

T-900 Series Operation Manual

for Pneumatic Pumps and Systems A, B, & H



Overview

INTRODUCTION

The T-900 Series calibration hand pump, designed by Mansfield & Green, **generates pressure for verifying, adjusting and calibrating mechanical and electronic pressure measurement devices.**

This hand pump is suitable for pressure tests in laboratory and field settings.

The T-900 Series calibration hand pump is easy to operate and allows for precise pressure generation. Combination models include a shuttle valve to allow vacuum generation as well. CPF* versions include Crystal Pressure Fittings (CPF), which allow users to produce leak-free seals without tools or thread tape. CPF fittings also include a self-venting weep hole to help assure a safe disconnection from a pressurized system.

*U.S. Patent No. 8,794,677

The T-900 Series calibration hand pump may be ordered as part of a Pump System, complete with a Crystal Pressure Indicator. T-900 Series Pump Systems include the most commonly used pressure fittings, seals, etc. All packaged in a carrying case with custom insert.

► T-900 Series Pumps and Pump Systems

	Pressure	Vacuum	Pressure Range	Pump System
T-960	■		0 to 2 bar / 0 to 30psi	AXX
T-960-CPF	■		0 to 2 bar / 0 to 30psi	AXX
T-965	■	■	-0.85 to 2 bar / -25 inHg to 30 psi	BXX
T-965-CPF	■	■	-0.85 to 2 bar / -25 inHg to 30 psi	BXX
T-970	■		0 to 40 bar / 0 to 580 psi	AHX
T-970-CPF	■		0 to 40 bar / 0 to 580 psi	AHX
T-975	■	■	-0.91 to 40 bar / -27 inHg to 580 psi	BHX
T-975-CPF	■	■	-0.91 to 40 bar / -27 inHg to 580 psi	BHX and HOX

FEATURES AND PARTS LISTS

Each hand pump includes a fine adjustment knob for precise pressure adjustments. The reference instrument threads directly to the top of the pump (if using a supplied quick connector). The device-under-test connects to the pressure hose via the supplied adapters.

Parts Included with Pump (T-960, T-965, T-970, and T-975)

▶ Reference Pressure Port Adapters

Part Number	Description
125793*	3/8" BSP Male to 1/4" BSP Female
125794*	3/8" BSP Male to 1/4" NPT Female

*Includes integral o-ring on 3/8 BSP male.

▶ Device Under Test Pressure Port Adapters

Part Number	Description
T-786	1/4" NPT Male to 1/4" BSP Female
T-941-2	0.61 meter Coiled Hose with 1/4" NPT Female Connection

