12	150	6
200	8	345	29.0	44	102	298.5	22	8	380	41.5	62	111	330.0	26	12	200	8
250	10	405	30.5	49	102	362.0	26	12	445	48.0	67	117	387.5	30	16	250	10

American Standard (ANSI) Flanges – Bolt Sizes

Nominal Flange Size		PN20 (CLASS 150)				PN20 (CLASS 300)			
		No. of Bolts	Dia. Bolts	L		No. of Bolts	Dia. Bolts	L	
¤ DN	◊ NPS			Stud Bolts	Mach. Bolts			Stud Bolts	Mach. Bolts
			ins.	mm	mm		ins.	mm	mm
15	½	4	½	60	45	4	½	65	55
20	¾	4	½	65	50	4	⅝	75	60
25	1	4	½	65	55	4	⅝	80	65
32	1¼	4	½	70	55	4	⅝	80	65
40	1½	4	½	70	60	4	¾	90	75
50	2	4	⅝	80	65	8	⅝	90	75
65	2½	4	⅝	90	75	8	¾	100	85
80	3	4	⅝	90	75	8	¾	110	90
90	3½	8	⅝	90	75	8	¾	110	95
100	4	8	⅝	90	75	8	¾	110	95
125	5	8	¾	90	80	8	¾	120	100
150	6	8	¾	100	85	12	¾	125	105
200	8	8	¾	110	90	12	⅞	140	110
250	10	12	⅞	115	95	16	1	115	130
300	12	12	⅞	120	100	16	1 – ⅛	170	145

Inch/Metric Bolting	
Inter changeable for ANSI B16.5 flanges as below	
FOR	USE
½"	M14
⅝"	M18
¾"	M20
⅞"	M24
1"	M27
1-⅛"	M30
1-¼"	M33
1-⅜"	M36
1-½"	M39
1-⅝"	M42
1-¾"	M45
1-⅞"	M48
2"	M52
2-¼"	M56
2-½"	M64
2-¾"	M72

American Standard (ANSI) Flanges – Temperature/Pressure Ratings

CARBON STEEL PIPE FLANGES TO ANSI/ASME B16.5 – 1988 (BS.1560)
FORGINGS TO ASTM A.105 and A.350 – LF2
FORGINGS TO ASTM A.181 GRADE II FOR CLASS 150 & 300 ONLY

TEMPERATURE IN°C	MAX. WORKING PRESSURE (kPa)*	
	PN20 (Class 150)	PN50 (Class 300)
-29 to 38	1960	5110
50	1920	5010
100	1770	4640
150	1580	4520

PRESSURE PIPE INFORMATION (PE80B and PE100)

Polyethylene (PE) Pipe Dimensions AS/NZS 4130:2009

(Polyethylene pipes for pressure applications)

Nominal size	SDR 41 PN4		SDR 26 PN6.3		SDR 21 PN8		SDR 17 PN10	
DN	Min wall thickness (mm)	Mean I.D. (mm)	Min wall thickness (mm)	Mean I.D. (mm)	Min wall thickness (mm)	Mean I.D. (mm)	Min wall thickness (mm)	Mean I.D. (mm)
16	1.6	13	1.6	13	1.6	13	1.6	13
20	1.6	17	1.6	17	1.6	17	1.6	17
25	1.6	22	1.6	22	1.6	22	1.6	22
32	1.6	29	1.6	29	1.6	29	1.9	28
40	1.6	37	1.6	37	1.9	36	2.4	35
50	1.6	47	2.0	46	2.4	45	3.0	44
63	1.6	60	2.4	58	3.0	57	3.8	55
75	1.9	71	2.9	69	3.6	67	4.5	66
90	2.2	86	3.5	83	4.3	81	5.4	78
110	2.7	105	4.3	101	5.3	99	6.6	96

Polyethylene (PE) Pipe Dimensions AS/NZS 4130:2009 – continued

(Polyethylene pipes for pressure applications)

Nominal size	SDR 13.6 PN12.5		SDR 11 PN16		SDR 9 PN20		SDR 7.4 PN25	
DN	Min wall thickness (mm)	Mean I.D. (mm)	Min wall thickness (mm)	Mean I.D. (mm)	Min wall thickness (mm)	Mean I.D. (mm)	Min wall thickness (mm)	Mean I.D. (mm)
16	1.6	13	1.6	13	1.8	12	2.2	11
20	1.6	17	1.9	16	2.3	15	2.8	14
25	1.9	21	2.3	20	2.8	19	3.5	18
32	2.4	27	2.9	26	3.6	24	4.4	23
40	3.0	34	3.7	32	4.5	31	5.5	38
50	3.7	42	4.6	40	5.6	38	6.9	35
63	4.7	53	5.8	51	7.1	48	8.6	45
75	5.5	63	6.8	61	8.4	58	10.3	53
90	6.6	76	8.2	73	10.0	69	12.3	65
110	8.1	93	10.0	89	12.3	84	15.1	78

Comparison of SDR and Pressure ratings (PN) for PE-80 and PE-X100 materials.

