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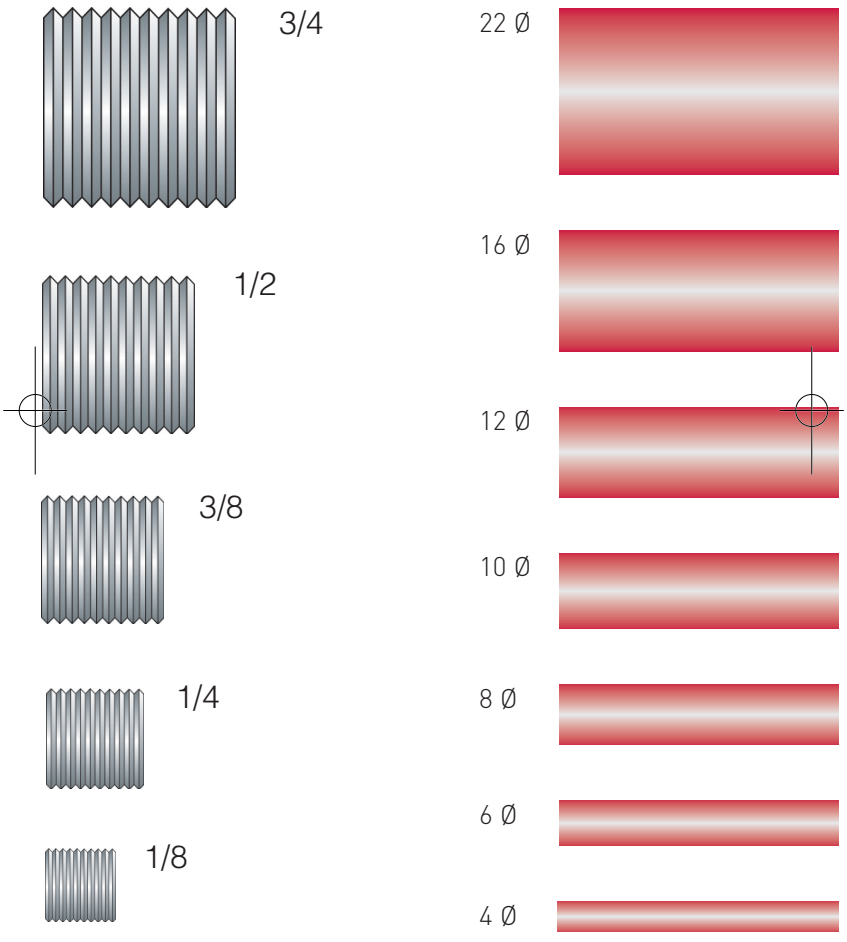
B.S.P. Thread and tube Ø indicator (shown to scale)



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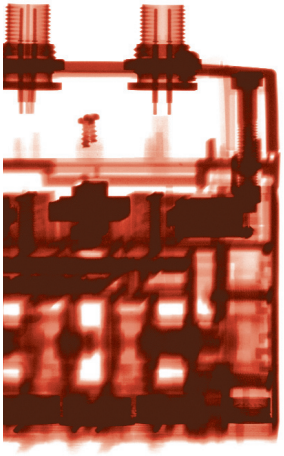

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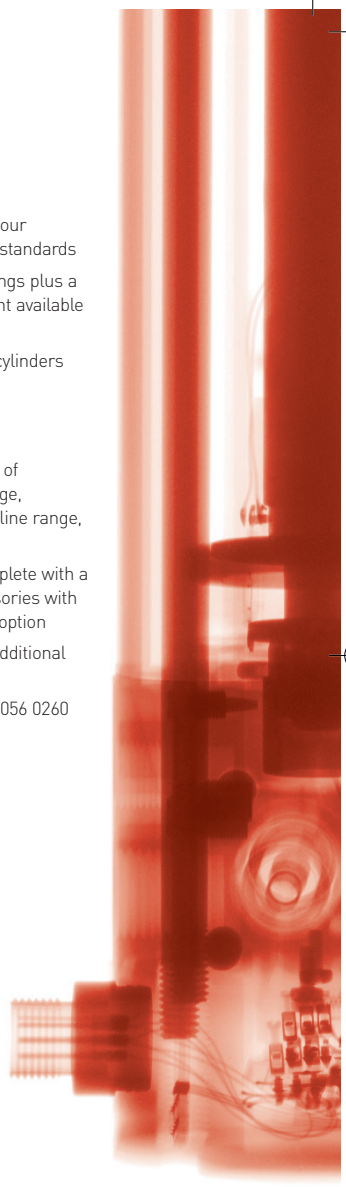

Cylinder selection

The theoretical thrust and pull is related to the effective piston area and the pressure. The tables show the theoretical forces in Newton for double acting cylinders at 6 bar inlet to the cylinder. For forces at other pressures divide the figures by 6 and multiply by the required pressure in bar gauge.