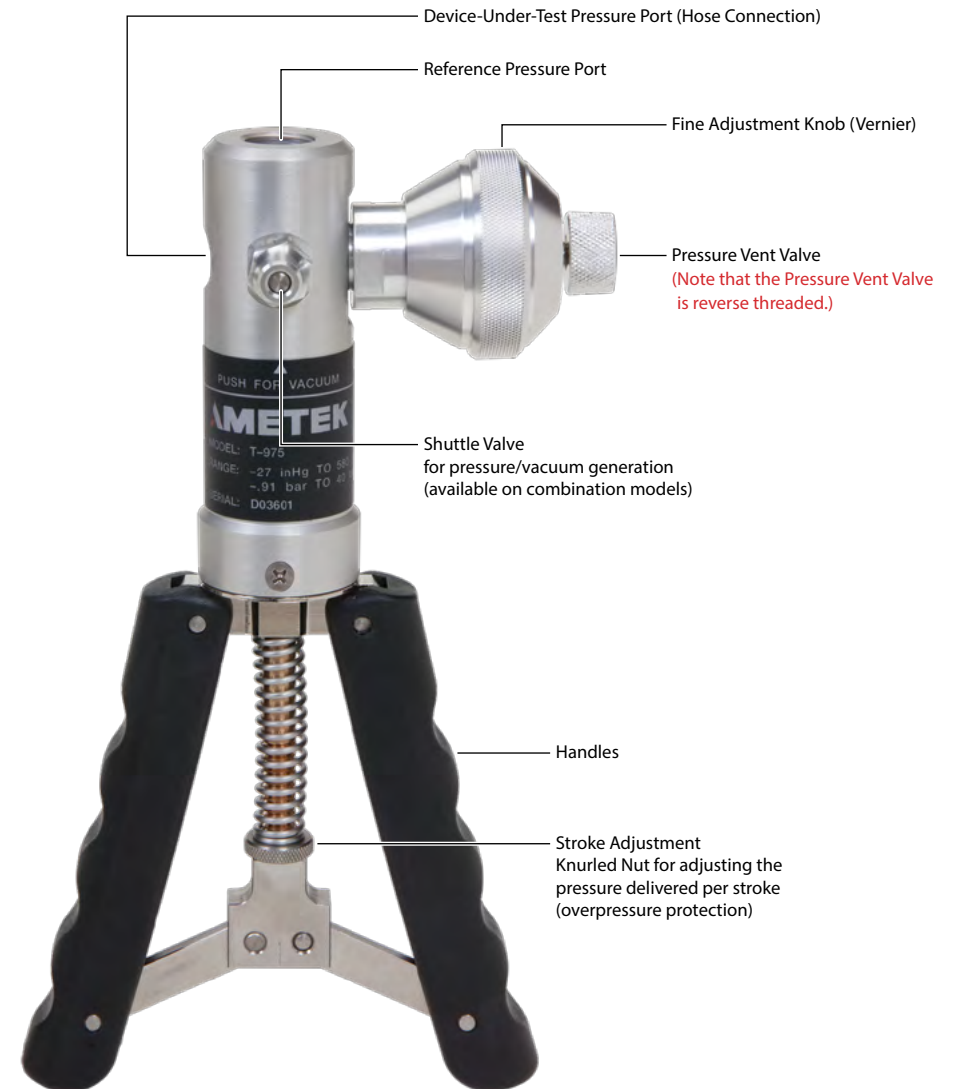
Parts Included with Pump (T-975-CPF)

▶ Reference Pressure Port Adapters

Part Number	Description
5238	3/8" BSP Male to CPF Male

▶ Device Under Test Pressure Port Adapters

Part Number	Description
5252	5/16-24 SAE Male to CPF Female
MPH-1	1 meter CPF Male Hose
MPF-1/4FPT	CPF Female to 1/4" NPT Female



Parts Included with Pump Systems for Crystal Reference Indicators

Part Number	Description	System A		System B		System H
		AXX	AHX	BXX	BHX	HOX
5238	3/8" BSP Male to CPF Male Fitting	■	■	■	■	■
5252	5/16-24 SAE Male to CPF Female Fitting	■	■	■	■	■
MPF-1/4FPT	CPF Female to 1/4" NPT Female Fitting	■	■	■	■	■ (2)
MPF-1/4BSPF	CPF Female to 1/4" BSP Female Fitting	■	■	■	■	■ (2)
MPF-1/8MPT *	CPF Female to 1/8" NPT Male Fitting	■ (2)	■ (2)	■ (2)	■ (2)	■ (2)
MPH-1	1 meter CPF Male Hose	■	■	■	■	■ (2)
60R120	1/4" Bonded Seals	■ (5)	■ (5)	■ (5)	■ (5)	■ (5)
50-REP700	O-ring and Lock Clip	■ (5)	■ (5)	■ (5)	■ (5)	■ (5)
1351 **	Test Leads; Red & Black, including clips	■	■	■	■	■
5249	Protective Vinyl Cap	■ (4)	■ (4)	■ (4)	■ (4)	■ (4)
601104	Pack Tape (1 roll)	■	■	■	■	■
124004	Shoulder Strap	■	■	■	■	■
124110	Aluminum Carrying Case (for nVision, HPC40 Series, and 30 Series)	■	■	■	■	■
125254	Aluminum Carrying Case (for XP2i and m1)	■	■	■	■	■
2888 *	Waterproof Carrying Case (for all gauges)	□	□	□	□	■

* When a Pump System A, B, or H is ordered for a 30 Series Calibrator, two (2) additional MPF-1/8MPT fittings are included.

** The 1351 Test Leads are included *only* with Pump Systems for the 30 Series Calibrator.

Carrying Case Options

Pump Systems A and B are delivered with an Aluminum Carrying Case. * Alternately, they may be ordered with a Waterproof Carrying Case by entering -W in the pump system ordering code. The Shoulder Strap and the Aluminum Carrying Case will be replaced by the Waterproof Carrying Case.