SDR	41	33	26	21	17	13.6	11	9	7.4
PE80	PN 3.2	PN 4	-	PN 6.3	PN 8	PN 10	PN 12.5	PN 16	PN 20
PE100	PN 4	-	PN 6.3	PN 8	PN 10	PN 12.5	PN 16	PN 20	PN 25

Pressure De-rating for Vinidex PE-X100 Pipe

At elevated temperatures and a 50 years expected lifetime

Temperature (°C)	SDR 9 PN16	SDR 11 PN12.5	SDR 13.6 PN10	SDR 17 PN8	SDR 21 PN6.3
20	1600	1250	1000	800	630
30	1410	1100	880	700	550
40	1260	980	790	630	500
50	1150	900	720	580	450
60	980	770	610	490	390
70	900	700	560	450	350
80	810	630	510	410	320
90	730	570	450	360	290

Notes:

- Minimum of 50 years expected for water up to 70°C
- Minimum of 25 years expected for water up to 80°C
- Minimum of 10 years expected for water up to 90°C

Pressure De-rating for Blueline PE-80B Pipe

At elevated temperatures and a 50 years expected lifetime

Temperature (°C)	SDR 9 PN16	SDR 11 PN12.5	SDR 13.6 PN10	SDR 17 PN8	SDR 21 PN6.3
20	1600	1250	1000	800	630
30	1504	1175	940	752	592
40	1296	1012	810	648	510
50	1104	862	690	552	434
60	1008	788	630	504	397
70	848	663	530	424	334

Notes:

- Minimum of 50 years expected for water up to 45°C
- Minimum of 28 years expected for water up to 50°C
- Minimum of 9 years expected for water up to 60°C
- Minimum of 1 year expected for water up to 70°C

Pressure De-rating for Electro-fusion Fittings

At elevated temperatures and a 50 years expected lifetime

Temperature (°C)	Pressure reduction factor	Maximum operating pressure (kPa)	
		PN16	PN12.5
20	1	1600	1250
25	0.9	1440	1130
30	0.81	1300	1010
35	0.72	1150	900
40	0.62	990	770
45	0.52	830	650
50	0.43	690	540

Pressure De-rating for Compression Fittings

At elevated temperatures and a 50 years expected lifetime

Temperature (°C)	Pressure reduction factor	Maximum operating pressure (kPa)	
		PN16	PN12.5
20	1	1600	1250
25	0.9	1440	1120
30	0.8	1280	1000
35	0.72	1150	900
40	0.65	1040	810
45	0.54	860	670
50	0.45	720	560
60	0.3	480	370

Pressure Conversion Chart

PN	kPa	m head	psi
3.2	320	33	46
4	400	41	58
6.3	630	64	91
8	800	82	116
10	1000	102	145
12.5	1250	128	181
16	1600	163	232

Identification marking of PE Pipe

PE pipes shall be legibly marked with the pipe code, manufacturer's name, trade name, nominal diameter, minimum wall thickness, pressure class, SDR number, material, date of manufacture, factory code, standard and quality designation at intervals not exceeding one metre.

Eg: DN63 PN12.5 BLUE IPLEX POLYPLEX BLUELINE 63 (x 5.8) PN12.5 PE80B 050106 4BO1 AS/NZS 4310 75m

Notes on pressure pipes

- PE80B and PE100 are made from different raw materials.
- PE80B and PE100 are made to **AS/NZS 4130:2009** from polyethylene manufactured to **AS/NZS 4131:2010**

RURAL PIPE INFORMATION

Rural Pipe Dimensions

Pipes shall be manufactured to the dimensions listed in the following Table:

DN	Mean ID (mm)		Wall Thickness (mm)	
	Min	Max	Min	Max
12	12.2	13.1	1.4	1.7
19	18.8	19.3	1.4	1.7
25	25.0	25.5	1.5	1.8
32	31.4	31.9	1.9	2.2
40	37.9	38.3	2.2	2.5
50	50.6	51.1	3.0	3.3

Temperature De-rating of Rural Pipe

Temp (°C)	Allowable Head (m)
20	63
25	55
30	50
35	45
40	40
45	35

Notes on Rural B pipe

- 45°C is the maximum temperature rating for rural pipe.
- For water temperatures ranging from 30°C to 45°C, a pipe life of 20 to 30 years could be expected.
- Rural B / econo pipe is manufactured to individual company specifications from virgin and recycled material.
- Rural B is not made to any Australian Standard.

Identification marking of Rural Pipe

Rural Pipe shall be legibly marked with the manufacturer's registered name, product name, nominal size, dimension ratio and date of manufacture {YYMMDD] at intervals not exceeding one metre (eg: for DN25 Iplex rural pipe manufactured on 15 June 2004):-

"IPLEX RURAL PE 25 630 kPa P1 040615"

CONVERSION TABLES

SALINITY CONVERSION TABLES

EC – TDS

- The measured salinity, as either EC or TDS, is listed in the 'salinity' (blue background) column.
- To convert from EC to TDS; locate the EC value in the 'salinity' column; read the corresponding value in the 'TDS' column.
- To convert from TDS to EC; locate the TDS value in the 'salinity' column; read the corresponding value in the 'EC' column.

