WEBTEC

WEBSTER INSTRUMENTS
(A DIVISION OF WEBTEC PRODUCTS)

Short Form Catalogue

**Manufacturers of hydraulic components and test equipment
for the Mobile, Industrial and Agricultural industries**

Contents

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(A DIVISION OF WEBTEC PRODUCTS)

Manufacturers of hydraulic components and test equipment
for the Mobile, Industrial and Agricultural industries

Experience
Over 40 years of product development enhanced by constant technical innovation to meet the ever changing needs of fluid power users.

Support
Located in Milwaukee, Wisconsin, with distributors across North America, we provide product engineering and support before, during and after the sale. We aim for same day shipment on stock items. Other locations include England, France, Germany and an agency in China for world wide support.

Quality
Dedication to quality starts with design and is carried through all stages of manufacture. This commitment and ability to meet demanding criterion is demonstrated by our manufacturing divisions' accreditation to ISO9001.

A Complete Line
Over 350 different portable hydraulic testers, flowmeters, pressure transducers, temperature sensors, speed sensors, hydraulic data acquisition systems and digital display units all designed to be easy to use, accurate and durable. For trouble shooting & testing of components or commissioning hydraulic circuits on mobile equipment, industrial machinery, hydraulic test stands or in the laboratory, Webster Instruments helps you perform your job quickly, efficiently and professionally.

General Information

Customer Satisfaction
We strive to provide the highest level of customer service possible while manufacturing the most progressive and the highest quality line of hydraulic test equipment available on the market today. If for any reason you are not satisfied with the performance of the item purchased or the level of service you receive, please call and let us know.
A satisfied customer is the best and most honest form of advertising we know.

How to get Technical Information
Call, fax, email or mail us. Call toll free in the US or Canada, **800-*WEBTEST* (800-932-8378)**, telephone; **(414) 769-6400**, fax: Toll Free: **866-FLOWMETER (866-356-9637)** or **414-769-6591**. Our email address is **sales@webster-inst.com**. Our website address is **www.webster-inst.com**. Correspondence can be sent to 1290 E. Waterford Ave. Milwaukee, WI 53235.

How to Open an Account
NET 30 day accounts can be opened with approved credit. To apply send bank reference, two trade references and your federal tax ID number. Credit card orders or COD shipments can be made for other accounts, as well as overdue accounts.

How to get Delivery Information
Call, fax, email or mail us. Our toll free phone number is **800-WEBTEST (800-932-8378)** or **414-769-6400**, Our fax number is: Toll Free: **866-FLOWMETER (866-356-9637)** or **414-769-6591** and our email is **sales@webster-inst.com**. We aim to ship same day via UPS standard service on orders placed before 1:00 pm - our UPS driver collects around 3:00 pm and we like to have a couple of hours to process paperwork and package the goods. However if you need something shipped same day by next day air or second day air the major carriers will pickup until 7:00 pm - we will do our best to process your order, even if you call after 1:00 pm. We can also ship Federal Express, Emery, Burlington or TNT.

How to Order
To order, call, fax, email or mail us. Our toll free phone number is **800-WEBTEST (800-932-8378)** or **414-769-6400**, Our fax number is: Toll Free: **866-FLOWMETER (866-356-9637)** or **414-769-6591** and our email is **sales@webster-inst.com**. The order desk is manned from 8:00 am to 5:00 pm Central Time, Monday through Friday - ask for the order desk. Outside these hours there is an automated attendant system, leave a message with your name and number and we will get back to you. The fax machine has its own line and is always open.

Stocking Policy
We endeavor to hold stock of popular items in Milwaukee. If you are a distributor and have a good established pattern you may want to hold stock to ensure faster product availability.

How to get Literature
Call us, fax us, or mail us.

How to Process Repairs
We like to think our equipment never goes wrong but if it does we will do our best for you. Call for an RGA# before returning your repair. A written estimate will be provided before we proceed. Occasionally we get units back with no paperwork at all - no address, no phone, no name. Please be sure to get your RGA # before returning any unit as we can not provide the high level of service you deserve without this important information.

Shortages / Damaged in Transit / Returned Goods
Shortages must be reported within 10 days of shipment. Goods damaged in shipment are the responsibility of the carrier and all claims must be submitted to the carrier.
Returned goods not proven to be defective due to materials or workmanship will be subject to a minimum 25% restocking fee.

Mastercard, Visa, and American Express are all accepted.

DHT 1 & 2 Series Digital Hydraulic Testers

Standard Features:

- High Contrast LCD Digital readout
- Bi-directional Loading Valve with **"INTERPASS"™** Burst Disc Protection
- Bi-directional flow & pressure readings
- Flow accuracy 1% of reading
- US & Metric units, button select (DHTxx2 series only)
- Portable (DHT402 only 14 lbs)
- rpm input circuitry

- EP seals optional
- Remote flow & temperature input is easily field calibrated for any LT series flowmeter (DHTxx2 series only)
- DHT 1 Series features simple on/off control
- CMOS low-power circuitry with "Auto-Off" extends battery life
- 6,000 psi Pressure Gauge (8500 psi DHT802)

Model No.	Flow range gpm Accuracy ±1% of Reading	Inlet/Outlet Ports	Max. Pressure psi	Remote Flow Input	Weight	Approximate Dimensions W x D x H	Temperature Range Internal	rpm Range & Remote
DHT401-S-6	2.5 - 100	1-5/16" -12UN #16 SAE ORB	6000	N/A	14 lbs	9.5" x 7.9" x 7.9"	32 - 250 °F (°C and lpm engineering units available)	N/A
DHT801-F-3*	5 - 210	1-1/2" #24 SAE Code 61 4-bolt flange	3000		22 lbs	9.7" x 8.9" x 8.9"		
DHT801-S-7*	5 - 210	1-7/8" -12UN #24 SAE ORB	7000		22 lbs	9.7" x 8.9" x 8.9"		
DHT302-S-6	2 - 80	1-5/16" -12UN #16 SAE ORB	6000	DHT Series 2 Testers EXTernal input is easily configured in the field to any Webster LT series flowmeter	14 lbs	9.5" x 7.9" x 7.9"	32 - 250 °F 0 - 120 °C Push Button Select	0 - 6000
DHT402-S-6	2.5 - 100							
DHT602-S-7*	5 - 160	1-7/8" -12UN #24 SAE ORB	7000		22 lbs			
DHT602-F-3*	5 - 160	1-1/2" #24 SAE Code 61 4-bolt flange	3000		22 lbs	9.7" x 8.9" x 8.9"		
DHT802-F-3*	5 - 210				22 lbs			
DHT802-S-7*	5 - 210	1-7/8" -12UN #24 SAE ORB	7000		22 lbs			

DHM 3 Series Digital Hydraulic Multimeter

Standard Features:

- Digital readings of flow, pressure, peak pressure, horsepower, temperature & volumetric efficiency.
- Real-time, automatic calculation of horsepower & volumetric efficiency
- Large 4.7" x 1.7" LCD display with variable contrast control
- Three display modes offers US & Metric engineering units

- Built-in loading valve with the exclusive **"INTERPASS"™** safety disc system
- Bidirectional for unrestricted connections
- Linearized flow accuracy ± 1% of actual reading across the entire flow range
- Easy to operate controls
- Portable & lightweight
- Standard 9 VDC battery operated with Auto-Off

Model Number	Flow Range	Ports	Pressure*	Peak Pressure	Weight	Approximate Dimensions W x D x H	Power	Temperature Range
DHM403-S-6	2.5 - 100 gpm	1-5/16" -12UN #16 SAE ORB	6000 psi	8700 psi	14 lbs	9.5" x 7.9" x 7.9"	0 - 500 HP (372 kW)	32 - 250 °F 0 - 120 °C Push Button Select
DHM803-S-7*	5 - 210 gpm	1-7/8" -12UN #24 SAE ORB	7000 psi		22 lbs	9.7" x 8.9" x 8.9"	0 - 1000 HP (745 kW)	

*Standard units are BAR, PSI, MPA, KSC'

HT 2 Series Analog Hydraulic Testers

Standard Features:
- Analog readout of flow, pressure, temperature & RPM
- Bi-directional Loading Valve with **"INTERPASS"™** Burst Disc Protection
- Bi-directional flow & pressure
- Flow Accuracy ± 2% FSD
- Dual Scale, US & Metric
- High/Low flow scales offer improved resolution
- Portable (HT402 only 14 lbs)
- Battery test switch position

- RPM input accepts signal from TH3 phototach for shaft rotational speed display
- CMOS low-power circuitry
- "Auto-Off" extends battery life
- Pressure gauge is connected via built-in shuttle valve always indicating high pressure side of load valve regardless of flow direction
- EP seals optional

Model No.	Flow Range gpm Accuracy ± 2.0% FSD		Inlet/Outlet Ports	Max. Pressure psi	Weight	Approximate Dimensions W x D x H	Temperature Range Internal & Remote	rpm Range 1 PPR - Phototach
	Low Scale	High Scale						
HT302-S-6	2 - 20	0 - 80	1-5/16" -12UN #16 SAE ORB	6000	14 lbs	9.5" x 7.9" x 7.9"		300 - 3000
HT402-S-6	0 - 25	0 - 105						300 - 4000
HT602-S-7*	0 - 40	0 - 160	1-7/8" -12UN #24 SAE ORB	7000	22 lbs		32 - 250 °F 0 - 120 °C Dual Scale	300 - 6000
HT602-F-3*	0 - 40	0 - 160	1-1/2" #24 SAE Code 61 4-bolt flange	3000	22 lbs	9.7" x 8.9" x 8.9"		300 - 6000
HT802-F-3*	0 - 50	0 - 210						300 - 5000
HT802-S-7*	0 - 50	0 - 210	1-7/8" -12UN #24 SAE ORB	7000	22 lbs			300 - 5000

* Performance Notes
All 600 and 800 Testers have limited pressure control below 23 USgpm (86 lpm). The maximum controllable pressure in this region is calculated by: max pressure (psi) = 289 x flow (gpm) +436.

Custom Kits

Webtec have been designing and manufacturing flow meters and hydraulics components for over 40 years. We operate within a Quality Management System that complies with the requirements of BS EN ISO 9001 which is externally audited and certificated each year.

Beyond compliance to the standard, Webtec is committed to continually improving in everything we do with particular emphasis on understanding what matters to our customers and suppliers, and designing our systems and work to meet their needs. We are always keen to hear from customer who may have special requirements not covered by our standard ranges.

A number of options are available (subject to quantity) these include:

Output: 0 to 3 volt for strip chart / computer
Tester kits to your specification
OEM (branded) versions of all products
Non-standard flow scales
Different pressure gauges fitted

Contact the sales office with your request

DHCR Remote Digital Hydraulic Testers

DHCR Series Digital hydraulic readout

Standard Features:
- Remote digital readout
- Bi-directional flow & pressure
- Flow accuracy 1% of Reading*
- 2 Flow & temp inputs, 1 RPM input
- US & Metric units selectable
- 9 V battery powered
- 6,000 psi pressure gauge
- EP seals optional
- M16x2 male pressure connection

DHCR Remote Digital Hydraulic Tester

- "Auto-Off" extends battery life
- Remote flow & temperature input is easily field calibrated for any LT series flowmeter
- Flow meters available with built-in loading valve "**INTERPASS**"™ burst disc safety feature
- Models include DHCR readout, LT or LTR flowmeter and 6 foot cable/hose assembly.

Model number	Max Pressure
DHCR-6	6000 psi
DHCR-7	7000 psi

Choose your Flow block

LT Series Turbine flow meters with frequency output

Standard Features:
- Flow: 0.25 - 400 gpm
- Pressure: Up to 7000 psi
- Accuracy: Up to 1% of indicated reading
- Frequency Output
- M16 x 2 male test point included

- Bi-Directional operation
- Temperature: sensor built-in
- Fluids: Wide range of hydraulic oil, lubrication oil, and fuels
- Calibration: 21 cSt as standard. Special calibration possible

Model Number	Main ports	Top ports	Flow Range	Maximum pressure
LT15-FR-S-S-6	3/4" -16UN #8 SAE ORB	7/16" -20UN #4 SAE ORB*	0.25 - 4 US gpm	6000 psi
LT60-FR-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	0.8 - 16 US gpm	6000 psi
LT150-FR-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	1.3 - 40 US gpm	6000 psi
LT300-FR-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
LT400-FR-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2.5 - 100 US gpm	6000 psi
LT600-FR-S-S-5	1-5/8" -12UN #20 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	5000 psi
LT600-FR-F-S-3	1-1/2" #24 SAE Code 61 4-bolt flange	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	3000 psi
LT800-FR-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 210 US gpm	7000 psi
LT800-FR-F-S-3	1-1/2" #24 SAE Code 61 4-bolt flange	7/16" -20UN #4 SAE ORB	5 - 210 US gpm	3000 psi
LT1500-FR-F-S-6	2" #32 SAE Code 62 4-bolt flange	7/16" -20UN #4 SAE ORB	12.5 - 400 US gpm	6000 psi

* Only one test port

LTR Series Turbine flow meters with built-in loading valve

Standard Features:
- Flow: 2 - 210 gpm
- Pressure: Up to 7000 psi
- Accuracy: Up to 1% of indicated reading
- Frequency Output
- Bi-Directional operation*
- Temperature: sensor built-in
- Fluids: Wide range of hydraulic oil, lubrication oil, and fuels

- Calibration: 21 cSt as standard. Special calibration possible
- Loading Valve: with bi-directional flow and pressure loading capability
- "**INTERPASS**"™ safety disc system, bypasses oil internally in the event of the valve being over pressurised
- M16x2 male test point included

Model Number	Main ports	Top ports	Flow Range	Maximum pressure
LT300R-FR-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
LT400R-FR-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2.5 - 100 US gpm	6000 psi
LT600R-FR-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm *	7000 psi
LT800R-FR-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 210 US gpm *	7000 psi

* LT600/800R has limited pressure control below 23 US gpm (86 lpm). The maximum controllable pressure in this region is calculated by: max pressure (psi) = 289 x flow (gpm) +436.

Complete hydraulic test kit to measure flow, pressure, and temperature under load

DHCR-LT1500 kit
- Flow: Up to 400 US gpm
- Pressure: Up to 420 bar, 6000 psi
- Accuracy: ± 1% of indicated reading
- Fast checks on pumps, motors, valves, cylinders and hydrostatic transmissions.
- Remote Inputs: 2 Flow and Temperature, Pressure and Speed
- Economical low power consumption from standard battery. Automatic "Power Off' feature.
- Infra-red Phototachometer with 'On Target' indicator.
- Measures flow in both directions (Note: LT1500 is uni-directional when used with HV1500 kit)

HV1500 kit
- Smooth progressive pressure control
- High tensile aluminium body rated at 420 bar (6000 psi)
- Connecting flange for use with DHCR-LT1500 kit included, with seals and bolts
- Pilot operated over pressure internal bypass valve
- Spare burst discs included
- Uni-directional

DHCR-LT1500 kit

Contents
DHCR, LT1500, connecting hose and cable assembly, user manuals all housed in a rugged carry case.
Case Dimensions: 626 x 492 x 350 (24.6 x 19.4 x 13.8)
Total Weight (Inc Case): 24 kg (53 lbs)

Operating specification for all parts
Ambient temperature: 15 to 40 °C (59 to 104 °F)
Ambient humidity: 10 to 95% RH
Altitude: up to 2000m (6,500 feet)
Oil temperature range: 15 to 90 °C (59 to 194 °F)
Oil cleanliness: ISO 18/15/12 (NAS 6) or better
Fluid type: Mineral oil only typically ISO 15 -68 oil
Viscosity Range: 10 centi-stokes to 100 centi-stokes
Max pressure: 420 bar (6,000 psi)
Seals: Viton

DHCR
Inputs: 1 pressure, 1 speed, 2 flow and temperature
Max pressure: 420 bar
Engineering units: (selectable)
       Flow: lpm, US gpm, I gpm
       Temperature: °C or °F
Dimensions: 200 x 160 x 90 (7.8 x 6.3 x 3.5)
Weight: 2.6 kg (5.7 lbs)
See separate Bulletin for further information.

LT1500
Main ports: 2" #32 SAE Code 62 4-bolt flange
Top ports: 7/16" -20UN #4 SAE ORB x 2
Flow range: 50 to 1500 lpm (13 to 400 US gpm)
Accuracy*: 1% of indicated reading over 15 to 100% of flow range. (Below 15% of flow range ± 2.25 lpm) * When used with DHCR
Dimensions: 260 x 140 x 100 (10 x 5.5 x 4)
Weight: 10 kg (22 lbs)

Frequency Output
Frequency: 20 - 2000 Hz
Impedance: 3700 Ohm +25% - 20%
Inductance: 1 kHz: 1,55H +25% - 20%

Construction
High tensile aluminium block houses a six blade turbine rotating on a combination axial/radial needle roller bearing and alloy steel shaft.