The Waterproof Carrying Case is the *only* option for Pump System H. So, when ordering a Pump System H, add -E-W to designate a drained pump in a waterproof case.



Ordering a Pump System

Any T-900 Series Pump System may be ordered with or without a reference indicator. The table below provides an explanation of the Pump System ordering scheme when ordering a system without an indicator. For details on ordering the Pump Systems with an indicator, see the indicator datasheet.

Reference Indicator	Pump System	Carrying Case
nVision NV-NONE	System A (T-960-CPF) . . . -AXX	Aluminum . . . (omit)
30 Series IS30-NONE	System A (T-970-CPF) . . . -AHX	Waterproof . . . -W
HPC40 Series . . . HPC40-NONE	System B (T-965-CPF) . . . -BXX	
XP2i XP2i-NONE	System B (T-975-CPF) . . . -BHX	
m1 M1-NONE		

▶ SAMPLE PART NUMBERS

NV-NONE-AXX System A pump system (for nVision) with an aluminum carrying case.

M1-NONE-BXX-W System B pump system (for m1) with a waterproof carrying case.

1KPSIXP2i-AXX-W System A pump system in a waterproof carrying case, with an XP2i gauge (1000 psi).

Operating and Safety Instructions

CONNECTIONS

Reference Pressure Port Connections

The reference indicator threads to the upper side of the calibration hand pump. A finger-tight connection is sufficient (if utilizing a JOFRA quick connector or a CPF fitting). If adapters are used, bonded seals and Teflon tape may be necessary.



Standard fitting connection.



Crystal CPF fitting connection.

Device-Under-Test Pressure Port Connections

In order to adapt the different connection threads of the device-under-test, the pressure hose can be fitted with different adapters. Please use a suitable sealing gasket or Teflon tape as applicable for the thread type.

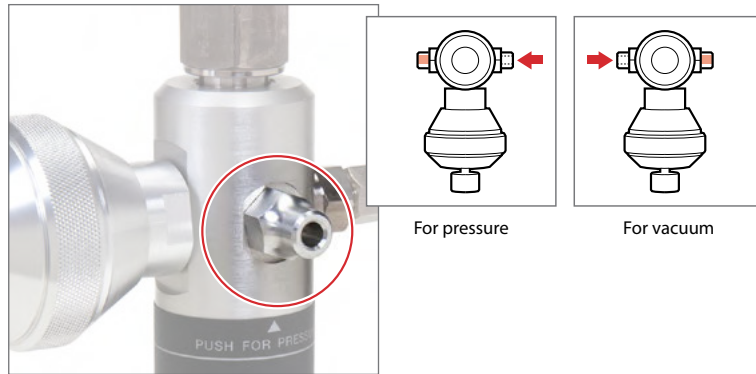
- ! **CAUTION:** Do not use teflon tape with BSP or CPF threads; this may damage your hand pump.
- ! **CAUTION:** The T-900 Series hand pump must not be soiled, or come into contact with fluids or aggressive media.
- ! **CAUTION:** To prevent leaks, tighten the tube fitting or CPF connection to a maximum torque of 15 N-m = 11 lb-ft.

GENERATING PRESSURE AND VACUUM

► Actuate the Shuttle Valve (Combination Models Only)

- Verify that the shuttle valve is positioned to provide pressure or vacuum. Use a pen or a small screwdriver for this purpose.

The encasement of the switch is intended to help prevent unintentional actuation. (Only applies to models T-965, T-975, and T-975-CPF.)