Notes:

- The salinity conversion values presented in the table are to be used as a guide only.
- TDS units of measure can be reported as ppm or mg/L, which are equivalent.

EC	Salinity	TDS
182	100	55
364	200	110
545	300	165
727	400	220
909	500	275
1091	600	330
1273	700	385
1455	800	440
1636	900	495
1818	1000	550
2000	1100	605
2179	1200	661
2360	1300	716
2539	1400	772
2721	1500	827
2902	1600	882
3081	1700	938
3260	1800	994
3441	1900	1049
3620	2000	1105
3802	2100	1160
3980	2200	1216
4159	2300	1272
4337	2400	1328
4516	2500	1384
4694	2600	1440

EC	Salinity	TDS
4873	2700	1496
5052	2800	1552
5230	2900	1608
5409	3000	1664
5587	3100	1720
5766	3200	1776
5944	3300	1832
6120	3400	1889
6298	3500	1945
6477	3600	2001
6652	3700	2058
6831	3800	2114
7006	3900	2171
7185	4000	2227
7360	4100	2284
7538	4200	2340
7714	4300	2397
7889	4400	2454
8068	4500	2510
8243	4600	2567
8418	4700	2624
8594	4800	2681
8769	4900	2738
8945	5000	2795
9120	5100	2852
9295	5200	2909

EC	Salinity	TDS
9471	5300	2966
9646	5400	3023
9821	5500	3080
9997	5600	3137
10169	5700	3195
10344	5800	3252
10520	5900	3309
10692	6000	3367
10867	6100	3424
11040	6200	3482
11215	6300	3539
11387	6400	3597
11563	6500	3654
11735	6600	3712
11907	6700	3770
12083	6800	3827
12255	6900	3885
12427	7000	3943
12599	7100	4001
12772	7200	4059
12944	7300	4117
13116	7400	4175
13288	7500	4233
13461	7600	4291
13633	7700	4349
13805	7800	4407
13978	7900	4465
14147	8000	4524
14319	8100	4582
14491	8200	4640
14661	8300	4699
14833	8400	4757
15002	8500	4816
15174	8600	4874
15344	8700	4933
15516	8800	4991
15685	8900	5050
15854	9000	5109

EC	Salinity	TDS
16027	9100	5167
16196	9200	5226
16365	9300	5285
16534	9400	5344
16704	9500	5403
16873	9600	5462
17042	9700	5521
17211	9800	5580
17381	9900	5639
17550	10000	5698
18393	10500	5994
19234	11000	6291
20068	11500	6590
20903	12000	6889
21732	12500	7190
22560	13000	7491
23383	13500	7794
24204	14000	8098
25024	14500	8402
25838	15000	8708
26650	15500	9015
27459	16000	9323
28265	16500	9632
29069	17000	9942
29869	17500	10253
30667	18000	10565
31463	18500	10878
32255	19000	11192
33045	19500	11507
33829	20000	11824
34614	20500	12141
35396	21000	12459
36147	21500	12788
36949	22000	13099
37724	22500	13420
38492	23000	13743
39261	23500	14066

Grains/gal – TDS

- The measured salinity, as either grains/gal or TDS, is listed in the 'salinity' (blue background) column.
- To convert from grains/gal to TDS; locate the grains/gal value in the 'salinity' column; read the corresponding value in the 'TDS' column.
- To convert from TDS to grains/gal; locate the TDS value in the 'salinity' column; read the corresponding value in the 'grains/gal' column.

1 grain/gal = 14.25 mg/L

Grains/gal	Salinity	TDS
3.5	50	713
7.0	100	1425
10.5	150	2138
14.0	200	2850
17.5	250	3563
21.1	300	4275
24.6	350	4988
28.1	400	5700
31.6	450	6413
35.1	500	7125
38.6	550	7838
42.1	600	8550
45.6	650	9263
49.1	700	9975
52.6	750	10688
56.1	800	11400
59.6	850	12113
63.2	900	12825
66.7	950	13538
70.2	1000	14250
73.7	1050	14963

Grains/gal	Salinity	TDS
77.2	1100	15675
80.7	1150	16388
84.2	1200	17100
87.7	1250	17813
91.2	1300	18525
94.7	1350	19238
98.2	1400	19950
101.8	1450	20663
105.3	1500	21375
112.3	1600	22800
119.3	1700	24225
126.3	1800	25650
133.3	1900	27075
140.4	2000	28500
175.4	2500	35625
210.5	3000	42750
245.6	3500	49875
280.7	4000	57000
315.8	4500	64125
350.9	5000	71250

PRESSURES

To convert from a pressure in section **1** to a pressure in section **2** multiply by the conversion value.