Filtration
It is recommended that a 25 micron filter is installed in the hydraulic circuit prior to the flow meter.

HV1500 kit
Dimensions in Millimetres (Inches)

Contents
HV1500 load valve, 2" #32 SAE Code 62 4-bolt flange Connector and fitting kit, user manual, all housed in a rugged carry case.
Case Dimensions: 626 x 492 x 350 (24.6 x 19.4 x 13.8)
Total Weight (Inc Case): 39 kg (86 lbs)

Specification
Controllable flow range: 100 - 1500 lpm (26 - 400 US gpm)
Ports, load valve: 2" #32 SAE Code 62 4-bolt flange
Ports, connector: 2" #32 SAE Code 62 4-bolt flange
Dimensions: 300 x 250 x 140 (12 x 10 x 5.5)
Weight: 28 kg (61.6 lbs)

Construction
Wetted parts:
High tensile aluminium block, Steel 212A42 electroless nickel plated and alloy steel.

Ordering information

Description	Order code / model number
DHCR / LT1500 kit	DHCR1500K
HV1500 kit	HV1500K

Accessories

TH3 Phototach

Infrared beam reflected off rotating shaft generates pulse signal for TACH input found on HT, DHT and DHCR testers. Powered by tester internal battery. Includes 20 foot cable. Order BA20 mag base separately.

TH3 Phototach Head

20" Cable

BA20 Magnetic base & flex arm
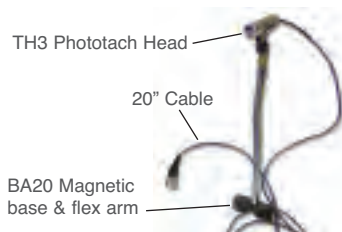
BA20 Magnetic Base and Flex Arm

Rugged steel flex arm and high strength magnetic base allow the sensor head to be mounted and aimed quickly & easily.

Remote Flow Input

The DHT 2 series portable testers feature a remote flow & temperature input socket located on the front panel adjacent to the pressure gauge. This versatile feature allows the tester to act as a readout for any model LT series flowmeter.

DHT 2 series testers can be configured in the field to any LT series flowmeter, effectively making the DHT series a 0.03 to 400 gpm tester with ± 1% accuracy. Using this feature is as easy as 1, 2, 3.

1. Connect any LT flowmeter to the EXT input on the front panel using the FT8525-6 Flow/Temp cable.

2. Select the default configuration via the keypad.

3. Switch to EXT position with the front panel rotary switch.

HV100 Loading Valve, 30 gpm, 1/2" Ports
HV200 Loading Valve, 50 gpm, 3/4" Ports

- *"INTERPASS"™* Rupture Disc Protection, bypasses over pressure oil internally - no external oil loss.
- Bi-directional
- 6,000 psi
- Three stage precision metering

HV400 Loading Valve, 100 gpm, 1" Ports
HV800 Loading Valve, 200 gpm, 1.5" Ports

- *"INTERPASS"™* Rupture Disc Protection, bypasses over pressure oil internally - no external oil loss.
- Pressure Gauge Port with shuttle valve
- Bi-directional
- 6,000 psi
- Pressure balanced for low handle effort

- 9 Volt lithium battery for severe cold weather tester operation (< 30 °F)
- Replacement burst discs - see below
- LT / LTR connecting cable
- Carry case made from structural resin
- HV1500K - Load valve testing kit capable of handling 400 US gpm and 6000 psi

Replacement Burst Discs (10 per Package)		
0 - 100 gpm Testers & Load Valves (300 / 400 models)		
Part Number	Color Code	Nominal Burst Pressure psi
FT338-6	Red	6000
FT338-5	Blue	5000
FT338-4	Green	4000
FT338-3	Yellow	3000
160 gpm & 200 gpm Testers (600 / 800 models)		
FT545-7	Orange	7000
FT545-6	Red	6000
FT545-5	Blue	5000
Note: Two discs required per replacement		

Repair & Calibration Services

Description
- Certificate of Conformity, reissue
- 3 pt. traceable flow test c/w data & graph
- 10 pt. traceable flow test c/w data & graph
- 3 pt. traceable pressure test c/w data & graph
- 10 pt. traceable pressure test c/w data & graph
- Operating manual, reissue
- HT series tester complete rebuild* (1 year warranty)
- DHT series tester complete rebuild* (1 year warranty)

We can repair it!

Repairs quoted on a time & material basis

* (complete rebuilds include turbine assembly, load valve, pressure gauge, new electronics, user manual, labor, calibration and certificate of conformity)

**We offer calibration and repair services with traceable flow & pressure facilities for all products.
We also offer Trade-Up discounts for obsolete or non-repairable models.**

Positive Displacement & Turbine Flowmeters

CT Series Turbine flow meters with conditioned output

Standard Features:
- Flow: 0.25 - 400 US gpm
- Pressure: Up to 7000 psi
- Output Options: 4 - 20 mA, 0 - 5 V, Pulse or SR (Sensor Recognition)
- Bi-Directional operation
- Fluids: Wide range of hydraulic oil, lubrication oils, and fuels

- Calibration: 21 cSt as standard. Special calibration possible
- SR models allows for fast and easy setup with HPM range of dataloggers. See HPM bulletin.
- Comprehensive range of accessories available including pressure transducers, temperature sensors panel meters and cables. See MPT, TP125 and DP130 bulletin for details or contact Webtec sales office

Model Number	Outputs available	Main ports	Top ports*	Flow range	Max. pressure
CT15-**-S-S-6	SR, 5V, mA, PU	3/4" -16UN #8 SAE ORB	7/16" -20UN #4 SAE ORB	0.25 - 4 US gpm	6000 psi
CT60-**-S-S-6	SR, 5V, mA, PU	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	0.8 - 16 US gpm	6000 psi
CT150-**-S-S-6	SR, 5V, mA, PU	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	1.3 - 40 US gpm	6000 psi
CT300-**-S-S-6	SR, 5V, mA, PU	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
CT400-**-S-S-6	SR, 5V, mA, PU	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2.5 - 100 US gpm	6000 psi
CT600-**-S-S-5	SR, 5V, mA, PU	1-5/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	5000 psi
CT800-**-S-S-7	5V, mA, PU	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 210 US gpm	3000 psi
CT800-**-F-S-3	5V, mA, PU	1-1/2" #24 SAE Code 61 4-bolt flange	7/16" -20UN #4 SAE ORB	5 - 210 US gpm	3000 psi
CT1500-**-F-S-6	5V, mA	1-1/2" #24 SAE Code 62 4-bolt flange	7/16" -20UN #4 SAE ORB	12.5 - 400 US gpm	420 bar

Replace ** with SR, mA, PU, 5V to give complete model number. *CT 15 has one of the specified top ports.

CTR Series Turbine flow meters with conditioned output and built-in loading valve

Standard Features:
- Flow: 2 - 210 US gpm
- Pressure: Up to 7000 psi
- Output Options: 4 - 20 mA, 0 - 5 V, Pulse or SR (Sensor Recognition)
- Loading Valve: with bi-directional flow and pressure loading capability *
- "*INTERPASS*"™ safety disc system, bypasses oil internally in the event of the valve being over pressurised

- Fluids: Wide range of hydraulic oil, lubrication oils, and fuels
- Calibration: 21 cSt as standard. Special calibration possible
- SR models allows for fast and easy setup with HPM range of dataloggers. See HPM bulletin.
- Comprehensive range of accessories available including pressure transducers, temperature sensors panel meters and cables. See MPT, TP125 and DP130 bulletins for details or contact Webtec sales office

Model Number	Outputs available	Main ports	Top ports*	Flow range	Max. pressure
CT300R-**-S-S-6	SR, 5V, mA, PU	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
CT400R-**-S-S-6	5V, mA, PU	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2.5 - 100 US gpm	6000 psi
CT600R-**-S-S-7	SR, 5V, mA, PU	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	7000 psi
CT800R-**-S-S-7	5V, mA, PU	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 210 US gpm	7000 psi

CT600,750,800 has limited pressure control below 23 US gpm (86 lpm). The maximum controllable pressure in this region is calculated by: max pressure (psi) = 289 x flow (gpm) +436.

Positive Displacement Flowmeters, Pulse Output

Model No.	Flow Range (gpm)	Pressure Rating (psi)	Ports
LT10	0.05 - 2.5	3600	3/8" BSPP

Precision gear type flowmeter for low flow monitoring.
Designed for hydraulic fluids with viscosity less than 28 cSt. (150 SUS).
Includes temperature output compatible with Webster test equipment.
Order 5 pin electrical connector part # FT7884

Available with JIC or BSP ports

Compact Turbine Flowmeters

Model No.	Flow Range (gpm)	Pressure Rating (psi)	Ports
LTE50-S-S-6	0.8 - 16	6000	1-1/16" -12UN #12 SAE ORB
LTE125-S-S-6	1.3 - 40	6000	1-1/16" -12UN #12 SAE ORB
LTE250-S-B-6	2 - 80	6000	1-5/16" -12UN #16 SAE ORB
LTE400-S-B-6	2.5 - 100	6000	1-5/16" -12UN #16 SAE ORB

E denotes flowmeter designed for compact installation. Unique flow conditioning permits use of elbows on inlet and outlet ports. Supplied with 2 sensor ports. Includes temperature output compatible with Webster test equipment. Order electrical connector FT7884.

Available with SAE or BSP ports

Cables / Options / Accessories

Model No.	Description
FT9880	4-Pin M12 x 1 connector for CT-MA and CT-5V flow meters
FT9879-05	Cable, for CT turbine flow meters with active pickup & M12x4 connector, 15 foot
FT7884	5-Pin Amphenol Style connector, screw lock for LT / LTR / LTE / LG flowmeters
FT8384-6	Cable, Flow, 20 ft. 2 wire shielded
	Use to connect LT flowmeter to DF130 readouts. FT7884 connector included.
FT8525-6	Cable, Flow & Temperature, 20 ft., PVC jacket rated at 140 °F,
	Use to connect LT series flowmeter to portable tester remote input.

Pressure Transducers

MPT Series Low Cost Pressure Transducers
(Replaces WPT series)

Standard Features:
- Accurate 0.25% Full Scale
- Economically Priced
- SST Wetted Parts
- Rugged Design

- Outputs: 0 - 5 V or 4 - 20 mA
- Ports: #4 SAE, 1/4" NPT or 1/4" BSP
- Ranges: 600, 1500, 3600, 6000, 9000 or 14500 psi

Ordering Code   MPT   600   P   U   MA

Pressure Range (see Table 1) ——————
Pressure Units (P) - psi ——————
Porting (U) 7/16" -20UN #4 SAE ORB Male ——————
Output (mA) 4 - 20 mA ——————
     (5V) 0 - 5 V

Table 1

Range (psi)	Code
200	200
600	600
1500	1K5
4000	4K0
6000	6K0
7500	7K5
10000	10K0

Pressure Transducers

LPG Series Heavy Duty Pressure Transducers

Standard Features:
- Stainless steel wetted parts
- Polysilicon strain gage
- 1/4" NPT male thread
- Over Pressure: 3 x rated or 22500 psi which ever is less
- Operating temperature -40 to 250 °F

- Output signals: 0 - 10V, 0 - 100 mV & 4 - 20 mA
- 50 mW power usage (mV model)
- Less than 5 mS response (mV model)
- Static error band ± 0.20% FSD
- Life cycle; 100 million cycles

Ordering Code: Select full scale pressure and signal output from table at right. i.e.: LPG7K5-N-MV is a 7500 psi transducer with 1/4" NPT male connection and 100 millivolt output.

Cable assembly, 20 foot long, part # FT9322-6 for connection to DP130 Readout

Use milliamp (mA) or Volt (V) output with digital panel meter DP130 (see page 11)

Ordering Table for LPG Series Transducer			
Select Model (LPG), Range (10k), Thread (N) & Output (MV)			
Eg: LPG10k-N-MV = 10,000 psi transducer with 1/4"NPT threads & 0 - 100 MV output			
Model	**Rated Pressure psi**	**Male Thread**	**Output**
LPG	0 - 100 (K1) / 0 - 7500 (7K5)	N = 1/4" NPT	MV = 100MV
	0 - 600 (K6) / 0 - 10000 (10K)	S = # 4 SAE	MA = 4 - 20MA
	0 - 3000 (3K) / 0 - 15000 (15K)		V = 0 - 10 V
	0 - 6000 (5K) / 0 - 20000 (20K)		
	0 - 6000 (6K) / 25000 +		

Use mA or V output for DP130 panel mount readout (see page 11).
Contact sales office for ranges from 25,000 to 150,000 psi.

Temperature Sensors and Digital Pressure Gauges

TP125 Temperature Transmitter

Outputs available: three wire 0 - 5 VDC (Model No. TP125-5V) or two wire 4 - 20 mA Model No. (TP125-MA). 6900 psi pressure rating, #4 SAE, 1/4" NPT or 1/4" BSP male process connection rated at 7000 psi and integral M12x1 4 pin electrical connection. Order mating electrical connector part # FT9880 or 15 foot cable assembly FT9879-05

Use with DP130 readout, data acquisition systems, PLC's or process meters with inputs.

Features
- Outputs: 4 - 20 mA or 0 - 5 VDC
- Overall length 4"
- Insertion length 0.5"
- 304 SST wetted parts
- Fluid temperature range 32 - 257 °F (scaled range 32 - 302 °F)

How to Order: Model: TP125 - ___ - ___
Output: 0 - 5 Vdc = 5V ─────
            4 - 20 mA = MA ─────
Connection: 1/4" NPT = N ─────
            7/16" -20UN #4 SAE ORB = S ─────

HPM110 Digital Pressure Gauge

The battery powered HPM110 simultaneously displays actual pressure, peak pressure and battery level. Four buttons control backlight, reset zero & peak value, display of min, max or actual pressure and engineering units. Two pressure ranges are available for continuous monitoring of oil, gas, water, hydraulic and other pressure media.

Features
- Accurate (± 0.5% Full Scale)
- Units: psi, bar, mBar, Mpa & KPA
- 3.2" Diameter housing with rubber cover
- Digital display with bar graph
- Stainless Steel wetted parts
- Backlit LCD Order GD2504-4S connector for UN style

Table 1

Range	Code
1500 psi	1K5
8700 psi	8K7

How to Order: Model: SR-HPM-110 - ___ - ___
Porting (MT = M16x2), ─────
(UN = 7/16" -20UN #4 SAE ORB Male) ─────
Pressure range (Table 1) ─────

Speed Sensors

MT1A Magnetic Speed Pickup
For accurate rotational speed - target sensing.

- Range: 300 - 10,000 rpm (1PPR)
- 3.0" L x 3/8" NPS thread
- Two locking nuts
- Monitor shaft key or Keyway.
- Can be used to sense gear teeth for improved performance below 300 rpm.

- Self energized magnetic pickup
- Mounting bracket not included
- Use cable part # FT8525-6
- Use with DS130 and portable test equipment

Digital Panel Mount Readouts

Flow, Pressure, Temperature & Speed Readouts - Complete Calibrated Test Systems
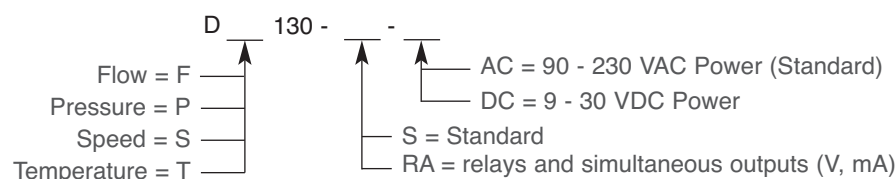
Standard Features:

- Large LED readout supplied calibrated to sensor
- Compact panel mounting only 3.6" behind panel
- Flow, pressure, temperature or speed inputs
- Factory calibrated with certificates of conformity.
- Simultaneous 10V & 4 - 20 mA output
- Hi / Low alarm / 5 AMP Form C contacts option

- Flow totalizing for DF130
- Integral mounting clips and removable screw terminal blocks speed installation
- UL / CUL / CE approval
- Universal 90 - 230 VAC or 9 - 36 VDC power

Digital Flow Readouts & Test Systems

Special Packages See page 5 & 9 for sensors

DF130 4 Digit Flow Rate or Total Readout, 90 - 230 VAC powered. Use with LT, LTE or LTR series flowmeters. Supplied as a complete factory calibrated test system.

Digital Pressure Readouts & Test Systems

Special Packages See pages 8, 9 & 10 for sensors

DP130 4 Digit Pressure Readout, 90 - 230 VAC powered. Use with MPT series pressure transducer. pressure transducers. Supplied as a complete factory calibrated test system. The DP130 can also be used with CT turbines.