Shuttle Valve

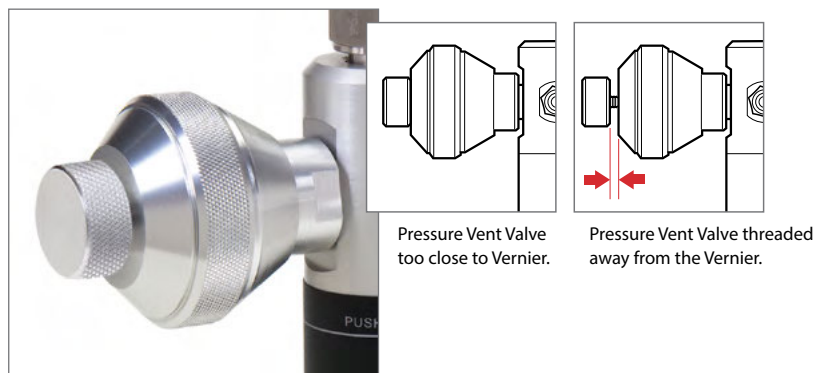
! CAUTION: Never actuate the shuttle valve while the hand pump is under pressure or vacuum. Actuate the shuttle valve only when the pump is vented.

► Apply Pressure or Vacuum

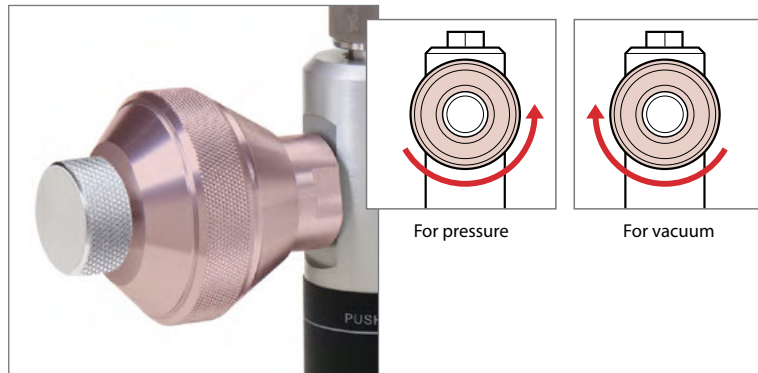
For optimal operation, the Fine Adjustment Knob (Vernier) should be positioned at mid-travel.

Note: The Pressure Vent Valve is reverse threaded. If the Fine Adjustment Knob (Vernier) is threaded into the pump body to its travel limit, and the Pressure Vent Valve is threaded too close to the Vernier, the Pressure Vent Valve may engage with the Vernier, preventing its movement. To correct this, turn the Pressure Vent Valve clockwise.

Note: Always start with the Pressure Vent Valve threaded several turns out, and away from the Vernier.

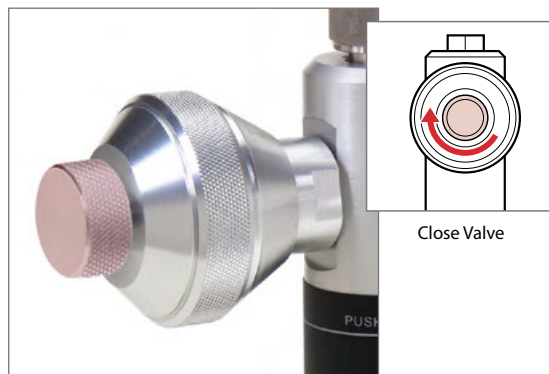


- 1 Verify that the Fine Adjustment Knob (Vernier) is positioned at mid-travel, and that the Pressure Vent Valve is open.
- 2 For maximum pressure, turn the Fine Adjustment Knob (Vernier) to the full, counter-clockwise position. For maximum vacuum, turn the Vernier to the full, clockwise position.



Fine Adjustment Knob (Vernier)

- 3 Zero your reference indicator.
- 4 Close the Pressure Vent Valve by turning it clockwise.



Pressure Vent Valve

Note: The Pressure Vent Valve seals on an o-ring, and not on a metal to metal seal; so excessive pressure is not required.

To apply pressure...

5 Operate the hand pump until the target pressure is nearly reached, but no more than 25 bar (for T-970, T-975, and T-975-CPF) or 1.5 bar (for T-960 and T-965).

6 Turn the Fine Adjustment Knob (Vernier) to reach the target pressure, as indicated on the reference indicator.

Note: After increasing pressure, the reading may drop slightly. This is due to thermodynamic or adiabatic effects, hose expansion, and sealing gaskets. If pressure does not stabilize, check the measuring circuit for tightness.

Note: Due to the low volume of each compression stroke of the hand pump, only small volume instruments should be tested.

To apply vacuum...