Eg: to convert from kPa to psi multiply the pressure value by 0.145.

1	2		
	psi	kPa	m
psi	1	6.895	0.703
kPa	0.145	1	0.102
m	1.422	9.8	1

PSI and kPa conversion table

- The measured pressure, as either psi or kPa, is listed in the 'pressure' (blue background) column.
- To convert from psi to kPa; locate the psi value in the 'pressure' column; read the corresponding value in the 'kPa' column.
- To convert from kPa to psi; locate the kPa value in the 'pressure' column; read the corresponding value in the 'psi'column.

psi	pressure	kPa	psi	pressure	kPa
0.15	1	6.9	2.90	20	137.9
0.29	2	13.8	3.05	21	144.8
0.44	3	20.7	3.19	22	151.7
0.58	4	27.6	3.34	23	158.6
0.73	5	34.5	3.48	24	165.5
0.87	6	41.4	3.63	25	172.4
1.02	7	48.3	3.77	26	179.3
1.16	8	55.2	3.92	27	186.2
1.31	9	62.1	4.06	28	193.1
1.45	10	69.0	4.21	29	200.0
1.60	11	75.8	4.35	30	206.9
1.74	12	82.7	4.50	31	213.7
1.89	13	89.6	4.64	32	220.6
2.03	14	96.5	4.79	33	227.5
2.18	15	103.4	4.93	34	234.4
2.32	16	110.3	5.08	35	241.3
2.47	17	117.2	5.22	36	248.2
2.61	18	124.1	5.37	37	255.1
2.76	19	131.0	5.51	38	262.0

psi	pressure	kPa
5.66	39	268.9
5.80	40	275.8
5.95	41	282.7
6.09	42	289.6
6.24	43	296.5
6.38	44	303.4
6.53	45	310.3
6.67	46	317.2
6.82	47	324.1
6.96	48	331.0
7.11	49	337.9
7.25	50	344.8
7.40	51	351.6
7.54	52	358.5
7.69	53	365.4
7.83	54	372.3
7.98	55	379.2
8.12	56	386.1
8.27	57	393.0
8.41	58	399.9
8.56	59	406.8
8.70	60	413.7
8.85	61	420.6
8.99	62	427.5
9.14	63	434.4
9.28	64	441.3
9.43	65	448.2
9.57	66	455.1
9.72	67	462.0
9.86	68	468.9
10.01	69	475.8
10.15	70	482.7
10.30	71	489.5
10.44	72	496.4
10.59	73	503.3
10.73	74	510.2
10.88	75	517.1

psi	pressure	kPa
11.02	76	524.0
11.17	77	530.9
11.31	78	537.8
11.46	79	544.7
11.60	80	551.6
11.75	81	558.5
11.89	82	565.4
12.04	83	572.3
12.18	84	579.2
12.33	85	586.1
12.47	86	593.0
12.62	87	599.9
12.76	88	606.8
12.91	89	613.7
13.05	90	620.6
13.20	91	627.4
13.34	92	634.3
13.49	93	641.2
13.63	94	648.1
13.78	95	655.0
13.92	96	661.9
14.07	97	668.8
14.21	98	675.7
14.36	99	682.6
14.50	100	689.5
15.23	105	724.0
15.95	110	758.5
16.68	115	792.9
17.40	120	827.4
18.13	125	861.9
18.85	130	896.4
19.58	135	930.8
20.30	140	965.3
21.03	145	999.8
21.75	150	1034.3
22.48	155	1068.7
23.21	160	1103.2

psi	pressure	kPa
23.93	165	1137.7
24.66	170	1172.2
25.38	175	1206.6
26.11	180	1241.1
26.83	185	1275.6
27.56	190	1310.1
28.28	195	1344.5
29.01	200	1379.0
30.46	210	1448.0
31.91	220	1516.9
33.36	230	1585.9
34.81	240	1654.8
36.26	250	1723.8
37.71	260	1792.7
39.16	270	1861.7
40.61	280	1930.6
42.06	290	1999.6
43.51	300	2068.5
44.96	310	2137.5
46.41	320	2206.4
47.86	330	2275.4
49.31	340	2344.3
50.76	350	2413.3
52.21	360	2482.2
53.66	370	2551.2
55.11	380	2620.1
56.56	390	2689.1
58.01	400	2758.0

psi	pressure	kPa
59.46	410	2827.0
60.91	420	2895.9
62.36	430	2964.9
63.81	440	3033.8
65.26	450	3102.8
66.72	460	3171.7
68.17	470	3240.7
69.62	480	3309.6
71.07	490	3378.6
72.52	500	3447.5
79.77	550	3792.3
87.02	600	4137.0
94.27	650	4481.8
101.52	700	4826.5
108.77	750	5171.3
116.03	800	5516.0
123.28	850	5860.8
130.53	900	6205.5
137.78	950	6550.3
145.03	1000	6895.0
152.28	1050	7239.8
159.54	1100	7584.5
166.79	1150	7929.3
174.04	1200	8274.0
181.29	1250	8618.8
188.54	1300	8963.5
195.79	1350	9308.3
203.05	1400	9653.0