Double acting

Cylinder bore mm (inches)	Piston rod diameter mm (inches)	Thrust N at 6 bar	Pull N at 6 bar
8	3	30	25
10	4	47	39
12	6	67	50
16	6	120	103
20	8	188	158
25	10	294	246
32	12	482	414
40	16	753	633
44.45 (1.75)	16	931	810
50	20	1178	989
63	20	1870	1681
76.2 (3)	25	2736	2441
80	25	3015	2721
100	25	4712	4418
125	32	7363	6881
152.4 (6)	(11/2)	10944	10260
160	40	12063	11309
200	40	18849	18095
250	50	29452	28274
304.8 (12)	(21/4)	43779	42240
320	63	48254	46384
355.6 (14)	(21/4)	59588	58049

Flow rates into cylinders

Cylinder diameter (mm)	System Cv required for piston speeds of:- 100 (mm/s)	250 (mm/s)	500 (mm/s)	750 (mm/s)	1000 (mm/s)	1250 (mm/s)
10	0.003	0.008	0.016	0.025	0.033	0.041
12	0.005	0.012	0.024	0.036	0.048	0.059
16	0.008	0.021	0.042	0.063	0.084	0.106
20	0.013	0.033	0.066	0.099	0.132	0.165
25	0.021	0.052	0.103	0.155	0.206	0.258
32	0.034	0.084	0.169	0.253	0.338	0.422
40	0.053	0.132	0.264	0.396	0.528	0.660
50	0.082	0.206	0.412	0.619	0.825	1.031
63	0.131	0.327	0.655	0.982	1.309	1.637
80	0.211	0.258	1.056	1.583	2.111	2.639
100	0.330	0.825	1.649	2.474	3.299	4.123
125	0.515	1.289	2.577	3.866	5.154	6.443
160	0.844	2.111	4.222	6.333	8.445	10.556
200	1.319	3.299	6.597	9.896	13.195	16.493
250	2.062	5.154	10.308	15.463	20.617	25.771
320	3.378	8.445	16.889	25.334	33.778	42.223

Cylinder metre (mm)	Flow required for piston speeds of:- 100 (mm/s)	250 (mm/s)	500 (mm/s)	750 (mm/s)	1000 (mm/s)	1250 (mm/s)
10	0.055	0.137	0.275	0.412	0.550	0.687
12	0.079	0.198	0.396	0.594	0.792	0.990
16	0.141	0.352	0.704	1.056	1.407	1.759
20	0.220	0.550	1.100	1.649	2.199	2.749
25	0.344	0.859	1.718	2.577	3.436	4.295
32	0.563	1.407	2.815	4.222	5.630	7.037
40	0.880	2.199	4.398	6.597	8.796	10.996
50	1.374	3.436	6.872	10.308	13.744	17.181
63	2.182	5.455	10.910	16.366	21.821	27.276
80	3.519	8.796	17.593	26.389	35.186	43.982
100	5.498	13.744	27.489	41.233	54.978	68.722
125	8.590	21.476	42.951	64.427	85.903	107.379
160	14.074	35.186	70.372	105.558	140.743	175.929
200	21.991	54.978	109.956	164.934	219.911	274.889
250	34.361	85.903	171.806	257.709	343.612	429.515
320	56.297	140.743	281.487	422.230	562.973	703.717

Maximum recommended air flow (dm³/s Free Air)* through ISO65 medium series steel pipes