5 Turn the Fine Adjustment Knob (Vernier) counter-clockwise to generate a first vacuum.

6 Operate the hand pump smoothly and slowly to reach the target pressure.

Note: After decreasing pressure, the reading may increase slightly. This is due to thermodynamic or adiabatic effects, hose expansion, and sealing gaskets. If pressure does not stabilize, check the measuring circuit for tightness.

Note: Due to the low volume of each compression stroke of the hand pump, only small volume instruments should be tested.

! WARNING: Never connect an external pressure supply to the pump.

► Relieve Pressure or Vacuum

▪ Relieve pressure by carefully opening the Pressure Vent Valve in a counter-clockwise direction.

! WARNING: Remove the reference indicator or the device-under-test only once the vent valve is open and no pressure is applied to the hand pump.

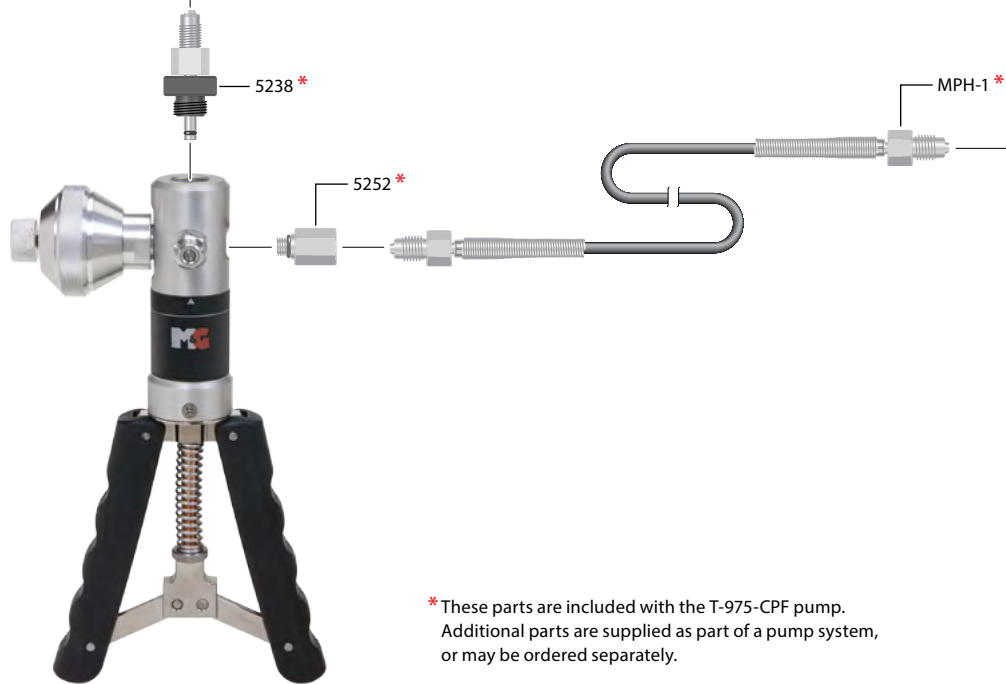
Adjustable Stroke

The T-900 Series hand pumps include a stroke adjustment in order to reduce the risk of overpressure. The knurled nut is used to set the lift stop. A shorter travel will generate less pressure per stroke; a longer travel will generate more pressure per stroke.



Set the lift stop with the knurled nut.

Connection Diagram



* These parts are included with the T-975-CPF pump. Additional parts are supplied as part of a pump system, or may be ordered separately.