PSI and metres conversion table

- The measured pressure, as either psi or metres, is listed in the 'pressure' (blue background) column.
- To convert from psi to metres; locate the psi value in the 'pressure' column; read the corresponding value in the 'metres' column.
- To convert from metres to psi; locate the metres value in the 'pressure' column; read the corresponding value in the 'psi' column.

psi	Pressure	metres	psi	Pressure	metres
1.42	1	0.7	42.67	30	21.1
2.84	2	1.4	44.10	31	21.8
4.27	3	2.1	45.52	32	22.5
5.69	4	2.8	46.94	33	23.2
7.11	5	3.5	48.36	34	23.9
8.53	6	4.2	49.79	35	24.6
9.96	7	4.9	51.21	36	25.3
11.38	8	5.6	52.63	37	26.0
12.80	9	6.3	54.05	38	26.7
14.22	10	7.0	55.48	39	27.4
15.65	11	7.7	56.90	40	28.1
17.07	12	8.4	58.32	41	28.8
18.49	13	9.1	59.74	42	29.5
19.91	14	9.8	61.17	43	30.2
21.34	15	10.5	62.59	44	30.9
22.76	16	11.2	64.01	45	31.6
24.18	17	12.0	65.43	46	32.3
25.60	18	12.7	66.86	47	33.0
27.03	19	13.4	68.28	48	33.7
28.45	20	14.1	69.70	49	34.4
29.87	21	14.8	71.12	50	35.2
31.29	22	15.5	72.55	51	35.9
32.72	23	16.2	73.97	52	36.6
34.14	24	16.9	75.39	53	37.3
35.56	25	17.6	76.81	54	38.0
36.98	26	18.3	78.24	55	38.7
38.41	27	19.0	79.66	56	39.4
39.83	28	19.7	81.08	57	40.1
41.25	29	20.4	82.50	58	40.8

psi	Pressure	metres
83.93	59	41.5
85.35	60	42.2
86.77	61	42.9
88.19	62	43.6
89.62	63	44.3
91.04	64	45.0
92.46	65	45.7
93.88	66	46.4
95.31	67	47.1
96.73	68	47.8
98.15	69	48.5
99.57	70	49.2
101.00	71	49.9
102.42	72	50.6
103.84	73	51.3
105.26	74	52.0
106.69	75	52.7
108.11	76	53.4
109.53	77	54.1
110.95	78	54.8
112.38	79	55.5
113.80	80	56.2
115.22	81	56.9
116.64	82	57.6
118.07	83	58.3
119.49	84	59.1
120.91	85	59.8
122.33	86	60.5
123.76	87	61.2
125.18	88	61.9
126.60	89	62.6
128.02	90	63.3
129.45	91	64.0
130.87	92	64.7
132.29	93	65.4
133.71	94	66.1

psi	Pressure	metres
135.14	95	66.8
136.56	96	67.5
137.98	97	68.2
139.40	98	68.9
140.83	99	69.6
142.25	100	70.3
149.36	105	73.8
156.47	110	77.3
163.58	115	80.8
170.70	120	84.4
177.81	125	87.9
184.92	130	91.4
192.03	135	94.9
199.15	140	98.4
206.26	145	101.9
213.37	150	105.5
220.48	155	109.0
227.60	160	112.5
234.71	165	116.0
241.82	170	119.5
248.93	175	123.0
256.05	180	126.5
263.16	185	130.1
270.27	190	133.6
277.38	195	137.1
284.50	200	140.6
298.72	210	147.6
312.94	220	154.7
327.17	230	161.7
341.39	240	168.7
355.62	250	175.8
369.84	260	182.8
384.07	270	189.8
398.29	280	196.8
412.52	290	203.9
426.74	300	210.9

kPa and metres conversion table

- The measured pressure, as either kPa or metres, is listed in the 'pressure' (blue background) column.
- To convert from metres to kPa; locate the metres value in the 'pressure' column; read the corresponding value in the 'kPa' column.
- To convert from kPa to metres; locate the kPa value in the 'pressure' column; read the corresponding value in the 'metres' column.