Note: The DP130 can also be used with CT-MA and CT-5V flow meters for 1% actual reading accuracy.

Digital Speed Readouts & Test Systems

Special packages See page 10 for sensors

DS130 4-1/2 Digit Speed Readout, 90 - 230 VAC powered. Use with MT1A or 54ZT speed pickups. Supplied as a complete factory calibrated test system.

Digital Temperature Readouts & Test Systems

Special Packages See page 10 for sensors

DT130 4-1/2 Digit Temperature Readout, 90 - 230 VAC powered. Use with TP125-MA-N temperature sensor Supplied as a complete factory calibrated test system.

Options & Accessories for Digital Panel Mount Readouts

Options for DF130, DP130, DT130 & DS130 Digital Panel Meters

D ___ 130 - ___ - ___

Flow = F
Pressure = P
Speed = S
Temperature = T

AC = 90 - 230 VAC Power (Standard)
DC = 9 - 30 VDC Power
S = Standard
RA = relays and simultaneous outputs (V, mA)

Common specification for all panel meters
Dimensions: 4.04" x 2.19"H x 3.87"D (Only 3.6" behind panel depth)
Panel Cutout: 3.62" x 1.77" (+0.04" - 0.0")

Cables

All Cables listed include mating connectors to match sensors and readouts. PVC coated rated at 140 °F ambient (teflon coated available for Skydrol applications).

Part No.	Feet	Connects from	Connects to
FT8525-6	20	LT Flowmeter	DHT Remote Input
FT9322-6	20	WPT & LPG Pressure Sensors	DP130
FT8384-6	20	LT Flowmeter/MT1A	DF130 / DS130
FT9879-05	15	TP125 Temperature Sensor	DT130 Readout / User input device
FT9879-05	16	CT-MA & CT-5V Series Flow Meters	User Input Device / DP130

Cables available in other lengths.
Cable available with teflon jacket for Skydrol applications. Contact sales office

HPM Handheld Digital Test System

Standard Features:

- Digital Readout of Pressure, Temperature, Flow, Differential Pressure* (*requires two transducers of same range).
- Available with 2, 4 or 6 inputs
- Data log 250,000 readings in HPM460
- Windows Compatible Software
- Accuracy: Pressure within 0.5% of full scale Flow within 1% of full scale.
- Pressure up to 9000 psi, peaks to 14,000 psi.

- Auto configuration / sensor recognition
- CT-SR Series flowmeters with Sensor Recognition
- Battery Powered standard 9 Volt battery. Optional rechargeable unit.
- Min / Max memory
- Printer Output (HPM400C, 460)
- USB connection (HPM540 only)

Model No.	Description
HPM420-050-A	2 input / 2 line readout, rechargeable 9 VDC battery & charger
HPM420-050-C	2 input / 2 line readout, rechargeable 9 VDC battery, charger & printer output
HPM420-050-AKIT	2 line / 2 input readout, 1 x PTT630 pressure transducer, universal sensor cable, 1 x battery charger & carry case
HPM540-05-0C	4 input readout / data logger with USB data output
HPM460-05-0C	6 input readout / data logger with RS232 data output

Pressure Sensors for HPM Series

Model No.	Description
PTT-015-05-0C	Pressure transducer with M16 x 2 female test point connector, 210 psi
PTT-060-05-0C	Pressure transducer with M16 x 2 female test point connector, 900 psi
PTT-150-05-0C	Pressure transducer with M16 x 2 female test point connector, 2100 psi
PTT-400-05-0C	Pressure transducer with M16 x 2 female test point connector, 6000 psi
PTT-600-05-0C	Pressure transducer with M16 x 2 female test point connector, 8700 psi
PTT-1K0-05-0C	Pressure transducer with M16 x 2 female test point connector, 14500 psi

Note: Order FT9788 universal sensor connecting cable for each sensor (see next page).

Flow Sensors for HPM Series
CT Series Turbine flow meters with conditioned output (Sensor Recognition)

Model Number	Main ports	Top ports*	Flow range	Max. pressure
CT15-SR-S-S-6	3/4" -16UN #8 SAE ORB	7/16" -20UN #4 SAE ORB	0.25 - 4 US gpm	6000 psi
CT60-SR-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	0.8 - 16 US gpm	6000 psi
CT150-SR-S-S-6	1-1/16" -12UN #12 SAE ORB	7/16" -20UN #4 SAE ORB	1.3 - 40 US gpm	6000 psi
CT300-SR-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
CT400-SR-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2.5 - 100 US gpm	6000 psi
CT600-SR-S-S-5	1-5/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	5000 psi
CT750-SR-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 200 US gpm	7000 psi

CT 15 has one of the specified top ports.

Flow Sensors with Load Valves for HPM Series
CTR Series Turbine flow meters with conditioned output (Sensor Recognition)

Model Number	Main ports	Top ports*	Flow range	Max. pressure
CT300R-SR-S-S-6	1-5/16" -12UN #16 SAE ORB	7/16" -20UN #4 SAE ORB	2 - 80 US gpm	6000 psi
CT600R-SR-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	4 - 160 US gpm	7000 psi
CT750R-SR-S-S-7	1-7/8" -12UN #24 SAE ORB	7/16" -20UN #4 SAE ORB	5 - 200 US gpm	7000 psi

CT600, 750, 800 has limited pressure control below 23 US gpm (86 lpm). The maximum controllable pressure in this region is calculated by: max pressure (psi) = 289 x flow (gpm) +436.

Note: All CT-SR flowmeters supplied with M16 x 2 test point mating to PTT pressure transducer and M10 x 1 port for TP400 temperature sensor installation

Temperature and Speed Sensors for HPM Series

FT9781	RPM-300-05-3C	Tachometer Photo-head with 3m cable
FT9282	RPM-WHL-00-0C	Contact wheel
FT9283	RPM-ADP-00-0C	Focus adaptor
TTP400		Temperature sensor, integral 2 m cable, M10 x 1 thread, 50 - 250 °F

Accessories for HPM Series

HV100		Optional 30 gpm load valve for CT60-SR-S-S-6
HV200		Optional 50 gpm load valve for CT150-SR-S-S-6

FT8305 — Small carry case fits 1 x HPM Readout, 2 x Pressure Transducer & cables

FT8850 — Large carry case fits 1 x HPM Readout, 2 x PT Pressure Transducers, 2 x CT Turbine blocks & 4 x cables

Kit pricing is available for HPM420, HPM540 & HPM460 kits, Contact sales office.

Cables / Connectors
FT9788	CBL-003-55-MM	Universal sensor cable, 3m long 5 pin M/M
FT9789	CBL-005-55-FM	Extension cable, 5m long, 5 pin F/M
FT9275	CBL-003-45-FM	Extension cable, 3m long, 4pin - 5pin F/M
FT9786	CBL-VAD-BP-1C	Cable kit for voltage module

General Accessories
FT9782	EXT-TRG-05-1C	External trigger adaptor
FT10138	SR-VADC-1	48VDC/1.5A Sensor Input Modual

Printer & Software Kits
FT9780	SWC-420-SP-2C	HPM-420-05-C PC Link Cable and Software kit
FT9273	DKJ-PTR-SP-1C	Printer Kit including Color Printer with power supply, battery, converter with printer cable

Special pricing is available for HPM420, HPM540 & HPM460 kits, Contact sales office.

C2000 Hydraulic data acquisition system

A complete hydraulic solution to provide professional test certificates for your customers

The C2000 is a 3rd generation solution for displaying, logging and reporting hydraulic test information, designed for use on pump test stands.

The C2000 offers the latest in data monitoring and logging capability. The super panel offers easy user configuration of up to 12 channels in either digital or slider mode.

Standard Features:
- Modular 8 - 64 inputs
- Windows™ compatible Software
- Hydraulic test solution

- Print test Certificates
- TCP/IP network ready
- Dedicated high-speed controller

Receive a pump . . .

Receive the pump (or other hydraulic component) from your customer

Check on-screen values . . .

Run oil through the pump and display real-time hydraulic values (Flow, pressure, temperature, speed plus custom measurements)

Record test data

Using your own test procedure you can display real time values and record test results on a keypress

Print your certificate

Print the test certificate at the touch of a button, ready to send back to the customer with the pump.

Features:
- Up to 64 channels

Sensors available:
- Flow meters 1 to 1500 lpm
- Pressure transducers 1 to 600 bar
- Temperature transducer 0 to 125°C
- Speed sensor
- Standard 4 - 20 mA or TTL inputs for additional sensors

Three logging modes:
- Log on a keypress
- Profile logging
- Continuous logging
- Logging speed up to 2 kHz per channel
- Over 8 million readings capability

Four monitoring screens:
- Super panel
- Two standard panels
- Real time graphing
- Custom reports

Other:
- Analysis of results
- Ethernet connection
- Industrial control unit included as standard
- Optional 19" rack
- Help on line
- Export files to other packages
- Easy upgrade path for future expansion if needed

C2000 mid-box
Up to 5 modules as standard 5U height
Expansion box adds up to an additional 3 modules 4U height

Input signal type
4 - 20 mA signals - measurement 8 channels per module
TTL - frequency measurement - 6 channels per module

FI Series 'MecMeter'™ In-Line Flowmeters

Standard Features:

- All mechanical operation - no batteries required
- "EASY-READ" Flow Dial
- Indicator will not de-couple from piston magnet under surge flows
- Variable orifice meter
- Accuracy 4% FSD
- 1/4" NPTF Pressure Gauge Port

- Quality finish enhances appearance
- Max pressure: 6,000 psi (0.75" line size)
- Max pressure: 5,000 psi (1.5" line size)
- Panel mounting holes
- Dual US / Metric scales
- Flow switch option
- Thermometer option
- Reverse flow models available

Aluminum body. Calibrated for Oil. Ports: 1-1/16" -12UN #12 SAE ORB

Model No.	Flow Range (gpm)
FI750-15-ASO	0.5 - 4
FI750-30-ASO	0.5 - 8
FI750-60-ASO	0.5 - 16
FI750-120-ASO	1 - 32
FI750-180-ASO	4 - 48

Aluminum body. Calibrated for Oil. Ports 3/4" NPTF

Model No.	Flow Range (gpm)
FI750-15-ANO	0.5 - 4
FI750-30-ANO	0.5 - 8
FI750-60-ANO	0.5 - 16
FI750-120-ANO	1 - 32
FI750-180-ANO	4 - 48

Brass body. Calibrated for Oil and Water. Ports: 3/4" NPTF

Model No.	Flow range water (gpm)	Flow range oil (gpm)
FI750-30-BNW	0.5 - 8	0.5 - 8
FI750-60-BNW	0.5 - 18	0.5 - 16
FI750-120-BNW	1 - 37	1 - 32

Aluminum body. Calibrated for Oil. Ports: 1-5/16" -12UN #16 SAE ORB
Allows reverse flow

Model No.	Flow Range (gpm)
RFI1000-120-ASOT	4 - 32
RFI1000-200-ASOT	4 - 54

Aluminum body. Calibrated for Oil. Ports: 1-7/8" -12UN #24 SAE ORB

Model No.	Flow Range (gpm)
FI1500-200-ASO	5 - 50
FI1500-300-ASO	4 - 80
FI1500-400-ASO	5 - 100

Brass body. Calibrated for Oil and Water. Ports: 1-7/8" -12UN #24 SAE ORB

Model No.	Flow range water (gpm)	Flow range oil (gpm)
FI1500-200-BSW	5 - 50	5 - 50
FI1500-400-BSW	5 - 100	5 - 100

See next page for option & accessories. Contact sales office for reverse flow capability

'MecMeter'™ Flowmeters Are Tough.

We parked a forklift on one to prove it!

FI Series 'MecMeter'™

Add a pressure gauge and a load valve for a low cost test kit

Rugged, Durable & Low Cost

Options & Accessories for FI Series Flowmeters

Option

Description

FI750 Series **Flow Switch**

Single pole, 2 position reed switch for alarms etc. Set point is field adjustable. Must be ordered at the same time as the FI, FI750 only.

FI1500 series

Dual contact, electronic flow switch (FI1500 series only)

Thermometer

FI750 or FI1500 series

Alcohol filled thermometer with dual temperature scale marked in °F and °C, range 65 - 230 °F.
When ordering add **"T"** to code.
Example: FI750-60-ASOT

FIK & RFIK Series Low Cost Hydraulic Test Kits

FIK Series Low Cost In-Line Pump Test Kit

Standard Features:
- Flow: 0.5 - 48 gpm
- Pressure: Up to 6000 psi
- Temperature: 68 - 248 °F
- Flow Accuracy within 4% FSD
- Large clear easy to read dials

- Smooth pressure control up to 6000 psi
- Safe to use, with **"INTERPASS"™** internal safety protection system. Protects system and operator against accidental over-pressure in both flow directions

Model Number	Calibrated Flow Range lpm	gpm	Inlet fitting	Outlet fitting
FIK-30ASOT	2 - 30	0.5 - 8	3/4" -16UN JIC Male	3/4" -16UN JIC Male
FIK-60ASOT	2 - 60	0.5 - 16	3/4" -16UN JIC Male	3/4" -16UN JIC Male
FIK-120ASOT	4 - 120	1 - 32	3/4" -16UN JIC Male	3/4" -16UN JIC Male
FIK-180ASOT	10 - 180	4 - 48	3/4" -16UN JIC Male	3/4" -16UN JIC Male

RFIK Series Mechanical Hydraulic Tester

Standard Features:
- Flow: 4 - 54 gpm
- Pressure: Up to 6000 psi
- Temperature: 68 - 248 °F
- Allows reverse flow
- No batteries required

- Flow Accuracy within 4% FSD
- Large clear easy to read dials
- Smooth pressure control up to 6000 psi
- Safe to use, with **"INTERPASS"™** internal safety protection system. Protects system and operator against accidental over-pressure in both flow directions

Model Number	Calibrated Flow Range lpm	US gpm	Inlet fitting	Outlet fitting
RFIK120-S-6	10 - 120	4 - 32	1-5/16" -12UN JIC Male	1-5/16" -12UN JIC Male
RFIK200-S-6	10 - 200	4 - 54	1-5/16" -12UN JIC Male	1-5/16" -12UN JIC Male

Flow, Temperature, Measure, display, switch, transmit

Standard Features:
- Flow: 0.25 - 100 US gpm
- Pressure: 6,000 psi
- Designed for permanent installation (few wearing parts)
- Easy to operate: 4 digit LED display, 3 large keys
- Accuracy better than 3% FSD
- Repeatability better than 1%
- Temperature measurement built-in

- Wide range of options: Choice of outputs V or mA. Two programmable switches. Complete with adaptors fitted (BSP or JIC Male). Engineering units lpm or US gpm (°C or °F)
- Easy installation: Mount in any orientation, Install straight after a bend. Allows reverse flow
- Traceable calibration on request
- Patent Pending Design

Model configuration

Example

HF100	-	TRNMA-3	-	S100V
Code 1		Code 2		Code 3

Above model number is a FlowHUB Transmitter: Flow range: 2 - 100 US gpm, Maximum pressure: 3000 psi (210 bar), Temperature: °F, Output: 4 - 20 mA, no switches, 1 5/16" JIC Male adaptors.

Step 1 - Choose flow range and engineering units

EU flow range (lpm & °C)			US flow range (US gpm and °F)		
Code 1	Flow range	Standard adaptors	Code 1	Flow Range	Standard adaptors
HF030	1 - 30	1/2" or 3/4" BSPP	HF008	0.3 - 8	1-1/16" -12UN JIC Male or 3/4" -16UN JIC Male
HF060	2 - 60	1/2" or 3/4" BSPP	HF016	0.5 - 16	1-1/16" -12UN JIC Male or 3/4" -16UN JIC Male
HF120	4 - 120	3/4" or 1" BSPP	HF032	1 - 32	1-1/16" -12UN JIC Male or 1-5/16" -12UN JIC Male
HF240	8 - 240	1" BSPP	HF064	2 - 64	1-5/16" -12UN JIC Male
HF360	8 - 360	1" BSPP	HF100	2 - 100	1-5/16" -12UN JIC Male

Step 2 - Choose electronics and maximum pressure

Electronic control and maximum pressure options		
Code 2	Maximum working pressure	Function description
SWTNA-3	3,000 psi (210 bar)	Two programmable switches
TRN5V-3	3,000 psi (210 bar)	Output 0 - 5 Volt
TRNMA-3	3,000 psi (210 bar)	Output 4 - 20 mA
ULT5V-6	6,000 psi (420 bar)	Two programmable switches, output 0 - 5 Volt
ULTMA-6	6,000 psi (420 bar)	Two programmable switches, output 4 - 20 mA

Step 3 - Choose adaptors

Adaptors			
BSPP options		SAE options	
Code 3	Description	Code 3	Description
B050V	1/2" BSPP	S050V	3/4" -16UN JIC Male
B075V	3/4" BSPP	S075V	1-1/16" -12UN JIC Male
B100V	1" BSPP	S100V	1-5/16" -12UN JIC Male

Custom configurations are available, please contact sales.