NPT MALE		
	MPF-1/8QTM	1/8" Quick Test NPT Male
	MPF-1/8MPT	1/8" NPT Male
	MPF-1/4QTM	1/4" Quick Test NPT Male
	MPF-1/4MPT	1/4" NPT Male
Additional NPT sizes available in non-CPF MP adapters		
NPT FEMALE		
	MPF-1/8QTF	1/8" Quick Test NPT Female
	MPF-1/4QTF	1/4" Quick Test NPT Female
	MPF-1/4FPT *	1/4" NPT Female
	MPF-1/2QTF	1/2" Quick Test NPT Female
Additional NPT sizes available in non-CPF MP adapters		
BSP		
	MPF-1/8BSPF	G 1/8" Female
	MPF-1/4BSPF	G 1/4" Female
	MPF-3/8BSPF	G 3/8" Female
	MPF-1/2BSPF	G 1/2" Female
	MPF-1/8QTFB	1/8" Quick Test Female
	MPF-1/4QTFB	1/4" Quick Test Female
	MPF-3/8QTFB	3/8" Quick Test Female
	MPF-1/2QTFB	1/2" Quick Test Female
TRANSMITTER		
	MPF-5/16TRM	for Foxboro, Rosemount, & Yokogawa
	MPF-1/4TRM	for Honeywell
TUBE		
	MPF-1/4TBM	1/4" Tube Male
	MPF-3/8TBM	3/8" Tube Male
	MPF-1/2TBM	1/2" Tube Male
CPF		
	MPF-MPF	Female to Female
	MPF-MPFTU	T-Union (Female)
	MPF-MPFBULK	Bulkhead (Female to Female)
	MPF-CAP	Cap
ADDITIONAL		
	MPF-M20QTF	M20 x 1.5 Quick Test Female
	MPF-M20X1.5F	M20 x 1.5 Female
	MPF-QCN	Quick-Connect Nut
	MPF-AN4M	AN4 Male

Specifications

Pressure Ranges

T-960, T-960-CPF	0 to 30 psi / 2 bar
T-965, T-965-CPF	-25 inHg to 30 psi / -0.85 to 2 bar
T-970, T-970-CPF	0 to 580 psi / 40 bar
T-975, T-975-CPF	-27 inHg to 580 psi / -0.91 to 40 bar

Medium

Air

Pressure Connections

► Reference Port

T-960, T-965, T-970, T-975 3/8" BSP Female (adapters to 1/4" NPT Female and 1/4" BSP Female).

T-960-CPF, T-965-CPF, T-970-CPF, T-975-CPF ... 3/8" BSP Female (adapter to CPF Male).

► Device Under Test Port

T-960, T-965, T-970, T-975 1/4" NPT Female and 1/4" BSP Female.

T-960-CPF, T-965-CPF, T-970-CPF, T-975-CPF ... 1/4" NPT Female.

Fine Adjustment

Fine Adjust Valve.

Overpressure

Overpressure protection by means of stroke adjustment.

Material

Anodized aluminum, Brass, ABS and Stainless Steel.

Dimensions

Pump 216 (L) x 121 (W) x 62 (D) mm.

Standard Supply 1.0 meter hose.

Support

TROUBLESHOOTING

Unstable Pressure or Vacuum

- ▶ **Problem:** Pressure or vacuum cannot be generated correctly, or set pressure or vacuum does not remain stable.
- ▶ **Solution:** If the problem persists after allowing time for thermodynamic effects to stabilize, this is likely to be caused by the incorrectly positioned or selected sealing gaskets. Also check that all adapters and pressure fittings have been tightened sufficiently to eliminate leaks.

Pressure or Vacuum is not Maintained

- ▶ **Problem:** The hand pump appears to leak.
- ▶ **Solution:** (1) Check that the vent valve is completely closed.
(2) Check that the shuttle valve switch is correctly positioned and is not in a “center position” (if a combination model).
(3) Verify that all the connection fittings are firmly tightened and properly sealed.

Pumping Action Appears Sluggish

- ▶ **Problem:** The first lift of the pump is somewhat sluggish.
- ▶ **Solution:** The hand pump has not been used for a longer period of time. This effect will disappear as the pump is operated.

FITTING KITS AND SPARE PARTS

Service Kits

- ▶ T-960, T-960-CPF, T-965, T-965-CPF, T-970, T-970-CPF, **T-975**, T-975-CPF

P/N: SPK-T900-002

Hoses

- ▶ T-960, T-965, T-970, and **T-975**

P/N: T-941-2 Hose, Coiled. 0.61 m, 5/16-24 SAE male x 1/4" NPT female.

P/N: T-941-3 Hose, Straight. 0.5 m, 5/16-24 SAE male x 1/4" NPT female.

P/N: T-941-4 Hose, Straight. 1.0 m, 5/16-24 SAE male x 1/4" NPT female.

P/N: T-941-5 Hose, Straight. 2.0 m, 5/16-24 SAE male x 1/4" NPT female.