kPa	Pressure	metres	kPa	Pressure	metres
9.8	1	0.10	284.3	29	2.96
19.6	2	0.20	294.1	30	3.06
29.4	3	0.31	303.9	31	3.16
39.2	4	0.41	313.7	32	3.26
49.0	5	0.51	323.5	33	3.37
58.8	6	0.61	333.3	34	3.47
68.6	7	0.71	343.1	35	3.57
78.4	8	0.82	352.9	36	3.67
88.2	9	0.92	362.7	37	3.77
98.0	10	1.02	372.5	38	3.88
107.8	11	1.12	382.4	39	3.98
117.6	12	1.22	392.2	40	4.08
127.5	13	1.33	402.0	41	4.18
137.3	14	1.43	411.8	42	4.28
147.1	15	1.53	421.6	43	4.39
156.9	16	1.63	431.4	44	4.49
166.7	17	1.73	441.2	45	4.59
176.5	18	1.84	451.0	46	4.69
186.3	19	1.94	460.8	47	4.79
196.1	20	2.04	470.6	48	4.90
205.9	21	2.14	480.4	49	5.00
215.7	22	2.24	490.2	50	5.10
225.5	23	2.35	500.0	51	5.20
235.3	24	2.45	509.8	52	5.30
245.1	25	2.55	519.6	53	5.41
254.9	26	2.65	529.4	54	5.51
264.7	27	2.75	539.2	55	5.61
274.5	28	2.86	549.0	56	5.71

kPa	Pressure	metres
558.8	57	5.81
568.6	58	5.92
578.4	59	6.02
588.2	60	6.12
598.0	61	6.22
607.8	62	6.32
617.6	63	6.43
627.5	64	6.53
637.3	65	6.63
647.1	66	6.73
656.9	67	6.83
666.7	68	6.94
676.5	69	7.04
686.3	70	7.14
696.1	71	7.24
705.9	72	7.34
715.7	73	7.45
725.5	74	7.55
735.3	75	7.65
745.1	76	7.75
754.9	77	7.85
764.7	78	7.96
774.5	79	8.06
784.3	80	8.16
794.1	81	8.26
803.9	82	8.36
813.7	83	8.47
823.5	84	8.57
833.3	85	8.67
843.1	86	8.77
852.9	87	8.87
862.7	88	8.98
872.5	89	9.08
882.4	90	9.18
892.2	91	9.28

kPa	Pressure	metres
902.0	92	9.38
911.8	93	9.49
921.6	94	9.59
931.4	95	9.69
941.2	96	9.79
951.0	97	9.89
960.8	98	10.00
970.6	99	10.10
980.4	100	10.20
1029.4	105	10.71
1078.4	110	11.22
1127.5	115	11.73
1176.5	120	12.24
1225.5	125	12.75
1274.5	130	13.26
1323.5	135	13.77
1372.5	140	14.28
1421.6	145	14.79
1470.6	150	15.30
1519.6	155	15.81
1568.6	160	16.32
1617.6	165	16.83
1666.7	170	17.34
1715.7	175	17.85
1764.7	180	18.36
1813.7	185	18.87
1862.7	190	19.38
1911.8	195	19.89
1960.8	200	20.40
2058.8	210	21.42
2156.9	220	22.44
2254.9	230	23.46
2352.9	240	24.48
2451.0	250	25.50
2549.0	260	26.52

kPa	Pressure	metres
2647.1	270	27.54
2745.1	280	28.56
2843.1	290	29.58
2941.2	300	30.60
3039.2	310	31.62
3137.3	320	32.64
3235.3	330	33.66
3333.3	340	34.68
3431.4	350	35.70
3529.4	360	36.72
3627.5	370	37.74
3725.5	380	38.76
3823.5	390	39.78
3921.6	400	40.80
4019.6	410	41.82
4117.6	420	42.84
4215.7	430	43.86
4313.7	440	44.88
4411.8	450	45.90
4509.8	460	46.92
4607.8	470	47.94

kPa	Pressure	metres
4705.9	480	48.96
4803.9	490	49.98
4902.0	500	51.00
5392.2	550	56.10
5882.4	600	61.20
6372.5	650	66.30
6862.7	700	71.40
7352.9	750	76.50
7843.1	800	81.60
8333.3	850	86.70
8823.5	900	91.80
9313.7	950	96.90
9803.9	1000	102.00
10294.1	1050	107.10
10784.3	1100	112.20
11274.5	1150	117.30
11764.7	1200	122.40
12254.9	1250	127.50
12745.1	1300	132.60
13235.3	1350	137.70
13725.5	1400	142.80

FLOW RATES

To convert from a flow rate in section **1** to a flow rate in section **2** multiply by the conversion value.

Eg: to convert from L/sec to m^3/day multiply the flow rate value by 86.4.

1	2						
	L/sec	**gal/min**	**gal/hr**	**gal/day**	**m^3/hr**	**m^3/day**	**ML/day**
L/sec	1	13.2	792	19006	3.6	86.4	0.0864
gal/min	0.07577	1	60	1440	0.27263	6.543	0.006543
gal/hr	0.0012628	0.0167	1	24	0.0045438	0.10905	0.00010905
gal/day	0.000052615	0.0006944	0.0417	1	0.0001893	0.0045438	4.5438E-06
m^3/hr	0.2778	9.177	220	5280	1	24	0.024
m^3/day	0.01157	0.15278	9.177	220	0.0417	1	0.001
ML/day	11.57	152.78	9177	220000	41.67	1000	1