Build your own FlowHUB

	-		-	
Code 1		Code 2		Code 3

Standard Features:

- Advanced sharp edge orifice design provides measurement stability over wide viscosity range
- Reliable and economical design
- Direct reading, dual calibrated scale, gpm/lpm, special scales available.
- Available in Aluminum, Brass or Stainless Steel to suit fluid
- Line sizes 1/2", 3/4", 1", 1-1/2" & 2"
- Flowrates available;
  0.05 to 150 gpm - liquids
  1.5 - 1350 SCFM - gases
- Max pressure rating 3500 & 6000 psi liquids, 1000 psi gases.

- Accurate within 2.5% over midscale, 4% FSD
- Ports available in SAE, NPT or BSP
- Optional single or dual flow switch, high temperature versions, transmitter version and phosphate ester models.
- Unrestricted mounting in any orientation, horizontal, vertical or inverted.
- High strength cast ALNICO magnet for superior coupling performance
- Available with free reverse flow or bidirectional reading

WP Series Flowmeter Ordering Guide

Ordering Example: WPB4A-6HJ-50

Coding Breakdown:

B = Basic Meter
4 = Size Code (3/4" or 1")
A = Aluminum Body
6 = 3500 psi Pressure Rating
H = Oil calibration
J = #16 O-Ring Ports
50 = 5 - 50 gpm Flow Range Rating

We can cross reference other manufacturers. Give us the Model No. and we will quote a replacement.

Model No. WP — Style — Size Code — Material — Pressure Rating — Fluid — Ports — Flow Range

Style

BASIC in-line for liquid	= B*
CASE DRAIN low pressure	= C[2]
PNEUMATIC for air and gas	= G
HI-TEMP 400 °F In-line	= H
Hi-TEMP 600 °F In-line	= J
Flow Alarm, 1 switch	= M
Flow Alarm, 2 switches	= N
Phosphate Ester In-line	= P
Flow Transmitter	= R
Hydraulic System Analyser	= T
(See also RFIK Series Test Kits)	

Size Code

1/4" to 1/2"	= 3
3/4" to 1"	= 4
1 1/4" to 2"	= 5

Material

Aluminum	= A*
Brass (See also FI Series)	= B
Stainless Steel	= S

Pressure Rating

600 psi Max. (Air & Gases / Aluminum & Brass)	= 4
1000 psi Max. (Air & Gases / Stainless Steel)	= 5
3500 psi Max. (Liquids / Aluminum * Brass)	= 6*
6000 psi Max. (see also FI Series)	= 7

Fluid Media[1]

Air or Gas	= A
Oil at 0.873 sg	= H*
Water at 1.0 sg	= W

Ports (All Female)

Port Code		Size Code
A	= 3/8" NPTF, dry seal	3 only
B	= 1/2" NPTF, dry seal	3 only
C	= 3/4" NPTF, dry seal	4 only
D	= 1: NPTF, dry seal	4 only
*E	= # 6 SAE ORB	3 only
*F	= # 8 SAE ORB	3 only
*G	= # 10 SAE ORB	3 only
*H	= # 12 SAE ORB	4 only
*J	= # 16 SAE ORB	4 only
K	= 1-1/4" NPTF, dry seal	5 only
L	= 1-1/2" NPTF, dry seal	5 only
M	= 2" NPTF, dry seal	5 only
N	= # 20 SAE ORB	5 only
P	= # 24 SAE ORB	5 only
Q	= # 32 SAE ORB	5 only
R	= 3/8" BSPP	3 only
T	= 1/2" BSPP	3 only
U	= 3/4" BSPP	4 only
V	= 1" BSPP	4 only
W	= 1-14" BSPP	5 only
Y	= 1-1/2 BSPP	5 only
X	= 2" BSPP	5 only
Y	= Cartridge	

Flow Range

Flow Code: Liquid/Gas	Size Code
01 = 0.05 - 1gpm 1.5 - 12 SCFM	3 only
0.1 - 1 gpm water	3 only
02 = 0.2 - 2 gpm 4 - 23 SCFM	3 & 4
0.2 - 2.6 gpm 2 - 30 SCFM	4 only
05 = 0.5 - 5.0 gpm 5 - 50 SCFM	3 only
0.5 - 5.0 gpm 6 - 60 SCFM	4 only
*10 = 1 - 10 gpm 10 - 100 SCFM	3 & 4
*15 = 1 - 15 gpm 15 - 150 SCFM	3 & 4
*20 = 2 - 20 gpm 20 - 215 SCFM	4 only
*25 = 2 - 25 gpm 20 - 250 SCFM	4 & 5
*30 = 3 - 30 gpm 30 - 330 SCFM	4 only
40 = 4 - 43 gpm 30 - 400 SCFM	4 only
*50 = 5 - 50 gpm 40 - 500 SCFM	4 only
5 - 50 gpm 30 - 470 SCFM	5 only
75 = 8 - 75 gpm 30 - 750 SCFM	5 only
*88 = 10 - 100 gpm 150 - 900 SCFM	5 only
15 - 90 gpm water	5 only
*99 = 20 - 150 gpm 150 - 1300 SCFM	5 only

Key

* Normally ships from stock
1 Contact sales office for special calibration or scale modifications
2 Case drain meters are available in aluminum body, NPT ports in size code 3 & 4 only. Also available with SAE oring ports (special order)

Fully customizable Pressure Test Kits

Standard Features:
- Custom built to your specification - pick and mix from huge range.
- Pressure Test Kits provide a complete test system for rapid pressure testing.
- Pressure test points can be fitted anywhere in the circuit for instant pressure checks saving installation costs of piping and gauges.
- Test hoses can be connected by hand under full system pressure without loss of oil or ingress of dirt. Oil samples can be taken and circuits bled of air.

- The kit includes gauges, hoses, test points and adaptors.
- The case provides ample storage and the gauge panel can be removed for convenient use while testing the machine. (PT4 and PT6 only)
- Three models available - completely assembled`

Model No.	Contents
PT200-2	Rugged Plastic case 2 gauges from table 1 2 hoses 2 meters long from table 2 2 test points from table 3 2 adaptors from table 4
PT100-4	Metal Case - removable gauge panel 4 gauges from table 1 2 hoses 2 meters long from table 2 4 test points from table 3 4 adaptors from table 4
PT100-6	Metal Case - removable gauge panel 6 gauges from table 1 6 hoses 2 meters long from table 2 6 test points from table 3 4 adaptors from table 4
PT200-8	Compact case 8 gauges from table 1 (complete with rubber cover) 3 hoses 2 meters long from table 2 7 test points from table 3 2 adaptors from table 4

See Contents tables on next page

Test kits can be modified or assembled to your specifications, Please contact sales office

Order specification sheet

Choose kit type

Kit	Part Number	
PT200-2	FT9212-1	
PT100-4	FT5823	
PT100-6	FT7915	
PT200-8	FT10278	

Table 1 - Pressure Gauges
Glycerine filled, 2.5" dial, dual scale psi/bar

Pressure range: psi	Part number	Quantity Required
0 - 160	FT5274-1	
0 - 300	FT5274-2	
0 - 600	FT5274-3	
0 - 1000	FT5274-6	
0 - 2000	FT5274-5	
0 - 3000	FT5274-7	
0 - 4000	FT5274-8	
0 - 6000	FT5274-4	

Table 2 - High pressure hoses (2 x M16 female)
Pressure rating 6000 psi at 122 °F. Minimum bend radius 3/4".

Length Inches	Part number	Quantity Required
12	FT9128-030	
39	FT9128-100	
78	FT9128-200	
98	FT9128-250	
157	FT9128-400	
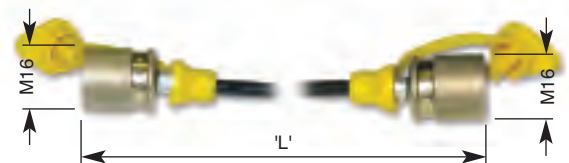
Custom lengths available subject to quantity

Table 3 - Pressure test points
Pressure rating 5800 psi max.

Thread G	L1	AF	Part number	Quantity Required
1/8" BSPT	36	17	8172675	
1/8" BSPP	37	17	8172671	
1/4" BSPT	36	17	8172676	
1/4" BSPP	40	19	FT9742-1	
M8 x1	38	17	8172666	
M10 x1	38	17	8172667	
M12 x 1.5	40	17	8172668	
M14 x 1.5	40	19	8172669	
M16 x 1.5	37	22	8172670	
7/16" -20UN #4 SAE ORB	38	17	FT9738-1	
1/8" NPT	38	17	8112618	
1/4" NPT	40	17	8172677	
9/16" -18UN #6 SAE ORB	40	19	8172678	
1/2" -20UN #5 SAE ORB	37	17	FT6777	
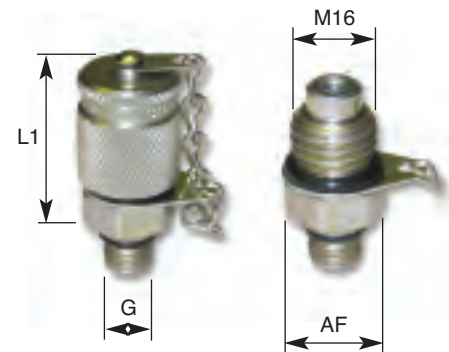
Table 4 - Adaptor fittings

Thread G	L1	L2	AF	Part number	Quantity Required
3/8" BSPP	25	12	25	FT1609	
1/2" BSPP	27	10	25	FT2771	
3/4" BSPP	32	10	32	FT5305	
M18 x 1.5	27	12	25	FT5306	
9/16" -18UN JIC Male	28	15	19	FT1607	
3/4" -16UN JIC Male	25	8	25	FT1606	
7/8" -14UN JIC Male	31	10	25	FT1605	
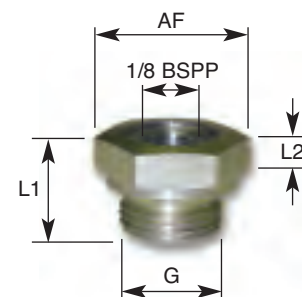
Pressure Test Points, Hoses, Gauges & Adaptors

Pressure Gauge Connectors
6000 psi (Bulkhead; connects FT9128-XXX hose to pressure gauge)

Model No.	Description
GA2504-1A	Adaptor, 1/4" NPT female to M16 x 2 male
GA2504-1	Adaptor, 1/4" BSP female to M16 x 2 male

1/4" NPT or BSP female connects to gauge

M16 x 2 Male connects to hose

Pressure Gauge Connectors
6000 psi (Direct; connects pressure gauge directly to test point)

Model No.	Description
GD2504-1A	Adaptor, 1/4" NPT female to M16 x 2 female
GD2504-1	Adaptor, 1/4" BSP female to M16 x 2 female
GD2504-4S	Adaptor, 7/16" -20UN #4 SAE ORB female to M16 x 2 female

1/4" NPT or BSP female connects to gauge
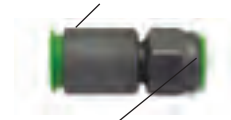
M16 x 2 female connects to PT2502 test points

Hose Union
6000 psi (M16 x 2 Male-Male; connects two FT9128-XXX hoses together)

Model No.	Description
PA2505	M16x2 Male to M16 x 2 Male

M16 x 2 Thread

0.75 AF, Connects two PH2503 hoses together

SPG Series Pressure Gauge

Standard Features:
- 1/4" NPT bottom or rear connection
- 2.5" Diameter
- SST Case
- Glycerine Filled
- Dual Calibration psi / bar
- Phosphor Bronze Bourdon Tube
- Temperature Range -40° to 180°F
- Bronze Connection

Bottom connection (S)			Center Back Connection (C)		
Pressure Range		Part No	Pressure Range		Part No.
psi	bar		psi	bar	
30	2	SPG25-30S	30	2	SPG25-30PC
60	4	SPG25-60S	60	4	SPG25-60PC
100	7	SPG25-100S	100	7	SPG25-100PC
160	11	SPG25-160S	160	11	SPG25-160PC
200	14	SPG25-200S	200	14	SPG25-200PC
300	20	SPG25-300S	400	25	SPG25-300PC
600	40	SPG25-600S	500	35	SPG25-600S
1000	70	SPG25-1KS	1000	70	SPG25-1KPC
1500	100	SPG25-1K5S	1500	100	SPG25-1K5PC
2000	140	SPG25-2KS	2000	140	SPG25-2KPC
3000	200	SPG25-3KS	3000	200	SPG25-3KPC
4000	270	SPG25-4KS	4000	270	SPG25-4KPC
5000	350	SPG25-5KS	5000	350	SPG25-5KPC
6000	400	SPG25-6KS	6000	400	SPG25-6KPC
10000	680	SPG25-10KS	10000	680	SPG25-10KPC

Quadrigauges

Standard Features:
- Three gauges, four functions: vacuum, low, medium and high pressure
- Cut-out valve prevents excess pressure on low range gauges
- 1/8" NPT male hose connection

Glycerin Filled Gauge
Measures only 8 3/8" in diameter, 6000 psi maximum pressures

Low pressure gauge in all models read to 30 In. Hg vacuum

- Reads pressure in psi, kg/cm2, vacuum in inches Hg and cms Hg.
- Compatible with mineral base hydraulic fluids
- Includes bleed screw
- Dust and moisture resistant case

Model Number	Gauge Type	Hose Length (Inches)	Vacuum "hg	Low psi	Medium psi	High psi
02-740-011	Dry	12	0 - 30	0 - 150	0 - 600	0 - 3000
03-740-019		36				0 - 5000
12-740-008	Filled **	36		0 - 250	0 - 900	0 - 6000
** Glycerine Filled Gauge						

ILFC Series In-Line Fixed Flow Control

Flow Control Valves maintain the flow rate of hydraulic fluid to a specified value.

Features
- Pressure compensated to ensure a constant flow rate under varying pressures.
- Pre-set in factory to customer requirements at any flow rate between 0.4 to 4.2 gpm.
- Uncontrolled flow is permitted in reverse direction.
- Zinc plated clear passivate.
- Cartridge version available, without steel body.

Flow Ranges: 0.4 - 3.7 gpm (1/4" ports), 0.4 - 4.2 gpm (3/8" ports)
Maximum Pressure: 3000 psi
Ports: BSPP, NPTF & SAE

VFC Series Pressure Compensated Constant Flow Valves

Variable Flow Control Valves maintain the flow rate of hydraulic fluid to a selected value.

Features
- Pressure compensated to ensure a constant flow rate under varying pressures.
- Knurled knob enables fast, accurate adjustment of flow rate in one direction (under pressure)
- Knurled knob can be locked in position by a grub (set) screw and provides weatherproof sealing to prevent the adjusting screw from corroding or seizing.
- Free (uncontrolled) flow is permitted in reverse direction.
- Special, Uni-directional version available on request.

Flow Ranges: 0.4 - 5.2 gpm (1/4" ports), 0.5 - 10 gpm (3/8" ports), 0.5 - 14.5 gpm (1/2" ports)
Maximum Pressure: 3000 psi
Ports: BSPP, NPTF & SAE

FV120 Series Fixed Priority Flow Divider

Priority Type Flow Dividers split a single input flow into a 'Priority' (regulated) flow and a 'By-Pass' (excess) flow which can be returned directly to the oil reservoir or used to power a second system. This often dispenses with the need for another pump to operate a second system.

Features
- 'Priority' flow rate is pre-set in factory to customer specifications at any value between 1 gpm and 9 gpm in increments of 1 gpm. Flow through the 'Priority' port will remain constant at the pre-set value as long as input flow equals or exceeds the Priority flow value.
- Pressure compensated permitting both 'Priority' and 'By-Pass' flows to be used simultaneously at varying pressures without effecting the 'Priority' flow rate.
- Built-in pressure relief valve protects the 'Priority' circuit from excess pressure and is adjustable from 500 psi to 3000 psi (Factory set 1200 psi unless otherwise specified).

Total Flow Capacity: 20 gpm
Maximum Pressure: 3000 psi

Ports
Inlet and By-Pass Port: 1/2" NPTF, 1/2" BSPP, 7/16" -20UN #4 SAE ORB
Priority and Relief Port: 3/8" NPTF, 3/8" BSPP, 9/16" -18UN #6 SAE ORB

FV200 Series Fixed Proportional Flow Divider

Proportional Flow Dividers split a single input flow into two output flows, each output being a fixed proportion of the input. For example, a 50/50 flow divider will always split a single input flow into two equal output flows which could be used to operate two motors at equal speeds. The actual rate of flow from each output is not fixed but will vary as the input flow rate varies.