P/N: T-941-6 Hose, Straight. 5.0 m, 5/16-24 SAE male x 1/4" NPT female.

- ▶ T-975-CPF

P/N: MPH-1 Hose, Straight. 1.0 m, 7/16-20 MP Male connection.

P/N: MPH-1.5 Hose, Straight. 1.5 m, 7/16-20 MP Male connection.

P/N: MPH-3 Hose, Straight. 3.0 m, 7/16-20 MP Male connection.

P/N: MPH-5 Hose, Straight. 5.0 m, 7/16-20 MP Male connection.

P/N: MPH-10 Hose, Straight. 10.0 m, 7/16-20 MP Male connection.

Adapters

- ▶ T-960, T-965, T-970, and **T-975**

P/N: 125793 Adapter. 3/8" BSP male x 1/4" BSP female for reference port.

P/N: 125794 Adapter. 3/8" BSP male x 1/4" NPT female for reference port.

P/N: 127844 Adapter. 5/16" UNF male x 1/8" BSP female for device-under-test pressure port

P/N: 10-90225 Adapter O-ring.

- ▶ T-960-CPF, T-965-CPF, T-970-CPF, and T-975-CPF

Refer to the [connection diagram on page 8](#) for a complete list of adapters.

Vernier and Vent Valve Assembly

- ▶ T-960, T-960-CPF, T-965, T-965-CPF, T-970, T-970-CPF, **T-975**, and T-975-CPF

P/N: SPK-T900-001

pressure

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Pressure Sources

Pneumatic, hydraulic and vacuum

Pneumatic and hydraulic models

Ranges from vacuum to 1,000 bar /
15,000 psi

Models available as comparators
with included test gauge(s)

Economical, easy-to-use, meet most
testing applications

Pumps offer advanced features such
as vernier valves

Options and accessories that include
alternate o-ring materials, fittings,
and reservoirs

PRODUCT DESCRIPTION

AMETEK offers the user several solutions for pressure generation. This line spans from a small pneumatic “bicycle” style pump to a hydraulic pump that generates up to 1,000 bar (15,000 psi). These are durable pumps with features such as vernier valves, vent valves, manifold connections, swivel fittings, and optional O-ring materials and fittings making the pumps flexible to meet your calibration and testing applications.

There are models for use with most media: both pneumatic and hydraulic models.



Pumps as part of ready-to-use pressure systems

All pumps from AMETEK are offered as part of a complete ready-to-use pressure system together with the JOFRA DPC-500, APC, CPC and IPI calibrators, which are as standard delivered in a carrying case, including pump, hose, set of fittings, batteries, test leads, user manual, and a traceable calibration certificate. For all pressure systems, the pump and the indicator are separate systems. Therefore, a replacement of the pump does not mean that the complete system has to be sent in for repair. Maintenance of the instrument is also made easy. Recalibration of the unit can be performed locally with an accurate pressure reference: No need to send the unit back to the manufacturer for recalibration. If a factory calibration is required, the pump and indicator are independent and only the indicator needs to be returned.