Applied # gauge press bar	Nominal standard pipe size (nominal bore) - mm										
	6	8	10	15	20	25	32	40	50	65	80
0.4	0.3	0.6	1,4	2,6	4	7	15	25	25	69	120
0.63	0.4	0.9	1.9	3.5	5	10	20	30	60	90	160
1.0	0.5	1.2	2.8	4.9	7	14	28	45	80	130	230
1.6	0.8	1.7	3.8	7.1	11	20	40	60	120	185	330
2.5	1.1	2.5	5.5	10.2	15	28	57	852	170	265	470
4.0	1.7	3.7	8.3	15.4	23	44	89	135	260	410	725
6.3	2.5	5.7	12.6	23.4	35	65	133	200	390	620	1 085
8.0	3.1	7.1	15.8	29.3	44	83	168	255	490	780	1 375
10.0	3.9	8.8	19.5	36.2	54	102	208	315	605	965	1 695
12.5	4.8	10.9	24.1	44.8	67	127	258	390	755	1195	2110
16.0	6.1	13.8	30.6	56.8	85	160	327	495	955	1515	2665
20.0	7.6	17.1	38.0	70.6	105	199	406	615	1185	1880	3315

• Air flow rates in cubic decimetres per second (m^3x 10-3-) of free air at standard atmospheric pressure of 1013 mbar. Generally abbreviated to dm3/s A.N.R. (Atmosphére Normale de Reférénce).

Applied pressure selected from ISO 2944: fluid power systems - nominal pressures

General notes

The flow values are based on a pressure drop (DP) as follows:

10% of applied pressure per 30 metres of pipe dias 6-15m/m

5% of applied pressure per 30 metres of pipe dias 20-80 m/m

Maximum recommended air flow (s.c.f.m) through medium weight steel pipe to BS 1387s

Applied # gauge press bar	Nominal standard pipe size (nominal bore) - inches										
	1/8	1/4	3/8	1/2	3/4	1	1.1/4	1.1/2	2	2.1/2	3
5	0.5	1.2	2.7	4.9	6.6	13	27	40	80	135	240
10	0.8	1.7	3.9	7.7	11.0	21	44	64	125	200	370
20	1.3	3.0	6.6	13.0	18.5	35	75	110	215	350	600
40	2.5	5.5	12.0	23.0	34.0	62	135	200	385	640	1100
60	3.5	8.0	18.0	34.0	50.0	93	195	290	560	900	1600
80	4.7	10.5	23.0	44.0	65.0	120	255	380	720	1200	2100
100	5.8	13.0	29.0	54.0	80.0	150	315	470	900	1450	2600
150	8.6	20.0	41.0	80.0	115.0	220	460	680	1350	2200	3900
200	11.5	26.0	58.0	108.0	155.0	290	620	910	1750	2800	5000
250	14.5	33.0	73.0	135.0	200.0	370	770	1150	2200	3500	6100

General notes

10% of applied pressure per 100ft of pipe dias 1/8"-1/2"
5% of applied pressure per 100ft of pipe dias 3/4" - 3"

Recommended oils

Recommended oils for use with Norgren lubricators heavy duty tool lubricants (ISO 3448 viscosity grades 32 to 68) for standard air tools and cylinders.

Manufacturer	Product viscosity number	ISO 3448
British Petroleum	Energal HLP32	32
Castrol	Hyspin AWS32	32
Century	PWLA	32
Elf	Elfona 32	32
Esso	Nuto H32	32
Gulf	Harmony 32	32
Mobil	SHC 524	32
Shell	Tellus 32	32
Texaco	Rondo 32	32
Shell	Tellus 37	37
Gulf	Hydrasil 46	46
British Petroleum	Energal HLP46	46
Shell	Tellus 46	46
Texaco	Regal Oil R & 046	46
Rocol	MO-10	46
British Petroleum	Energal HLP68	68

Light duty tool lubricants (ISO 3448 viscosity grades 10 to 22) for small air tools

Manufacturer	Product viscosity number	ISO 3448
British Petroleum	Energal HLP10	10
Castrol	Hyspin AWS10	10
Shell	Tellus R10	10
Total	Azolla ZS10	10
Century	P198	15
Duckhaams	Zeroflo 15	15
Elf	Elfolna	15
Esso	Nuto H15	15
Mobil	Gargoyle Artic Oil Light	15
Rocol	MO-4	15
Shell	Tellus 22	22

Recommended oils

Recommended oils for use with Norgren lubricators.
Low temperature applications - for use when temperature remains below 0°C (+32°F)

Manufacturer	Product	ISO 3448 viscosity number
Mobil	SHC 624	32
Duckhams	Zeroflo 32	32

Antifreeze Lubrication

Manufacturer	Product
Castrol	Antifreeze Mist Lubricant

Assembly greases
The following greases may be used in the reassembly of Norgren Air line equipment