Features
- Pressure compensated to keep each output flow at a fixed percentage of the input flow, regardless of pressure variations between the output ports.
- Three standard models are available giving proportional splits of 25 / 75%, 50% / 50% and 40% / 60%. Other proportional splits are available up to 10% / 90%.
- Three flow ranges are available.

Flow Ranges: 2.6 - 8 gpm, 5.3 - 13 gpm, 10.5 - 20 gpm
Maximum Pressure: 3000 psi

Ports
Inlet Port: 1/2" BSPP, 3/4" BSPP
Outlet Ports: 3/8" BSPP, 3/4" BSPP

VFD50 Series Variable Priority Flow Divider

Priority Type Flow Dividers split a single input flow into a 'Priority' (regulated) flow and a 'By-Pass' (excess) flow which can be returned directly to the oil reservoir or used to power a second system. In many instances this dispenses with the need for another pump to operate a second system.

Features
- Clearly marked hand-dial permits fast visual adjustments to pre-determined 'Priority' flow and fast easy adjustment of 'Priority' circuit to meet varying requirements.
- Pressure compensated permitting both 'Priority and 'By-Pass' flows to be used simultaneously at varying pressures without effecting the Priority flow rate.

Flow Ranges: 0 - 4 gpm, 0 - 8 gpm
Maximum Pressure: 3600 psi
Ports: 3/8" BSPP x 3 Ports, Manifold Mounted, 3/8" NPTF x 3 Ports

2FV2V Series Flow Divider with Manual Priority Control

Priority Type Flow Dividers split a single input flow into a 'Priority' (regulated) flow and a 'By-Pass' (excess) flow which can be returned directly to the oil reservoir or used to power a second system. In many instances this dispenses with the need for another pump to operate a second system.

Features
- Clearly marked single-turn hand dial permits fast visual adjustments to pre-determined 'Priority' flow and fast easy adjustments of 'Priority' circuit to meet varying requirements.
- Pressure compensated permitting both 'Priority' and 'By-Pass' to be used simultaneously at varying pressures without affecting the 'Priority' flow rate.
- All models (except manifold mount) can be supplied with an adjustable pressure relief valve or check valve on 'Priority' flow. Anti-cavitation check valve can be routed between the 'By-Pass' and 'Priority' flows.
- Anti-tamper locknut option available for all models, Contact sales office for more information.
- For intermittent reverse flow, needle valve 'pull back' facility available on request.
- Remote control versions available.

Flow Ranges: 0 - 3 gpm, 0 - 5 gpm, 0 - 8 gpm, 0 -12.5 gpm, 0 - 20 gpm, 0 - 25 gpm, 0 - 30 gpm
Maximum Pressure: 3600 psi

Port Threads Inlet Regulated Flow and Excess Flow:
3/4" BSPP, 3/4" NPTF, M22 x 1.5, M27 x 2, 1-1/16" -12UN #12 SAE ORB, 1/2" BSPP,
Manifold mounted (custom hole pattern)

Other Variable Priority Flow Dividers avaliable

RV2FV2V Variable Priority Flow Divider with Relief Internally Drained
Specifications as above with relief from Priority to Bypass

RVX2FV2V Variable Priority Flow Divider with Relief Externally Drained
Specifications as above with relief from Priority to External Drain

AC2FV2V Variable Priority Flow Divider with Anti Cavitation Check from Priority to Bypass

CK2FV2V Variable Priority Flow Divider with Reverse Flow Check from Priority to Inlet

2FV2V Series Flow Divider with Electric Motor Drive

Priority Type Flow Dividers split a single input flow into a 'Priority' (regulated) flow and a 'By-Pass' (excess) flow which can be returned directly to the oil reservoir or used to power a second system. In many instances this dispenses with the need for another pump to operate a second system.

Features
- Minimum to full Priority flow in 15 seconds.
- Powered from Nom. 12 VDC (12 - 16 VDC).
- Electric motor drive permits adjustment from a position away from the valve such as a cab or a control panel.
- Pressure compensated permitting both 'Priority' and 'By-Pass' flows to be used simultaneously at varying pressures without effecting the 'Priority' flow rate.
- Can be used as unidirectional two port in line flow control by plugging the 'By-Pass' flow port. (**Note:** in this configuration a relief valve must be used on the inlet line).
- 24 volt versions available on request

Flow Ranges: 0.15 - 3 gpm, 0.15 - 5 gpm, 0.15 - 8 gpm, 0.15 -12.5 gpm, 0.15 - 20 gpm, 0.15 - 25 gpm, 0.15 -30 gpm
Maximum Pressure: 3600 psi

Ports
Port Threads Inlet Regulated Flow and Excess Flow:
3/4" BSPP, 3/4" NPTF, M22 x 1.5, M27 x 2, 1-1/16" -12UN #12 SAE ORB, 1/2" BSPP, Manifold mounted (custom hole pattern)

FDM Series Flow Divider with Remote Priority Control

The FDM remote control flow divider is ideally suited for the agricultural and industrial user seeking a cost-effective method of controlling hydraulic motor speed. The priority flow port gives an output independent of load pressure while the By-Pass port can be used to power a secondary circuit.

Features
- Minimum to maximum priority flow in less than 3 seconds (at full pressure)
- 9 - 28 V D.C. supply enables unit to be powered from a vehicle supply
- Remote control using: Potentiometer (shown above), 0 - 5 VDC, 4 - 20 mA loop
- Remote operating distance: up to 130 feet
- Pressure compensated permitting both 'priority' and 'By-Pass' flow to be used simultaneously at varying pressures without affecting the 'priority' flow rate
- Automatic current limiting to prevent overheating and motor overload
- Valve settings immune to power failure
- Tolerant to vibration and oil contamination
- Valve cover zinc plated and Teflon® coated for corrosion resistance
- Designed to meet Nema type 5
- Range of cables available please contact sales office

Flow Ranges: 0.15 - 3 gpm, 0.15 - 5 gpm, 0.15 - 8 gpm, 0.15 -12.5 gpm, 0.15 - 20 gpm, 0.15 - 25 gpm, 0.15 -30 gpm
Maximum Pressure: 3600 psi

Port Threads Inlet Regulated Flow and Excess Flow:
3/4" BSPP, 3/4" NPTF, M22 x 1.5, M27 x 2, 1-1/16" -12UN #12 SAE ORB, 1/2" BSPP

2FV2V Series Manifold Mounted Variable Priority Flow Divider

Priority Type Flow Dividers split a single input flow into a 'Priority' (regulated) flow and a 'By-Pass' (excess) flow which can be returned directly to the oil reservoir or used to power a second system. In many instances this dispenses with the need for another pump to operate a second system.

Features
- Pressure compensated permitting both 'Priority' and 'By-Pass' flows to be used simultaneously at varying pressures without affecting the 'Priority' flow rate.
- Can be used as uni-directional two port in line flow control by plugging the 'By-Pass' flow port. (**Note:** in this configuration a relief valve must be used on the inlet line).
- Manifold Mounted.
- Anti-tamper locknut option available for all models, Contact sales office for more information.
- For intermittent reverse flow, needle valve 'pull back' facility available on request.

Flow Ranges: 0 - 3 gpm, 0 - 5 gpm, 0 - 8 gpm, 0 -12.5 gpm
Maximum Pressure: 3600 psi

Ports: Manifold Mounted

FDC60 Fixed Flow Divider

A Flow Divider-Combiner will divide a single flow into two separate flows which will always be in the same ratio to each other regardless of any pressure differential between the two lines. If the flow is reversed (e.g. return stroke of two cylinders) the return flows are held in the same ratio to each other and combined into a single flow, regardless of individual loads on the cylinders

Features
- Pressure compensated to keep the two divided flow rates at the same ratio regardless of pressure variations between them.
- Flow ratios are pre-set at factory from 50% - 50% up to 10% - 90%.
- Flow ranges are available from 1.3 - 18.5 gpm.
- Cast iron/hardened steel construction (no aluminium) makes it suitable for mining applications.

Flow Ranges: 0.5 - 1.3 gpm, 1.3 - 2.6 gpm, 2.1 - 5.3 gpm, 4.2 - 8 gpm, 6.6 - 10 gpm, 9 - 13 gpm
12 - 16 gpm, 14.5 - 18.5 gpm
Maximum Pressure: 4500 psi

Ports: Contact sales for detailed Porting information

SV80 Series Diverter Valve

A Diverter Valve provides an alternative to the standard directional control valve when a neutral position is not required. It allows flow to be directed into either of two lines which enables fast changing from one system to another, or from one system to tank thus providing an idling circuit.

Features
- Flow may be directed by mechanically pushing the spool with spring offset or by a mechanical push pull operation in which case the valve stem is threaded or fitted with a moulded knob.
- Customer can select from one of two spool types allowing flow to be diverted from one line to another or from system to tank.
- A choice of port threads are available.
- Special versions also available.

Maximum Flow: 20 gpm
Maximum Pressure: 3000 psi

Ports: 1/2" BSPP, 7/8" -14UN #10 SAE ORB, M22 x 1.5, 1/2" NPTF

Operation: Spring Offset, Mechanical Push - Manual, Push - Pull - Threaded, Push - Pull

DV80 Series Diverter Valve

A Diverter Valve provides an alternative to the standard directional control valve when a neutral position is not required. It allows flow to be directed into either of two lines which enables fast changing from one system to another, or from one system to tank thus providing an idling circuit.

Features
- Flow may be directed by mechanically pushing the spool with spring offset.
- Customer can select from one of two spool types allowing flow to be diverted from one line to another or from system to tank.
- A choice of port threads and spool end types are available.
- Spring and spool end protected from environment in sealed housing.
- Special versions also available

Maximum Flow: 20 gpm
Maximum Pressure: 3000 psi

Ports: 1/2" BSPP, 7/8" -14UN #10 SAE ORB

Operation: Roller, Ball, Manual

180 Series Manual Directional Control Valve

The Directional Control Valve of the rotary spool type consists of a rotor which is rotated with respect to the valve body. When the rotor is placed in selected positions inlet and outlet ports are connected in various combinations permitting the start, stop or directional change of fluid under pressure. The functions specific to a valve depends primarily on rotor type selected.

Features
- Pressure loaded seats working against optically flat rotors automatically compensated for valve wear to assure near zero leakage even after more than 500,000 cycles.
- Customer can select from numerous variations including 7 flow patterns, 3 flow ratings, many porting configurations, ball or offset ball operating handles, spring centring and detents.
- Valves may be in-line, panel or manifold mounted.
- Valve can be used in series without drain up to a max working pressure of 3600 psi.

Flow Ranges: up to 10 gpm, three sizes available
Maximum Pressure: up to 10000 psi

Ports: NPTF, BSPP & Manifold Mount

BG4D 1/2" Lever Operated Directional Control Valve

The Directional Control Valve of the rotary spool type consists of a rotor which is rotated with respect to the valve body. When the rotor is placed in selected positions inlet and outlet ports are connected in various combinations permitting the start, stop or directional change of fluid under pressure. The functions specific to a valve depends primarily on rotor type selected.

Description
- Nominal flow rate: 14.5 gpm
- Max. operating pressure: 5000 psi
- Max. pressure on 'T' port: 5000 psi
- Recommended operating viscosity range: min. 13 c/st - max 800 c/st
- Recommended operating temperature range: min. -22 °F - max 176 °F
- Recommended filtration: 25 microns or better
- Seals medium nitrile (contact Technical Sales for alternatives)
- Leakage: typical max. allowable on works test 0.004 gpm at 2000 psi, , oil 35 cSt at 104 °F
- Mounting unrestricted

Ports: Contact sales office for details

RV020 Direct In-line relief Valve

Pressure Relief Valves limit the maximum working pressure of a hydraulic system to a pre-determined rating thus providing protection against the overloading of system components.

Features
- Direct acting in-line relief valve giving high tolerance to particle contamination.
- Quick response provides protection against shock loads.
- Relief pressure is factory set to customer requirements within a range between 290 - 3000 psi.
- Straight through porting allows the valve to be connected directly in-line with a T piece thus making the best use of restricted space.
- Provides protection against thermal expansion of fluids.

Maximum Flow: 5 gpm
Maximum Pressure: 3000 psi

Ports: 3/8" NPTF, 3/8" BSPP

YB Series Pumps

Compact, light weight aluminium gear pumps available in six displacements from 0.15 to 0.73 in^3/rev at pressures to 2000 psi continuous, 2500 psi intermittent duty.

MYB Series Motors

Compact, light weight aluminium gear motors available in four displacements from 0.29 to 1.73 in^3/rev. Efficient performance at speeds to 5000 rpm & supply pressure to 2000 psi.

B Series Pumps

Basic - cast iron fixed clearance gear pumps available in nine displacements from 0.11 to 0.74 in^3/rev at pressures to 3500 psi.

MB Series Motors

Basic - cast iron fixed clearance gear motors available in seven displacements from 0.15 to 0.59 in^3/rev at supply pressure to 2500 psi.

YC Series Pumps

Compact, light weight aluminium gear pumps with pressure balanced design available in six displacements from 0.58 to 1.94 in^3/rev at pressures to 2500 psi.

MYC Series Motors

Compact, light weight aluminium gear motors with pressure balanced design available in six displacements from 0.58 to 1.94 in^3/rev and speeds to 5000 rpm.

K Series Pumps

Highly flexible multi-section, rugged, dependable gear pumps with pressure balanced wear plate available in nine displacements from 0.86 to 3.88in^3/rev.

MK Series Motors

Highly flexible, rugged, dependable gear motors available in seven displacements from 1.29 to 3.88 in^3/rev with 1300 lb-in torque at speeds to 2000 rpm with 2500 psi supply pressure.

Imperial

Hydraulic Motor or Engine Torque

$$T = \frac{5252 \times HP}{rpm}$$

Where: T = Torque in pounds feet
HP = Horsepower
rpm = Engine speed in revolutions per minute

Example: What is the torque of an engine that develops 40 HP at 2500 rpm?

$$T = \frac{5252 \times 40}{2500} = 84 \text{ lbs - feet}$$

Axle Torque

The torque available at the driving axle is the hydraulic motor torque multiplied by gear reduction through the transmission and axle.

Where Ta = T x Rta x Ra
Ta = Axle torque (lb in)
Ra = Axle gear reduction
Rta = Gear reduction through auxiliary transmission if used
T = Motor torque (lb in)

Example: What is the rear axle torque in high gear on a vehicle having 1000 lb in motor torque, an auxiliary ratio of 4:1, and an axle ratio of 20:1.

Ta = 1000 x 4 x 20 = 80,000 lb in.

Hydraulic Motor Torque Required

The torque required to slip the wheels is the vehicle weight over the driving tires times the coefficient of friction of the driving tires on rolling surface times the rolling radius of tires divided by the overall gear reduction.

$$ST = \frac{VW \times u \times r}{R}$$

Where VW: = Vehicle weight over driving tires VW (lbs)
u = Coefficient of friction of tires on average road surface, generally 0.6.
T = Rolling radius of loaded driving tire in inches.
R = Overall gear reduction in both axle and transmission.

Hydraulic Motor Torque To Slip Wheels

Example: What is the motor torque required to slip wheels of a vehicle where the weight over he driving tire is 2000lb, the coefficient of friction of the tires is 0.6., the rolling radius is 15 inches. The total reduction of power train is 10.

$$ST = \frac{2000 \times .6 \times 15}{10} = 1800 \text{ lb in}$$

Hydraulic Motor Speed From mph

The motor speed is obtained by multiplying 168 by the ratio of the power train by the miles per hour and diving this sum by the rolling radius of the tire.

$$rpm = \frac{168 \times R \times mph}{r}$$

Metric

Hydraulic Motor or Engine Torque

$$T = \frac{9.545 \times P}{rpm}$$

Where: T = Torque in newton metre (N m)
P = Power in watts (W)
rpm = Engine speed in revolutions per minute

Example: What is the torque of an engine that develops 30,000w at 2500 rpm?

$$T = \frac{9.545 \times 30,000}{2500} = 114.54 \text{ N-m}$$

Axle Torque

The torque available at the driving axle is the hydraulic motor torque multiplied by gear reduction through the transmission and axle.

Where Ta = T x Rta x Ra
Ta = Axle torque (N m)
Ra = Axle gear reduction
Rta = Gear reduction through auxiliary transmission if used
T = Motor torque (N m)

Example: What is the rear axle torque in high gear on a vehicle having 100 Nm in motor torque, an auxiliary ratio of 5:1, and an axle ratio of 20:1.

Ta = 100 x 5 x 20 = 10,000 N m.

Hydraulic Motor Torque Required

The torque required to slip the wheels is the vehicle weight over the driving tires times the coefficient of friction of the driving tires on rolling surface times the rolling radius of tires divided by the overall gear reduction.

$$ST = \frac{VW \times u \times r}{R \times 101.97}$$

Where VW: = Vehicle weight over driving tires VW (kg)
u = Coefficient of friction of tires on average road surface, generally 0.6.
r = Rolling radius of loaded driving tire in millimetres.
R = Overall gear reduction in both axle and transmission.