Find more information about JOFRA pressure calibrators at www.jofra.com

Pump model	T-811	T-811-M	T-965	T-975	T-960	T-810	T-810-M	T-970	T-620
Pump spec.									
Pressure range									
Vacuum	X	X							
Vacuum to 2 bar / 30 psi			X						
Vacuum to 40 bar / 580 psi				X					
0 to 2 bar / 30 psi					X				
0 to 14 bar / 200 psi						X	X		
0 to 40 bar / 580 psi								X	
0 to 200 bar / 3,000 psi									X
0 to 350 bar / 5,000 psi									
0 to 700 bar / 10,000 psi									
0 to 1,000 bar / 15,000 psi									
Technology, features and design									
Type	Pneumatic	Pneumatic	Pneumatic	Pneumatic	Pneumatic	Pneumatic	Pneumatic	Pneumatic	Hydraulic
Test medium	Air	Air	Air	Air	Air	Air	Air	Air	Oil
Reservoir capacity	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	200 cl / 0.5 pint
Operation	Bicycle-pump	Bicycle-pump	Scissor	Scissor	Scissor	Bicycle-pump	Bicycle-pump	Scissor	Pistol-grip
"O" rings	Buna-N	Buna-N	Buna-N	Buna-N	Buna-N	Buna-N	Buna-N	Buna-N	Buna-N
Wetted parts	Delrin and stainless steel	Delrin and stainless steel	Anodized aluminum, nickel-plated brass, stainless steel, nylon	Anodized aluminum, nickel-plated brass, stainless steel, nylon	Anodized aluminum, nickel-plated brass, stainless steel, nylon	Delrin and stainless steel	Delrin and stainless steel	Anodized aluminum, nickel-plated brass, stainless steel, nylon	Aluminum, brass, stainless steel, and Lexan®
Test connections	1/8" NPT female termination	1/8" BSP female termination	0.6 m / 24 in hose with 1/4" BSP and NPT female terminations	0.6 m / 24 in hose with 1/4" BSP and NPT female terminations	0.6 m / 24 in hose with 1/4" BSP and NPT female terminations	1/8" NPT female termination	1/8" BSP female termination	0.6 m / 24 in hose with 1/4" BSP and NPT female terminations	0.6 m / 24 in hose with 1/4" BSP and NPT female terminations
Size	15.2x10.2x30.5 cm / 6x4x12 in	15.2x10.2x30.5 cm / 6x4x12 in	21.6x12.1x6.2 cm / 8.5x4.8x2.4 in	21.6x12.1x6.2 cm / 8.5x4.8x2.4 in	21.6x12.1x6.2 cm / 8.5x4.8x2.4 in	15.2x10.2x 30.5 cm / 6x4x12 in	15.2x10.2x 30.5 cm / 6x4x12 in	21.6x12.1x6.2 cm / 8.5x4.8x2.4 in	21.6x12.1x6.2 cm / 8.5x4.8x2.4 in
Weight	1.4 kg / 3.0 lb	1.4 kg / 3.0 lb	1.4 kg / 3.0 lb	1.4 kg / 3.0 lb	1.4 kg / 3.0 lb	1.4 kg / 3.0 lb	1.4 kg / 3.0 lb	1.4 kg / 3.0 lb	1.4 kg / 3.0 lb
Calibration system									
JOFRA DPC-500, APC and IPI	N/A	N/A	N/A	System B	System A	N/A	N/A	System A	System C
JOFRA CPC	N/A	N/A	N/A	System B	System A	N/A	N/A	System A	N/A
Ordering									
Order number	T-811	T-811-M	T-965	T-975	T-960	T-810	T-810-M	T-970	T-620

MODEL T-620 / T-620H



Model T-620 hydraulic pressure pump is small, lightweight and portable. The T-620 features a transparent reservoir to easy

view of the test fluid. The pump is compatible with petroleum-based oils or hydraulic fluids. The reference gauge is mounted on the body manifold with a swivel fitting for easy viewing. A vernier adjustment allows for precisely control pressure. A vent valve is provided for quick and positive shut-off and pressure release. The pump is equipped with a 0.6 m (24 in) rubber hose with 1/4 in NPT connector and 1/4 in BSP adapter for connecting to the instrument-under-test.

MODEL T-810 / T-811



Model T-810 pneumatic pressure pump is an economical and lightweight pump. The pump has a T-fitting allowing for connection to

the 1/8 in NPT threads and the 1/8 BSP threads on the T-810M model. The body is flat on one side preventing it from rolling and offers features such as a fine control vernier and a thumbscrew for rapid or gradual pressure release.

Model T-811 vacuum pump is similar to the T-810 except it is designed to generate vacuum from 0 to -0.9 bar / 13 psi. It is available with metric threads in the T-811M model.

MODEL T-960 / T-965 / T-970 / T-975



Model T-960 pneumatic pressure pump features an extended range vernier adjustment for precisely controlling pump pressure

and comfortable pistol grip handle.

Model T-970 pneumatic pressure pump is similar to the T-960, but generate pressure up to 40 bar (580 psi).

Model T-965 / T-975 pneumatic pressure pump features both vacuum and pressure generation. A button (valve) makes it easy to switch from vacuum to pressure measurements. Built-in release valve, vernier valve for fine adjustment and dual pressure output enable safe and simple operation. The unit offers both metric and imperial threads on the reference connection and the hose.