Manufacturer	Product
British Petroleum	Energrease LS2 (non silicone)
Dow Corning	Molykote BR-2 Plus (non silicone)
Carleton-Stuart	Magnalube G (non silicone)
Dow Corning	DC44 (silicone)
Dow Corning	DC55 (silicone)

Low temperature industrial compressed air applications below -29°C (-20°F)

Manufacturer	Product
Kluber	Unisilicon L50/2 (silicone)

Food and potable water applications

Manufacturer	Product
Dow Corning	Molykote 111 (silicone)

Oils listed in the above tables may be used in Norgren lubricators. All oils, however, may not be compatible with the equipment to be lubricated. Contact your lubricant supplier and the builder of the equipment to be lubricated to obtain specific lubricant recommendations.

The chart below details a selection of process fluids with their respective compatible valve materials. For more details contact your local Norgren Technical Sales Centre on: Tel 0800 056 0260

Body material

Fluid	Brass	Gun metal	St. steel	PVDF
Acetone	•			•
Acetylene	•		•	
Air	•	•	•	•
Alcohol	•	•	•	•
Antifreeze solvent	•	•	•	•
Argon	•	•	•	•
Beer		•	•	
Citric acid			❍	
CO2 gaseous (dry)	•	•	•	•
Deionized water			•	•
Demineralized water			•	•
Diesel	•	•	•	•
Ethylene Glycol	•	•	•	•
Glykol	•		•	
Fuel oil	•	•	•	
Fuels (Petrol)	•	•	•	
HCL acid.<30%				•
Hot water	•	•	•	
Inert gases	•	•	•	•
Ink				•
LPG		•	•	
Milk		•	•	
Natural gas	•	•	•	
Nitrogen	•	•	•	•
Nitrous oxide	•		•	
Oxygen * (De-greased)	•	•	•	
Propane/Butane			•	
Sea Water		•	•	
Sodium Hydroxide (40%)				•
Steam	•	•	•	
Unleaded petrol	•	•	•	
Water	•	•	•	•

• = Suitable, ❍ = Recommended

Seal material

Fluid	NBR	HNBR	FKM	EPDM	PTFE
	Temperature range °C				
	-10/+90	-20/+150	-10/+180	-20/+130	-20/+200
Acetone				❍	
Acetylene				❍	
Air	❍	•	•		•
Alcohol				❍	•
Antifreeze solvent				❍	•
Argon	•	•	❍	•	•
Beer				❍	❍
Citric acid				❍	❍
CO_2 gaseous (dry)	•	•	❍	•	•
Deionized water				❍	
Demineralized water	•	•	•	❍	•
Diesel	•	•	❍		•
Ethylene Glycol				❍	•
Glykol				❍	•
Fuel oil	•	•	❍		
Fuels (Petrol)			❍		
HCL acid.<30%					❍
Hot water		❍		❍	❍
Inert gases			❍		
Ink					❍
LPG			❍		❍
Milk				❍	❍
Natural gas			❍		•
Nitrogen	•	•	❍	•	•
Nitrous oxide			❍		
Oxygen * (De-greased)			❍		
Propane/Butane			❍		
Sea Water	❍			❍	❍
Sodium Hydroxide (40%)	❍			❍	❍
Steam		❍		•	❍
Unleaded petrol			❍		
Water	❍			❍	

• = Suitable, ❍ = Recommended

Conversion factors

The following table gives conversions of Imperial and discontinued Metric units into preferred SI units and other acceptable units. For most practical purposes the approximate conversion will prove adequate but for more critical use the second set of conversion factors should be used.