Hydraulic Motor Torque To Slip Wheels

Example: What is the motor torque required to slip wheels of a vehicle where the weight over the driving tire is 1000 kg, the coefficient of friction of the tires is 0.6., the rolling radius is 400 mm. The total reduction of power train is 10.

$$ST = \frac{1000 \times 0.6 \times 400}{10 \times 101.97} = 235.36 \text{ Nm}$$

Hydraulic Motor Speed From kph

The motor speed is obtained by multiplying 2651.51 by the ratio of the power train by the kilometres per hour and dividing this sum by the rolling radius of the tire.

$$rpm = \frac{2651.51 \times R \times kph}{r}$$

Imperial

168	=	Factor
rpm	=	Revolutions per minute of engine
r	=	Rolling radius of loaded drive tire in inches
R	=	Overall gear reduction including both axle and transmission
mph	=	Vehicle speed in miles per hour

Example: Find the motor speed where the overall gear reduction is 10, vehicle speed is 15 mph and rolling radius of driving tire is 15 inches. 1680 rpm

$$rpm = \frac{168 \times 10 \times 15}{15} = 1680 \text{ rpm}$$

Miles Per Hour From Motor Speed

Vehicles speed in miles per hour is the rolling radius of loaded driving tire multiplied by the motor rpm and divided by 168 times the overall gear reduction of the power train.

$$mph = \frac{rpm \times r}{168 \times R}$$

168	=	Factor
rpm	=	Revolutions per minute of the motor
r	=	Rolling radius of loaded driving tire in inches
R	=	Overall gear reduction including both axle and transmission
mph	=	Vehicle speed in miles per hour

Example: Find the mph of a vehicle where the motor speed is 1680 rpm, the rolling radius of loaded driving tire is 15 inches and the overall gear reduction is 10.

$$mph = \frac{1680 \times 15}{168 \times 10} = 15 \text{ mph}$$

Tractive Effort

The tractive effort is obtained by multiplying the torque by the total ratio of power train and dividing this sum by the rolling radius of the driving tires.

$$TE = \frac{T \times R}{r}$$

Where: T	=	Motor torque in lb. in.
R	=	Overall gear reduction including both axle and transmission.
r	=	Rolling radius of loaded driving tire in inches.

Example: Find the tractive effort where the rolling radius of driving tires is 15 inches, the total ratio of power train is 10, the motor torque is 1000 lb in.

$$TE = \frac{1000 \times 10}{15} \quad 667$$

Overall Gear Reduction

The overall gear reduction is the rpm times the rolling radius of the loaded driving tire divided by 168 times the vehicle speed in miles per hour.

$$R = \frac{rpm \times r}{168 \times mph}$$

Metric

2651.51	=	Factor
rpm	=	Revolutions per minute of engine
r	=	Rolling radius of loaded drive tire in millimetres
R	=	Overall gear reduction including both axle and transmission
mph	=	Vehicle speed in kilometres per hour

Example: Find the motor speed where the overall gear reduction is 10, vehicle speed is 20 kph and rolling radius of driving tire is 400 millimetres.

$$rpm = \frac{2651.51 \times 10 \times 20}{400} \quad 1325.75 \text{ rpm}$$

Kilometres Per Hour From Motor Speed

Vehicles speed in kilometres per hour is the rolling radius of loaded driving tire multiplied by the motor rpm and divided by 2651.51 times the overall gear reduction of the power train.

$$kph = \frac{rpm \times r}{2651.51 \times R}$$

2651.51	=	Factor
rpm	=	Revolutions per minute of the motor
r	=	Rolling radius of loaded driving tire in millimetres
R	=	Overall gear reduction including both axle and transmission
kph	=	Vehicle speed in kilometres per hour

Example: Find the kph of a vehicle where the motor speed is 1326 rpm, the rolling radius of loaded driving tire is 400 millimetres and the overall gear reduction is 10.

$$kph = \frac{1326 \times 400}{2651.51 \times 10} = 20 \text{ kph}$$

Tractive Effort

The tractive effort is obtained by multiplying the torque by the total ratio of power train and dividing this sum by the rolling radius of the driving tires.

$$TE = \frac{T \times R \times 1000}{r}$$

Where: T	=	Motor torque in lb in.
R	=	Overall gear reduction including both axle and transmission.
r	=	Rolling radius of loaded driving tire in millimeters.

Example: Find the tractive effort where the rolling radius of driving tires is 400 millimetres, the total ratio of power train is 10, the motor torque is 115 Nm.

$$TE = \frac{115 \times 10 \times 1000}{400} = 2875 \text{ N}$$

Overall Gear Reduction

The overall gear reduction is the rpm times the rolling radius of the loaded driving tire divided by 2651.51 times the vehicle speed in kilometres per hour.

$$R = \frac{rpm \times r}{2651.51 \times kph}$$

Imperial

168	=	Factor
rpm	=	Revolutions per minute of engine
r	=	Rolling radius of loaded driving tire in inches
R	=	Overall gear reduction including both axle and transmission
mph	=	Vehicle speed in miles per hour

Example: Find out overall gear reduction of a vehicle where the motor speed is 1680 rpm, the rolling radius of loaded driving tire is 15 inches and the mph is 15.

$$R = \frac{1680 \times 15}{168 \times 15} \quad 10 \text{ to } 1$$

Rolling Radius Of Loaded Driving Tire

The rolling radius of loaded driving tire is 168 times the overall gear reduction times the miles per hour divided by the engine speed.

$$r = \frac{168 \times R \text{ mph}}{rpm}$$

168	=	Factor
rpm	=	Revolutions per minute of the motor
r	=	Rolling radius of loaded driving tires in inches
R	=	Overall gear reduction including both axle and transmission
mph	=	Vehicle speed in miles per hour

Example: Find the rolling radius of loaded driving tire of a vehicle where the overall gear reduction is 10, the miles per hour 15 and the engine speed 1680 rpm.

$$r = \frac{168 \times 10 \times 15}{1680} = 15 \text{ inches}$$

Road Rolling Resistance

The road rolling resistance is the force required to push a vehicle over the surface it is rolling over and maybe expressed in several ways. One, in terms of pounds resistance per thousand pounds of gross weight. Other methods are derived from this basic expression. Following is a table of rolling resistance in pounds per thousand pounds of gross weight for various road surfaces.

Rolling resistance is the gross vehicle weight in lbs, times the rolling resistance of the surface divided by 1000.

$$RR = \frac{GVW \times R}{1000}$$

Where: RR	=	Road rolling resistance in pounds
GVW	=	Gross vehicle weight in pounds
R	=	Rolling resistance in pounds per thousand pounds vehicle weight
1000	=	A constant to determine number of thousand pounds in vehicle

Example: What is the rolling resistance of a vehicle with a gross weight of 10,000 pounds on poor asphalt

$$RR = \frac{10,000 \times 22}{1000} = 220 \text{ lbs}$$

Metric

2651.51	=	Factor
rpm	=	Revolutions per minute of engine
r	=	Rolling radius of loaded driving tire in millimetres
R	=	Overall gear reduction including both axle and transmission
kph	=	Vehicle speed in kilometres per hour

Example: Find out overall gear reduction of a vehicle where the motor speed is 1680 rpm, the rolling radius of loaded driving tire is 381mm and the kph is 24.

$$R = \frac{1680 \times 381}{2651.51 \times 24} \quad 10 \text{ to } 1$$

Rolling Radius Of Loaded Driving Tire

The rolling radius of loaded driving tire is 2651.51 times the overall gear reduction times the kilometres per hour divided by the engine speed.

$$r = \frac{2651.51 \times R \times kph}{rpm}$$

2651.51	=	Factor
rpm	=	Revolutions per minute of the motor
r	=	Rolling radius of loaded driving tires in millimetres
R	=	Overall gear reduction including both axle and transmission
kph	=	Vehicle speed in kilometers per hour

Example: Find the rolling radius of loaded driving tire of a vehicle where the overall gear reduction is 10, the kilometres per hour 20 and the engine speed 1500 rpm.

$$r = \frac{2651.51 \times 10 \times 20}{1500} = 353.5 \text{ mm}$$

Road Rolling Resistance

The road rolling resistance is the force required to push a vehicle over the surface it is rolling over a maybe expressed in several ways. One, in terms of newtons resistance per hundred kilograms of gross weight. Other methods are derived from this basic expression. Following is a table of rolling resistance in pounds per thousand pounds of gross weight for various road surfaces.

Rolling resistance in Newton per hundred kilograms is the gross vehicle weight in kg, times the rolling resistance of the surface divided by 100.

$$RR = \frac{GVW \times R}{100}$$

Where: RR	=	Road rolling resistance in newtons
GVW	=	Gross vehicle weight in kilograms
R	=	Rolling resistance in newtons per hundred kilograms vehicle weight
100	=	A constant to determine number of 100 kg in vehicle

Example: What is the rolling resistance of a vehicle with a gross weight of 4,500 kg on poor asphalt

$$RR = \frac{4,500 \times 22}{100} = 990 \text{ lbs}$$

Imperial

Many formula are arranged to use the rolling resistance in the table below as a factor. To set the table data up in factor form divide the resistance in lbs by 1000.

$$Q = \frac{R}{1000}$$

Where: Q = Rolling resistance factor per pound of gross vehicle weight.

R = Rolling resistance in pounds per thousand pounds vehicle weight.

Example: What is the rolling resistance factor per pound of gross vehicle weight on poor concrete?

$$Q = \frac{20}{1000} = .02$$

Another method of expressing road rolling resistance is percent of grade. To express rolling resistance in percent of grade multiply rolling resistance per thousand pounds vehicle by 100 and divide by 1000.

$$RR\% = \frac{R \times 100}{1000}$$

Where: RR% = Road rolling resistance in percent Grade of grade

R = Rolling resistance pounds per thousand pounds vehicle weight

100 = A constant to express percent.

Example: What is the road rolling resistance expressed in percent of grade of a vehicle on poor concrete?

$$RR\% = \frac{20 \times 100}{1000} = 2\%$$

Table Of Rolling Resistance In Pounds Per 1000 Pounds Of Gross Weight

Concrete, excellent	10 lbs
Concrete, good	15 lbs
Concrete, poor	20 lbs
Asphalt, good	12 lbs
Asphalt, fair	17 lbs
Asphalt, poor	22 lbs
Macadam, good	15 lbs
Macadam, fair	22 lbs
Macadam, poor	37 lbs
Cobbles, ordinary	55 lbs
Cobbles, poor	85 lbs
Snow, 2 inch	25 lbs
Snow, 4 inch	37 lbs
Dirt, smooth	25 lbs
Dirt, sandy	37 lbs
Mud	37 lbs to 150 lbs
Sand, level soft sand	60 lbs to 150 lbs
Sand, dune	160 lbs to 300 lbs

Metric

Many formula are arranged to use the rolling resistance in the table below as a factor. To set the table data up in factor form divide the resistance in N by 100

$$Q = \frac{R}{100}$$

Where: Q = Rolling resistance factor per kilogram of gross vehicle weight.

R R = Rolling resistance in newtons per hundred kilograms vehicle weight.

Example: What is the rolling resistance factor per kilogram of gross vehicle weight on poor concrete?

$$Q = \frac{20}{100} = .2$$

Another method of expressing road rolling resistance is percent of grade. To express rolling resistance in percent of grade multiply rolling resistance per hundred kilograms vehicle by 100 and divide by 1000.

$$RR\% = \frac{R \times 100}{1000}$$

Where: = Road rolling resistance in percent of RR% grade

R = Rolling resistance newtons per hundred kilograms vehicle weight

100 = A constant to express percent.

1000 = 100 x 10 (factor to account for discrepancy between newtons and kilograms).

Example: What is the road rolling resistance expressed in percent of grade of a vehicle on poor concrete?

$$RR\% = \frac{20 \times 100}{1000} = 2\%$$

Table Of Rolling Resistance In Newtons Per 100 Kilogram Of Gross Weight

Concrete, excellent	10 N
Concrete, good	15 N
Concrete, poor	20 N
Asphalt, good	12 N
Asphalt, fair	17 N
Asphalt, poor	22 N
Macadam, good	15 N
Macadam, fair	22 N
Macadam, poor	37 N
Cobbles, ordinary	55 N
Cobbles, poor	85 N
Snow, 2 inch	25 N
Snow, 4 inch	37 N
Dirt, smooth	25 N
Dirt, sandy	37 N
Mud	37 N to 150 N
Sand, level soft sand	60 N to 150 N
Sand, dune	160 N to 300 N

Imperial
Draw Bar Pull

The torque on the driving axle creates a force between the tires and the road which is used to propel the vehicle. This gross force is termed the tractive effort and the net force, that is, gross force minus rolling resistance is the draw bar pull.

$$DP = \frac{T \times R}{r} - \frac{RR}{1000} \times GVW$$

Where: DP = Draw bar pull in lbs
T = Motor torque in lb-in
R = Overall gear reduction including both axle and transmission
r = Rolling radius of loaded driving tire in inches
RR = Road rolling resistance in pounds
GVW = Gross vehicle weight of motive vehicle in pounds

Example: What is the draw bar pull of a vehicle with a motor torque of 1000 lb-in, an overall gear reduction of 10:1 and rolling radius of the driving tire is 15 inches and a GVW of 10,000 lbs over good concrete?

$$DP = \frac{1000 \times 10}{15} - \frac{15}{1000} \times 10000 = 516 \text{ lbs}$$

Gradeability

Obviously, the tractive effort available at the wheels must be greater than the sum of the rolling resistance encountered. If this is not so, the transmission must be shifted to a lower gear in order to increase the tractive effort. The percentage of grade which can be negotiated is given by the formula.

$$G = \frac{100 \times T \times R}{r \times GVW} - RR$$

Where: 100 = A constant expressing percentage grade and inches.
T = Motor torque in lb inches
R = Overall gear reduction including both axle and transmission
T = Rolling radius of loaded driving tire in inches
GVW = Gross vehicle weight in pounds
RR = Rolling resistance expressed in percentage grade.

Example: What percentage grade can be negotiated by a vehicle having a hydraulic motor torque of 1000 lb inches, an overall gear reduction in high of 12 to 1, a tire rolling radius of 15 inches and a gross vehicle weight of 10,000 lbs over good concrete.

$$G = \frac{100 \times 1000 \times 12}{15 \times 10,000} - 1.5\%$$

G = 8 - 1.5 = 6.5%

Grade Resistance

The grade resistance of a vehicle is .01 times the gross weight times the percentage grade.

GR = .01 x GVW x % grade
Where: GR = Grade resistance
GVW = Gross vehicle weight

Example: What is the grade resistance of a vehicle having a gross weight of 10,000 lbs. on a 5% grade?

GR = .01 x 10,000 x 5 = 500 lbs

Metric
Draw Bar Pull

The torque on the driving axle creates a force between the tires and the road which is used to propel the vehicle. This gross force is termed the tractive effort and the net force, that is, gross force minus rolling resistance is the draw bar pull.

$$DP = \frac{T \times R}{r} - \frac{RR}{100} \times GVW$$

Where: DP = Draw bar pull in newtons
T = Motor torque in newton metre's
R = Overall gear reduction including both axle and transmission
r = Rolling radius of loaded driving tire in millimetres
RR = Road rolling resistance in newtons
GVW = Gross vehicle weight of motive vehicle in kilograms

Example: What is the draw bar pull of a vehicle with a motor torque of 115 N m, an overall gear reduction of 10:1 and rolling radius of the driving tire is 400 millimetres and a GVW of 4,500 kilograms

$$DP = \frac{115 \times 10 \times 1000}{15} - \frac{15}{100} \times 4500 = 2200 \text{ N}$$

Gradeability

Obviously, the tractive effort available at the wheels must be greater than the sum of the rolling resistances encountered. If this is not so, the transmission must be shifted to a lower gear in order to increase the tractive effort. The percentage of grade which can be negotiated is given by the formula.

$$G = \frac{T \times R \times 10200}{r \times GVW} - RR$$

Where: 1000 = Factor
T = Motor torque in newton metre's
R = Overall gear reduction including both axle and transmission
r = Rolling radius of loaded driving type in millimetres
GVW = Gross vehicle weight in kilograms
RR = Rolling resistance expressed percentage grade.

Example: What percentage grade can be negotiated by a vehicle having a hydraulic motor torque of 117 newton metre's, an overall gear reduction in high of 12 to 1, a tire rolling radius of 400 mm and a gross vehicle weight of 4,500 kg over good concrete.

$$G = \frac{117 \times 121 \times 200}{400 \times 4500} - 1.5\%$$

G = 8 - 1.5 = 6.5%

Grade Resistance

The grade resistance of a vehicle is 0.0981 times the gross weight times the percentage grade.