Gal/hr and L/sec conversion table

- The measured flow, as either gal/hr or L/sec, is listed in the 'Flow' (blue background) column.
- To convert from gal/hr to L/sec; locate the gal/hr value in the 'Flow' column; read the corresponding value in the 'L/sec' column.
- To convert from L/sec to gal/hr; locate the L/sec value in the 'Flow' column; read the corresponding value in the 'gal/hr' column.

gal/hr	Flow	L/sec
792	1	0.00
1584	2	0.00
2376	3	0.00
3168	4	0.01
3960	5	0.01
4752	6	0.01
5544	7	0.01
6336	8	0.01
7128	9	0.01
7920	10	0.01
9504	12	0.02
11088	14	0.02
12672	16	0.02
14256	18	0.02
15840	20	0.03
19800	25	0.03
23760	30	0.04
31680	40	0.05
39600	50	0.06
79200	100	0.13
	200	0.25
	300	0.38
	400	0.51
	500	0.63
	600	0.76
	700	0.88
	800	1.01

gal/hr	Flow	L/sec
	900	1.14
	1000	1.26
	1500	1.89
	2000	2.53
	2500	3.16
	3000	3.79
	3500	4.42
	4000	5.05
	4500	5.68
	5000	6.31
	6000	7.58
	7000	8.84
	8000	10.10
	9000	11.36
	10000	12.63

L/sec and ML/day conversion table

- The measured flow, as either L/sec or ML/day, is listed in the 'Flow' (blue background) column.
- To convert from ML/day to L/sec; locate the ML/day value in the 'Flow' column; read the corresponding value in the 'L/sec' column.
- To convert from L/sec to ML/day; locate the L/sec value in the 'Flow' column; read the corresponding value in the 'ML/day' column.

L/sec	Flow	ML/day
11.57	1	0.0864
23.14	2	0.1728
34.71	3	0.2592
46.28	4	0.3456
57.85	5	0.432
69.42	6	0.5184
80.99	7	0.6048
92.56	8	0.6912
104.13	9	0.7776
115.7	10	0.864
138.84	12	1.0368
161.98	14	1.2096
185.12	16	1.3824
208.26	18	1.5552
231.4	20	1.728
	25	2.16
	30	2.592
	40	3.456
	50	4.32
	100	8.64
	200	17.28

Gal/hr and m³/day conversion table

- The measured flow, as either gal/hr or m³/day, is listed in the 'Flow' (blue background) column.
- To convert from gal/hr to m³/day; locate the gal/hr value in the 'Flow' column; read the corresponding value in the 'm³/day' column.
- To convert from m³/day to gal/hr; locate the m³/day value in the 'Flow' column; read the corresponding value in the 'gal/hr' column.

gal/hr	Flow	m³/day
9.2	1	0.109
18.4	2	0.218
27.6	3	0.327
36.8	4	0.436
46	5	0.545
55.2	6	0.654
64.4	7	0.763
73.6	8	0.872
82.8	9	0.981
92	10	1.09
110.4	12	1.308
128.8	14	1.526
147.2	16	1.744
165.6	18	1.962
184	20	2.18
230	25	2.725
276	30	3.27
368	40	4.36
460	50	5.45
920	100	10.9
1840	200	21.8
2760	300	32.7
3680	400	43.6
4600	500	54.5
5520	600	65.4
6440	700	76.3

gal/hr	Flow	m³/day
7360	800	87.2
8280	900	98.1
9200	1000	109
13800	1500	163.5
18400	2000	218
23000	2500	272.5
27600	3000	327
32200	3500	381.5
36800	4000	436
41400	4500	490.5
46000	5000	545
55200	6000	654
64400	7000	763
73600	8000	872
82800	9000	981
92000	10000	1090

PIPE AND CASING VOLUMES

Casing and Pipe Water Volumes (m^3)

Casing diameter		Bore depth (m)										
inches	mm	1	10	20	50	100	200	300	400	500	1000	1500
1	25.4	0.00	0.01	0.01	0.03	0.05	0.10	0.15	0.20	0.25	0.51	0.76
2	50.8	0.00	0.02	0.04	0.10	0.20	0.41	0.61	0.81	1.01	2.03	3.04
3	76.2	0.00	0.05	0.09	0.23	0.46	0.91	1.37	1.82	2.28	4.56	6.84
4	101.6	0.01	0.08	0.16	0.41	0.81	1.62	2.43	3.24	4.05	8.11	12.16
5	127	0.01	0.13	0.25	0.63	1.27	2.53	3.80	5.07	6.33	12.67	19.00
6	152.4	0.02	0.18	0.36	0.91	1.82	3.65	5.47	7.30	9.12	18.24	27.36
7	177.8	0.02	0.25	0.50	1.24	2.48	4.97	7.45	9.93	12.41	24.83	37.24
8	203.2	0.03	0.32	0.65	1.62	3.24	6.49	9.73	12.97	16.21	32.43	48.64
9	228.6	0.04	0.41	0.82	2.05	4.10	8.21	12.31	16.42	20.52	41.04	61.57
10	254	0.05	0.51	1.01	2.53	5.07	10.13	15.20	20.27	25.34	50.67	76.01