From old unit	To SI Unit	Approximate conversion	Accuracy	Conversion for greater accuracy
Length				
Inch (in)	millimetres (mm)	÷4 then x100	1,6%	x25,4
Foot (ft)	metre (m)	÷3	1,6%	x0,305
Yard (yd)	metre (m)	x1	9%	x12 then ÷13
n/16 inch	millimetres (mm)	'n' x3 then ÷2	5,5%	x1,6
n/1000 inch	millimetres (mm)	'n' ÷ 4 then ÷10	1,6%	x0,0254
Mile (mi)	kilometre (km)	x1,5	6,8%	x1,609
Mass				
Pound (lb)	kilogramme (kg)	÷2	10%	x0,45
Pound (lb)	gramme (g)	x1000 then ÷2	10%	x454
Ounce (oz)	gramme (g)	x30	6%	x28,4
Long Ton (UK)	tonne (t)	x1	1,6%	x1,02
Short Ton (USA)	tonne (t)	x9 then –10	0,8%	x0,91
Force (Weight)				
Pound-force (lbf)	newton (N)	x4	10%	x9 then ÷2
Kilopond (kp)	newton (N)	x10	2%	x9,8
Torque				
Pound-force foot (lbf ft)	newton-metre (N m)	x3 then ÷2	10%	x1,36
Pound-force inches (lbf in)	newton-metre (N m)	÷10	11%	x0,11
Pressure				
lbf/in² (psig)	bar	x7 then ÷100	1,5%	÷14,5
lbf/in² (psig)	N/m²	x7000	1,5%	x6895
lbf/in² (psig)	kilopascal (kPa)	x7	1,5%	x6,9
lbf/in² (psig)	megapascal (MPa)	x7 then ÷1000	1,5%	x6,9 then ÷1000
kgf/cm²* or kp/cm²	bar	x1	2,0%	x0,98
kgf/cm²* or kp/cm²	N/m²	x100000	2,0%	x98070
kgf/cm²* or kp/cm²	kilopascal (kPa)	x100	2,0%	x98
kgf/cm²* or kp/cm²	megapascal (MPa)	÷10	2,0%	x0,098
Atmosphere (std)	bar	x1	1,3%	x1,013
Atmosphere (std)	N/m²	x100000	1,3%	x101300
Atmosphere (std)	kilopascal (kPa)	x100	1,3%	x101,3
Atmosphere (std)	megapascal (MPa)	÷10	1,3%	x0,101
Inches Water Gauge (inH_2O)	millibar (mbar)	x10 then ÷4	0,6%	x2,49
mm Water Gauge (mmH_2O)	millibar (mbar)	÷10	2,0%	x0,098
mm of Mercury (mmHg)	millibar (mbar)	x9 then ÷7	0,04%	x1,33
Torr	millibar (mbar)	x9 then ÷7	0,04%	x1,33
Tons/in²	bar	x1000 then ÷7	7,5%	x154
Tons/ft²	bar	x1	1,5%	x1,07

*Also known as a 'technical' atmosphere

Conversion factors

From old unit	To SI Unit	Approximate conversion	Accuracy	Conversion for greater accuracy
Volume				
Gallon (UK) (gal)	litre (L)	x5	10%	x4,54
Gallon (USA) (gal)	litre (L)	x4	5,7%	x3,79
Pint (UK) (pt)	litre (L)	x6 then ÷10	5,6%	x0,57
Pint (USA) (pt)	litre (L)	÷2	5,7%	x0,47
Fluid ounce (UK) (fl oz)	cubic cm (cm^3)	x30	5,6%	x28,4
Fluid ounce (USA) (fl oz)	cubic cm (cm^3)	x30	1,4%	x29,6
Flow				
Cubic feet per minute (cfm)	cubic decimetres /second (dm^3/s)**	÷2	5,9%	x0,472
Cubic feet	cubic metres per minute (cfm)	÷2 then ÷1000 /second (m^3/s)	5,9%	x0,472 then ÷1000
Cubic feet per hour	cubic decimetres /second (dm^3/s)**	x8 then ÷1000	1,7%	x7,9 then ÷1000
Litres/minute (L/m)	cubic decimetres /second (dm^3/s)**	x2 then ÷100	20%	÷60
Cubic metres/hour (m^3/h)	cubic decimetres /second (dm^3/s)**	÷4	10%	x0,28
**The litre is equal to 1 cubic decimetre (dm^3) within 28 parts per million and for most practical purposes can be considered to be the same. For more precise work, increase the volume in litres by 1 part in 36000 to find the volume in dm^3.				
Power				
Horsepower (hp)	watt (W)	x3 then ÷4 then x1000	0,6%	x746
Horsepower (hp)	kilowatt (kW)	x3 then ÷4	0,6%	x0,746
Energy, Work				
Foot-pound-force (ft lbf)	joule (J)	x9 then ÷7	5,5%	x1,35
Kilogramme-force metres (kgf m)	joule (J)	x10	1,3%	x9,807
British thermal unit (Btu)	joule (J)	x1000	5,5%	x1055
Temperature				
Fahrenheit (°F)	Celsius (°C)	–32 then ÷2	10% between 0°F and 400°F	+40 then x5 then ÷9 then –40