GR = 0.0981 x GVW x % grade
Where: GR = Grade resistance in newtons
GVW = Gross vehicle weight in kilograms

Example: What is the grade resistance of a vehicle having a gross weight of 4,500 kg. on a 5% grade?

GR = 0.0981 x 4,500 x 5 = 2207.25 N

Imperial

Air Resistance

The air resistance against a vehicle is a force in lbs equal to .0025 times the miles per hour squared times the frontal area.

Where: AR	=	.0025 mph^2 x FA
AR	=	Air resistance in lbs
mph	=	Speed in miles per hour
FA	=	Frontal area of vehicle in sq. ft

Example: What is the air resistance of a vehicle travelling 40 miles per hour and having a frontal area of 80 square feet?

AR	=	.0025 x (40)2 x 80 = 320 lbs

Horsepower Required To Overcome Air Resistance

The horsepower required to overcome air resistance is the speed in miles per hour, cubed, times the frontal area in square feet divided by 150,000

$$HP = \frac{mph^3 \times FA}{150,000}$$

mph	=	Speed in miles per hour
FA	=	Frontal area in square feet
HP	=	Horsepower
150,000	=	A conversion constant

Example: What is the horsepower required to overcome air resistance of a vehicle travelling 40 miles per hour and having a frontal area of 80 square feet?

$$HP = \frac{40^3 \times 80}{150,000} = 34.13$$

Ground Speed Of Track Laying Vehicle

The ground speed of a track laying vehicle is the hydraulic motor rpm times the circumference of the driving sprocket divided by 168 times 2 times 3.1416 times the overall gear reduction of the power train.

$$V = \frac{rpm \times C}{168 \times 2 \times 3.1416 \times R}$$

Where: V	=	Ground speed in mph
rpm	=	Rev. per min. of engine
C	=	Circumference
C	=	N x L
N	=	No. of teeth in sprocket
L	=	Length of links in inches
R	=	Overall gear reduction

Example: Find the ground speed in miles per hour where the motor speed is 1800 rpm, the number of teeth in the sprocket is 41, the length of link 8", and the total reduction of power train is 61 to 1.

C	=	41 x 8 = 328

$$V = \frac{1800 \times 328}{168 \times 2 \times 3.1416} \times 61 = 9.169 \text{ mph}$$

Metric

Air Resistance

The air resistance against a vehicle is a force in newtons equal to 0.0462 times the kilometres per hour squared times the frontal area.

Where: AR	=	0.0462 x kph^2 x FA
AR	=	Air resistance in newtons
kph	=	Speed in kilometres per hour
FA	=	Frontal area of vehicle in sq. metre's

Example: What is the air resistance of a vehicle travelling 65 kilometres per hour and having a frontal area of 7.5 m^2?

AR	=	0.0462 x (65)2 x 7.5 = 1464 N

Horsepower Required To Overcome Air Resistance

The power required to overcome air resistance is the speed in kilometres per hour, cubed, times the frontal area in divided by 77.86

$$P = \frac{kph^3 \times FA}{77.86}$$

kph	=	Speed in kilometres per hour
FA	=	Frontal area in square meters
P	=	Power in watt
77.86	=	A conversion factor

Example: What power is required to overcome air resistance of a vehicle travelling 65 kilometres per hour and having a frontal area of 7.5 m^2?

$$P = \frac{(65^3) \times 7.5}{77.86} = 26453.73 \text{ Watts}$$

Ground Speed Of Track Laying Vehicle

The ground speed of a track laying vehicle is the hydraulic motor rpm times the circumference of the driving sprocket divided by 16660 times the overall gear reduction of the power train.

$$V = \frac{rpm \times C}{16660 \times R}$$

Where: V	=	Ground speed in kph
rpm	=	Rev. per min. of engine
C	=	Circumference
C	=	N x L
N	=	No. of teeth in sprocket
L	=	Length of links in millimetres
R	=	Overall gear reduction

Example: Find the ground speed in kilometres per hour where the motor speed is 1800 rpm, the number of teeth in the sprocket is 41, the length of link 200 mm, and the total reduction of power train is 61 to 1.

C	=	41 x 200 = 8200

$$V = \frac{1800 \times 8200}{16660 \times 61} = 14.524 \text{ kph}$$

Viscosity of Hydraulic Oil

The internal resistance to flow of a liquid is measured as viscosity. More precisely absolute viscosity (µ) which is defined in terms of the shear force between two parallel layers of fluid for a certain slip velocity between them.

This is represented by Newton ís equation ($\tau = \mu \, \dfrac{\partial u}{\partial y}$).

Very often a hydraulic fluid will be selected on the basis of its viscosity and the operating temperature of the system. A fluid will flow more easily the less viscous it is, since less energy is required to overcome the internal frictional forces. Any saving in energy must be balanced against an increase in leakage due to the lower fluid viscosity.

There are two measures of viscosity: absolute (also known as dynamic) and kinematic. The S.I. unit for absolute viscosity is N s m^{-2} or Pa.s. The non-S.I. unit is the poise (P) equivalent to 0.1 N s m^{-2} (not to be confused with the poiseuille (Pl), used in France, and equal to 10 poise) though the centipoise (cP) is more commonly used. In the hydraulics industry kinematic viscosity is more frequently used, where:

$$\text{kinematic viscosity} = \frac{\text{dynamic viscosity}}{\text{density}}$$

The S.I. unit for kinematic viscosity (v) is mm^2 s^{-1} which corresponds to the older but still commonly used unit the centistoke (cSt).

Past measures of viscosity using arbitrary scales like Redwood No 1 seconds, Saybolt Universal Seconds (SUS), or degrees Engler should no longer be used. These units have been superseded by the empirical measures previously mentioned; conversion tables do exist but are only true at a fixed temperature.

Effect of temperature on viscosity

The temperature and viscosity of hydraulic oil are inversely related; as temperature increases, viscosity decreases. In order to define the kinematic viscosity of oil, its viscosity is quoted at a set temperature (40°C for the ISO standard) and the oil is given a value according to the viscosity index (V.I.). For example an oil quoted as conforming to ISO 22 will have a viscosity of 22 mm^{2}s^{-1}/ cSt at 40°C.

Viscosity Index

The viscosity index is a single number representation of the viscosity temperature characteristics of a fluid. The greater the value of the V.I. the smaller the change in viscosity for a given change in temperature, and vice-versa. Oils with a V.I. of 80 or more are said to have a high V.I. value. Oils with a V.I. between 80 and 40 are said to have a medium value and those below 40 a low value. Typically mineral oils used by the fluid power industry have a high V.I. of about 100. If temperature and kinematic viscosity are plotted to give a linear relationship (using logarithmic scales) then the V.I. is a measure of the gradient of the line. As the V.I. is increased the gradient is reduced. A typical temperature-viscosity curve for ISO oils can be seen opposite.

Effect of pressure on viscosity

Contrary to popular belief, varying pressure can lead to significant variations in viscosity. In a closed flow circuit at a fixed temperature, a change in pressure of 6000 psi (400 bar) can lead to a change of up to 8% in viscosity. However there are problems in calculating this variation.

Density and specific volume

The density of mineral oils is typically around 870kg m^{-3} (In comparison synthetic oils usually have a density of around 1200kg m^{-3}). The specific gravity, the ratio of the density of the fluid to the density of water, is a dimensionless quantity typically 0.87 for mineral oils.

Graph of Temperature versus Kinematic Viscosity
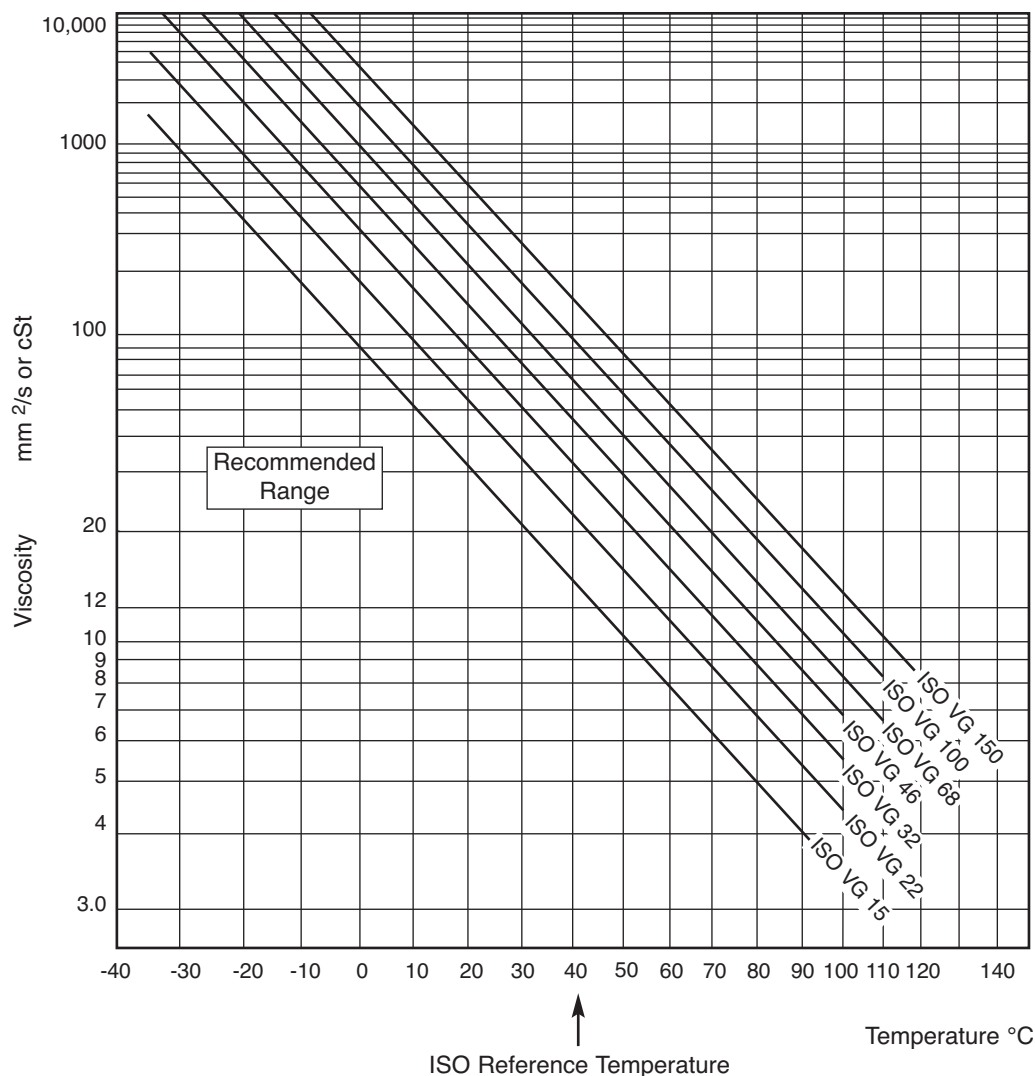
Metric Conversion Factors

Symbols of SI units, multiples and submultiples are given in
parentheses in the right hand column

Multiply	By	To Obtain
Length		
centimetre	0.03280840	foot
centimetre	0.3937008	inch
fathom	1.8288*	metre (m)
foot	0.3048*	metre (m)
foot	30.48*	centimetre (cm)
foot	304.8*	millimetres (mm)
inch	0.0254*	metre (m)
inch	2.54*	centimetre (cm)
inch	25.4*	millimetre (mm)
kilometre	0.6213712	mile (US statute)
metre	39.37008	inch
metre	0.5468066	fathom
metre	3.280840	foot
metre	0.1988388	rod
metre	1.093613	yard
metre	0.0006213712	mile (US statute)
microinch	0.0254*	micrometre (micron)(um)
Micrometre (Micron)	39.37008	microinch
mile (US statute)	1,609.344*	metre (m)
mile (US statute)	1.609.344*	kilometre (km)
millimetre	0.003280840	foot
millimetre	0.03937008	inch
rod	5.0292*	metre (m)
yard	0.9144*	metre (m)
Area		
acre	4046.856	metre^2 (m^2)
acre	0.4046856	hectare
centimetre^2	0.1550003	inch^2
centimetre^2	0.001076391	foot^2
foot^2	0.09290304*	metre$_2$ (m^2)
foot^2	929.0304*	centimetre$_2$ (cm^2)
foot^2	92,903.04*	millimetre$_2$ (mm^2)
hectare	2.471054	acre
inch^2	645.16*	millimetre$_2$ (mm^2)
inch^2	6.4516*	centimetre$_2$ (cm^2)
inch^2	0.00064516*	metre$_2$ (m^2)
metre^2	1,550.003	inch^2
metre^2	10.763910	foot^2
metre^2	1.195990	yard^2
metre^2	0.0002471054	acre
millimetre^2	0.00001076391	foot^2
millimetre^2	0.001550003	inch^2
yard^2	0.8361274	metre^2 (m^2)

* Where an Asterisk is shown, the figure is exact.

Technical Information

Multiply	By	To Obtain
Volume (including Capacity)		
centimetre^3	0.06102376	inch^3
foot^3	0.02831685	metre^3 (m^3)
foot^3	28.31685	litre
gallon (UK liquid)	0.004546092	metre^3 (m^3)
gallon (UK liquid)	4.546092	litre
gallon (US liquid)	0.003785412	metre^3 (m^3)
gallon (US liquid)	3.785412	litre
inch^3	16.38706	millliliter^3 (ml^3)
inch^3	16.38706	centimetre^3 (cm^3)
inch^3	0.0000168706	metre^3 (m^3)
litre	0.001*	metre^3 (m^3)
litre	0.2199692	gallon (UK liquid)
litre	0.2641720	gallon (US liquid)
litre	0.03531466	foot^3
metre^3	219.9692	gallon (UK liquid)
metre^3	264.1720	gallon (US liquid)
metre^3	35.31466	foot^3
metre^3	1.307951	yard^3
metre^3	1000.	litre
metre^3	61.023.76	inch^3
millimetre^3	0.00006102376	inch^3
yard^3	0.7645549	metre^3 (m^3)
Velocity, Acceleration, and Flow		
centimetre/second	1.968504	foot/minute
centimetre/second	0.03280840	foot/second
centimetre/minute	0.3937008	inch/minute
foot/hour	0.00008466667	metre/second (m/s)
foot/hour	0.00508*	metre/minute
foot/hour	0.3048*	metre/hour
foot/minute	0.508*	centimetre/second
foot/minute	18.288*	metre/hour
foot/minute	0.3048*	metre/minute
foot/minute	0.00508*	metre/second (m/s)
foot/second	30.48*	centimetre/second
foot/second	18.288*	metre/minute
foot/second	0.3048	metre/second (m/s)
foot/second^2	0.3048*	metre/second^2 (m/s^2)
foot^3/minute	28.31685	litre/minute
foot^3/minute	0.0004719474	metre^3/second (m^3/s)
gallons/min (US liquid)	0.003785412	metre^3/minute
gallons/min (US liquid)	0.00006309020	metre^3/second (m^3/s)
gallons/min (US liquid)	0.06309020	litre/second
gallons/min (US liquid)	3.785412	litre/minute
gallons/min (US liquid)	0.004546092	metre^3/minute
gallons/min (US liquid)	0.00007576820	metre^3/second (m^3/s)
inch/minute	25.4*	millimetre/minute
inch/minute	2.54*	centimetre/minute
inch/minute	0.0254*	metre/minute
inch/second^3	0.0254*	metre/second^3 (m/s^3)