PIPE AND CASING WATER VELOCITIES

Bore Water Velocities (m/sec)

Casing diameter		flow rate (L/sec)									
inches	mm	0.5	1	2	5	10	15	20	25	50	100
1	25.4	0.99	1.97	3.95	9.87	-	-	-	-	-	-
2	50.8	0.25	0.49	0.99	2.47	4.93	-	-	-	-	-
3	76.2	0.11	0.22	0.44	1.10	2.19	3.29	4.39	5.48	-	-
4	101.6	0.06	0.12	0.25	0.62	1.23	1.85	2.47	3.08	6.17	-
5	127	0.04	0.08	0.16	0.39	0.79	1.18	1.58	1.97	3.95	-
6	152.4	0.03	0.05	0.11	0.27	0.55	0.82	1.10	1.37	2.74	-
7	177.8	0.02	0.04	0.08	0.20	0.40	0.60	0.81	1.01	2.01	4.03
8	203.2	0.02	0.03	0.06	0.15	0.31	0.46	0.62	0.77	1.54	3.08
9	228.6	0.01	0.02	0.05	0.12	0.24	0.37	0.49	0.61	1.22	2.44
10	254	0.01	0.02	0.04	0.10	0.20	0.30	0.39	0.49	0.99	1.97

Example artesian well information

Unit Number	Well Name	Well Depth (m)	Temp. (°C)	Shut in Pressure (kPa)	Well Shut in Time[#1] (Minutes)	Casing Code	Asset Life (years)	Construction/ Rehabilitation Date	Well Age (years)
6640 - 23	BHPB - C1	534	57	618	30	FRP	25	10/09/2005	10
6639 - 16	Cooryaninna 2	534	57	599	30	FRP	25	15/05/1994	21
6539 - 17	D3	707	65	471	30	FRP	25	16/10/1996	19
6539 - 14	Dulkaninna 2	707	65	597	30	FRP	25	11/12/2003	11
6639 - 17	Jewellery Creek 2	545	58	708	30	FRP	25	21/06/1993	22
6639 - 2	Sinclair Bore	554	78	225	30	FRP	25	11/07/1998	17

- #1: Always follow the guidelines on page 4 when closing valves on well headworks. Where present the 'Well Shut in Time' is the recommended minimum time that the well should be shut in to collect the pressure reading required for completing the Well Maintenance Information.
- Blue highlighted row: GAB Monitoring Well

WELL MAINTENANCE SHEET

Station Name				
Unit Number	Well Name	Antecedent[#1] Temperature at headworks (°C)	Maximum Shut in Pressure (kPa)	Shut in Test Time (min)[#2]

COORDINATES	Easting		Northing	

Insert photograph here	Caption
	Headworks

- #1: Antecedent is the temperature on arrival, which can differ significantly from the groundwater temperature.
- #2: Time that the well was shut in and pressure measurements taken.

INSPECTED BY:	DATE

Components	Leakage	Condition good(G) / fair(F) / poor(P)	Comments / Action
MAIN VALVE			
Body	Yes / No	G / F / P	
Gland	Yes / No	G / F / P	
Spindle	N/A	G / F / P	
CHECK OPERATION OF MAIN VALVE Note: After testing the operation of the main valve the gland may develop a small leak – retighten gland nuts on gland housing			Checked: Yes / No Operating: Yes / No
FLANGES			
Flange	Yes / No	G / F / P	
Bolts / Nuts	Yes / No	G / F / P	
Gaskets	Yes / No	G / F / P	
DISTRIBUTION VALVES			
Glands	Yes / No	G / F / P	
Body	Yes / No	G / F / P	
Spindle	N/A	G / F / P	
Threads	Yes / No	G / F / P	
PRESSURE TEST VALVE	Yes / No	G / F / P	

Components	Leakage	Condition good(G) / fair(F) / poor(P)	Comments / Action
DISTRIBUTION MANFOLD(S)	Yes / No	G / F / P	
COOLING POND			
Isolation Valve	Yes / No	G / F / P	
Float Valve	Yes / No	G / F / P	
Liner	Yes / No	G / F / P	
Vegetation	N/A	N/A	
Dam Condition	Yes / No	G / F / P	
Fencing	Yes / No	G / F / P	
PIPELINE			
Air relief Valve	Yes / No	G / F / P	
Tanks – Capital	Yes / No	G / F / P	
Float Valve	Yes / No	G / F / P	
Isolation Valve	Yes / No	G / F / P	
Overflow – fencing, erosion around base of tank	Yes / No	G / F / P	
	Yes / No	G / F / P	
Troughs – Capital – float valve	Yes / No	G / F / P	
PACKER			
Pressure	Yes / No	N/A	Pressure reading kpa
Stability of Headworks	Yes / No	G / F / P	
DEGASSER	Yes / No Yes / No	G / F / P	
Air Release Valve		G / F / P	
Additional Comments:			