Multiply	By	To Obtain
Velocity, Acceleration and Flow (Continued)		
kilometre/hour	0.6213712	mile/hour (US statute)
litre/minute	0.03531466	foot^3/minute
litre/minute	0.2641720	gallons/min (US liquid)
litre/second	15.85032	gallons/min (US liquid)
mile/hour	1.609344*	kilometre/hour
millimetre/minute	0.03937008	inch/minute
metre/second	11,811.02	foot/hour
metre/second	196.8504	foot/minute
metre/second	3.280840	foot/second
metre/second^2	3.280840	foot/second^2
metre/second^2	39.37008	inch/second^2
metre/minute	3.280840	foot/minute
metre/minute	0.05468067	foot/second
metre/minute	39.37008	inch/minute
metre/hour	3.280840	foot/hour
metre/hour	0.05468067	foot/minute
metre^3/second	2118.880	foot^3/minute
metre^3/second	13,198.15	gallon/minute (UK liquid)
metre^3/second	15,850.32	gallon/minute (US liquid)
metre^3/minute	219.9692	gallon/minute (UK liquid)
metre^3/minute	264.1720	gallon/minute (US liquid)
Mass and Density		
grain(1/7000 lb avoirdupois	0.06479891	gram (g)
gram	15.43236	grain
gram	0.001*	kilogram (kg)
gram	0.03527397	ounce (avoirdupois)
gram	0.03215074	ounce (troy)
gram/centimetre^3	0.03612730	pound/inch^3
hundredweight (long)	50.80235	kilogram (kg)
hundredweight (short)	45.35924	kilogram (kg)
kilogram	1000.*	gram (g)
kilogram	35.27397	ounce (avoirdupois)
kilogram	32.15074	ounce (troy)
kilogram	2.204622	pound (avoirdupois)
kilogram	0.06852178	slug
kilogram	0.0009842064	ton (long)
kilogram	0.001102311	ton (short)
kilogram	0.001*	ton (metric)
kilogram	0.001*	tonne
kilogram	0.01968413	hundredweight (long)
kilogram	0.02204622	hundredweight (short)
kilogram/metre^3	0.06242797	pound/foot^3
kilogram/metre^3	0.01002242	pound/gallon (UK liquid)
kilogram/metre^3	0.008345400	pound/gallon (US liquid)
ounce (avoirdupois)	28.34952	gram (g)
ounce (avoirdupois)	0.02834952	kilogram (kg)
ounce (troy)	31.10348	gram (g)
ounce (troy)	0.03110348	kilogram (kg)
pound (avoirdupois)	0.4535924	kilogram (kg)
pound/foot^3	16.01846	kilogram/metre^3 (kg/m^3)

Multiply	By	To Obtain
Mass and Density (Continued)		
pound/inch^3	27.67990	gram/centimetre^3 (g/cm^3)
pound/gal (US liquid)	119.8264	kilogram/metre^3 (kg/m^3)
pound/gal (UK liquid)	99.77633	kilogram/metre^3 (kg/m^3)
slug	14.59390	kilogram (kg)
ton (long 2240 lb)	1.016.047	kilogram (kg)
ton (short 2000 lb)	907.1847	kilogram (kg)
ton (metric)	1,000.*	kilogram (kg)
tone	1,000.*	kilogram (kg)
Force and Force / Length		
Dyne	0.00001*	newton (N)
kilogram - force	9.806650*	newton (N)
kilopond	9.806650*	newton (N)
newton	0.1019716	kilogram - force
newton	0.1019716	kilopond
newton	0.2248089	pound - force
newton	100.000.*	dyne
newton	7.23301	poundal
newton	3.596942	ounce - force
newton/metre	0.005710148	pound/inch
newton/metre	0.06852178	pound/foot
ounce - force	0.2780139	newton (N)
pound - force	4.448222	newton (N)
poundal	0.1382550	newton (N)
pound/inch	175.1268	newton/metre (N/m)
pound/foot	14.59390	newton/metre (N/m)
Moment of Inertia and Section Modulus		
moment of inertia (kg.m^2)	23.73036	pound - foot^2
moment of inertia (kg.m^2)	3.417.171	pound - inch^2
moment of inertia (lb.ft^2)	0.042.14011	kilogram - metre^2 (kg.m^2)
moment of inertia (lb.inch^2)	0.0002926397	kilogram - metre^2 (kg.m^2)
moment of section (foot^4)	0.008630975	metre^4 (m^4)
moment of section (inch^4)	41.62314	centimetre^4
moment of section (metre^4)	115.8618	foot^4
moment of section (centimetre^4)	0.02402510	inch^4
section modulus (foot^3)	0.02831685	metre^3 (m^3)
section modulus (inch^3)	0.00001638706	metre^3 (m^3)
section modulus (metre^3)	35.31466	foot^3
section modulus (metre^3)	61,023.76	inch^3

Multiply	By	To Obtain
Bending Moment or Torque		
dyne - centimetre	0.0000001.*	newton - metre (N-m)
kilogram - metre	9.806650.*	newton - metre (N-m)
ounce - inch	7.061552	newton - millimetre
ounce - inch	0.007061552	newton - metre (N - m)
newton - metre	0.7375621	pound - foot
newton - metre	10,000,000.*	dyne - centimetre
newton - metre	0.1019716	kilogram - metre
newton - metre	141.6119	ounce - inch
newton - millimetre	0.1416119	ounce - inch
pound - foot	1.355818	newton - metre (N-m)
Momentum		
kilogram - metre/second	7.233011	pound - foot/second
kilogram - metre/second	86.79614	pound - inch/second
pound - foot/second	0.1382550	kilogram - metre/second (kg.m/s)
pound - inch/second	0.01152125	kilogram - metre/second (kg.m/s)
Energy and Work		
Btu (International Table)	1,055.056	joule (J)
Btu (mean)	1,055.87	joule (J)
calorie (mean)	4.19002	joule (J)
foot - pound	1.355818	joule (J)
foot - poundal	0.04214011	joule (J)
joule	0.0009478170	Btu (International table)
joule	0.0009470863	Btu (mean)
joule	0.2386623	calorie (mean)
joule	0.7375621	foot - pound
joule	23.73036	foot - poundal
joule	0.9998180	joule (International US)
joule	0.9999830	joule (US legal, 1948)
joule (International US)	1.000182	joule (J)
joule (US legal, 1948)	1.000017	joule (J)
joule	0002777778	watt - hour
watt - hour	3600.*	joule (J)

Multiply	By	To Obtain
Pressure and Stress		
atmosphere (14.6959 lb/inch^2)	101,325	pascal (Pa)
bar	100,000.*	pascal (Pa)
bar	14.50377	pounds/inch^2
bar	100,000.*	newton/metre^2 (N/m^2)
hectobar	0.6474898	ton (long)/inch^2
kilogram/centimetre^2	14.22334	pounds/inch^2
kilogram/metre^2	9.806650*	newton/metre^2 (N/m^2)
kilogram/metre^2	9.806650*	pascal (Pa)
kilogram/metre^2	0.2048161	pound/foot^2
kilonewton/metre^2	0.1450377	pound/inch^2
newton/centimetre^2	1.450377	pound/inch^2
newton/metre^2	0.00001*	bar
newton/metre^2	1.0*	pascal (Pa)
newton/metre^2	0.0001450377	pound/inch^2
newton/metre^2	0.1019716	kilogram/metre^2
newton/millimetre^2	145.0377	pound/inch^2
pascal	0.00000986923	atmosphere
pascal	0.00001*	bar
pascal	0.1019716	kilogram/metre^2
pascal	1.0*	newton/metre^2 (N/m^2)
pascal	0.02088543	pound/foot
pascal	0.0001450377	pound/inch^2
pound/foot^2	4.882429	kilogram/metre^2
pound/foot^2	47.88026	pascal (PA)
pound/inch^2	0.06894757	bar
pound/inch^2	0.07030697	kilogram/centimetre^2
pound/inch^2	0.6894757	newton/centimetre^2
pound/inch^2	6.894757	kilonewton/metre^2
pound/inch^2	6,894.757	newton/metre^2 (N/m^2)
pound/inch^2	0.006894757	newton/millimetre$_2$ (N/m^2)
pound/inch^2	6,894.757	pascal (Pa)
ton (long)/inch^2	1.544426	hectobar

Multiply	By	To Obtain
Power		
Btu/Hour (International Table)	0.2930711	watt (W)
foot-pound/hour	0.0003766161	watt (W)
foot-pound/minute	0.02259697	watt (W)
horsepower (550 ft-lb/s)	0.7456999	kilowatt (kW)
horsepower (500 ft-lb/s)	745.6999	watt (W)
horsepower (electric)	746.*	watt (W)
horsepower (metric)	735.499	watt (W)
horsepower (UK)	745.70	watt (W)
Kilowatt	1.341022	horsepower (550 ft - lb/s)
watt	2,655.224	foot-pound/hour
watt	44.25372	foot-pound/minute
watt	0.001341022	horsepower (550 ft-lb/s)
watt	0.001340483	horsepower (electric)
watt	0.001359621	horsepower (metric)
watt	0.001341022	horsepower (UK)
watt	3.412141	Btu/Hour (International Table)
Viscosity		
centipose	0.001*	pascal-second (Pa.s)
centistoke	0.000001*	metre^2/second (m^2/s)
metre^2/second	1,000,000.*	centistoke
metre^2/second	10,000.*	stoke
pascal-second	1000.*	centipose
pascal-second	10.*	poise
poise	0.1*	pascal-second (Pa.s)
stoke	0.0001.*	metre^2/second (m^2/s)
Temperature		
temperature Celsius, tC	temperature Kelvin,tK	$tK = tC + 273.15$
temperature Fahrenheit,tF	temperature Kelvin,tK	$tK = tF + 459.67/1.8$
temperature Celsius,tC	temperature Fahren,tF	$tF = 1.8 tc + 32$
temperature Fahrenheit,tF	temperature Celsius,tC	$tC = tF - 32/1.8$
temperature Kelvin,tK	temperature Celcius,tC	$tC = tK - 273.15$
temperature Kelvin,tK	temperature Fahren,tF	$tF = 1.8 tK - 459.67$
temperature Kelvin,tK	temperature Rankine,tR	$tR = 9/5 tK$
temperature Rankine tR	temperature Kelvin,tK	$tK = 5/9 tR$

Formula For	Word Formula		Formula
Fluid Pressure (In Pounds/Square Inch)	**Pressure** =	$\dfrac{\textbf{Force (pounds)}}{\textbf{Unit Area (Square Inches)}}$	$P = \dfrac{F}{A}$ or $psi = \dfrac{F}{A}$
Cylinder Area (In Square Inches)	**Area** = =	π x **Radius**^{2} (Inches) $\dfrac{\pi}{4}$ x **Diameter**^{2} (Inches)	$A = \pi r^2$ $A = \dfrac{\pi D^2}{4}$ or $A = 0.785\ D^2$
Cylinder Force (In Pounds, Push or Pull)	**Force** =	**Pressure** (psi) x **Net Area** (Square Inches)	$F = psi \times A$ or $F = PA$
Cylinder Velocity or Speed (In Feet/Second)	**Velocity** =	$\dfrac{231 \times \textbf{Flow Rate (gpm)}}{12 \times 60 \times \textbf{Net Area (Square Inches)}}$	$v = \dfrac{231}{720A}$ or $v = \dfrac{0.3208}{A}$
Cylinder Volume Capacity In Gallons of Fluid	**Volume** = =	$\dfrac{\pi \times \textbf{Radius}^2 \textbf{(Inches)} \times \textbf{Stroke (Inches)}}{231}$ $\dfrac{\textbf{Net Area (Square Inches)} \times \textbf{Stroke (inches)}}{231}$	$V = \dfrac{\pi r^2 L}{231}$ $V = \dfrac{AL}{231}$
Cylinder Flow Rate In Gallons per minute	**Flow Rate** =	$\dfrac{12 \times 60 \times \textbf{Velocity (feet/sec)} \times \text{Net Area}}{231 \text{ (Square Inches)}}$	$Q = \dfrac{720vA}{231}$ or $Q = 3.11\ vA$
Fluid Motor Torque (In Inch Pounds)	**Torque** = = =	$\dfrac{\textbf{Pressure (psi)} \times \textbf{Displacement (cu,in,rev)}}{2\pi}$ $\dfrac{\textbf{Horsepower} \times 63025}{\text{rpm}}$ $\dfrac{\textbf{Flow Rate (gpm)} \times \textbf{Pressure (psi)} \times 36.77}{\text{rpm}}$	$T = \dfrac{psi\ d}{2\pi}$ or $\dfrac{pd}{2\pi}$ $T = \dfrac{63025\ HP}{n}$ $T = \dfrac{36.77\ QP}{n}$ or $T = \dfrac{36.77\ Q\ psi}{n}$
Fluid Motor Torque (100 psi in Inch Pounds)	**Torque** /100psi =	$\dfrac{\textbf{FM Displacement (Cu, Inches/Rev)}}{0.0628}$	$T/100\ psi = \dfrac{d}{0.0628}$
Fluid Motor Speed (In Rev/Min)	**Speed** =	$\dfrac{231 \times \textbf{Flow Rate (gpm)}}{\textbf{FM Displacement (Cu, In/Rev)}}$	$n = \dfrac{231\ Q}{d}$
Fluid Motor Power (In Horsepower Output)	**Horsepower Input** =	$\dfrac{\textbf{Torque Output (Inches/Pounds)} \times \text{rpm}}{63025}$	$HP = \dfrac{Tn}{63025}$
Pump Outlet Flow In Gallons/min	**Flow** =	$\dfrac{\text{rpm} \times \textbf{Pump Displacement (Cu, In/Rev)}}{231}$	$Q = \dfrac{nd}{231}$
Pump Input Power (In Horsepower Required)	**Horsepower** =	$\dfrac{\textbf{Flow Rate Output (gpm)} \times \textbf{Pressure (psi)}}{1714 \times \textbf{Efficiency (Overall)}}$	$HP = \dfrac{QP}{1714\ Eff}$ or $\dfrac{gpm \times psi}{1714\ Eff}$
Flow Rate Through Piping (In Feet/second Velocity)	**Velocity** =	$\dfrac{0.3207 \times \textbf{Flow Rate through ID (gpm)}}{\textbf{Internal Area (square inches)}}$	$v = \dfrac{0.3207Q}{A}$
Compressibility 1/2% Of Oil	**Additional Volume** =	$\dfrac{\textbf{Pressure (psi)} \times \textbf{Volume of Oil Under Pressure}}{250,000}$	$VA = \dfrac{PV}{250,000}$ Approx. 1 1/2% per 1000 psi
Flow In Gallons/min	**Flow** =	**Flow Coefficiency** x $\sqrt{\dfrac{\textbf{Pressure Drop}}{\textbf{Specific Gravity}}}$	$Q = CA \times \sqrt{\dfrac{P1\ P2}{Sg}}$
Flow (Cu, Ft, Sec)	**Flow** = **Orifice Coefficient** x **Area** (sq.ft) x $\sqrt{2 \times \textbf{Press Head (ft)} \times \textbf{Specific Gravity}}$		$Q = CA \times \sqrt{2HSg}$
Heat Dissipation (Btu/hr)	**Cooling Capacity** =	2 x To-Ta x Area of Reservoir (sq. ft)	$Btu/hr = 2\ deltaTA$

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JANUARY

M	T	W	T	F	S	S	
				1	2	3	1
4	5	6	7	8	9	10	2
11	12	13	14	15	16	17	3
18	19	20	21	22	23	24	4
25	26	27	28	29	30	31	5

FEBRUARY

M	T	W	T	F	S	S	
1	2	3	4	5	6	7	6
8	9	10	11	12	13	14	7
15	16	17	18	19	20	21	8
22	23	24	25	26	27	28	9

MARCH

M	T	W	T	F	S	S	
1	2	3	4	5	6	7	10
8	9	10	11	12	13	14	11
15	16	17	18	19	20	21	12
22	23	24	25	26	27	28	13
29	30	31					14

APRIL

M	T	W	T	F	S	S	
			1	2	3	4	14
5	6	7	8	9	10	11	15
12	13	14	15	16	17	18	16
19	20	21	22	23	24	25	17
26	27	28	29	30			18

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MAY

M	T	W	T	F	S	S	
					1	2	18
3	4	5	6	7	8	9	19
10	11	12	13	14	15	16	20
17	18	19	20	21	22	23	21
24	25	26	27	28	29	30	22
31							23

JUNE

M	T	W	T	F	S	S	
	1	2	3	4	5	6	23
7	8	9	10	11	12	13	24
14	15	16	17	18	19	20	25
21	22	23	24	25	26	27	26
28	29	30					27

JULY

M	T	W	T	F	S	S	
			1	2	3	4	27
5	6	7	8	9	10	11	28
12	13	14	15	16	17	18	29
19	20	21	22	23	24	25	30
26	27	28	29	30	31		31

AUGUST

M	T	W	T	F	S	S	
						1	31
2	3	4	5	6	7	8	32
9	10	11	12	13	14	15	33
16	17	18	19	20	21	22	34
23	24	25	26	27	28	29	35
30	31						36

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SEPTEMBER

M	T	W	T	F	S	S	
		1	2	3	4	5	36
6	7	8	9	10	11	12	37
13	14	15	16	17	18	19	38
20	21	22	23	24	25	26	39
27	28	29	30				40

OCTOBER

M	T	W	T	F	S	S	
			1	2	3		40
4	5	6	7	8	9	10	41
11	12	13	14	15	16	17	42
18	19	20	21	22	23	24	43
25	26	27	28	29	30	31	44

NOVEMBER

M	T	W	T	F	S	S	
1	2	3	4	5	6	7	45
8	9	10	11	12	13	14	46
15	16	17	18	19	20	21	47
22	23	24	25	26	27	28	48
29	30						49

DECEMBER

M	T	W	T	F	S	S	
		1	2	3	4	5	49
6	7	8	9	10	11	12	50
13	14	15	16	17	18	19	51
20	21	22	23	24	25	26	52
27	28	29	30	31			1

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