

PosiTest® Pull-Off Adhesion Tester

Instruction Manual v1.0

Introduction

The portable, hand-operated PosiTest Pull-Off Adhesion Tester measures the force required to pull a specified test diameter of coating away from its substrate using hydraulic pressure. The pressure is displayed in both MPa and PSI on a precision dial indicator and can be related to the coating's strength of adhesion to the substrate.

In accordance with ASTM D4541 and ISO 4624, the PosiTest Pull-Off Adhesion Tester evaluates the adhesion (pull-off strength) of a coating by determining the greatest tensile pull off force that it can bear before detaching. Breaking points, demonstrated by fractured surfaces, occur along the weakest plane within the system consisting of the dolly, adhesive, coating layers and substrate.

There are a few basic steps for testing coating adhesion with a PosiTest Adhesion Tester:

1. Dolly & Coating Preparation

- The dolly and the coating are cleaned and abraded.

2. Adhesive & Dolly Application

- The adhesive is prepared and applied to the dolly. The dolly is then adhered to the coated surface and adhesive is allowed to cure.

3. Test Area Separation

- The test area of the coating is separated from the area surrounding the dolly by cutting or drilling. Drilling (50mm or 20mm dollies) must be done before dolly is adhered to the surface – cutting with hole-saw (20mm dollies only) should be done after dolly is adhered and adhesive is cured.

4. Pull-off Test

- After connecting actuator's quick-coupling to the dolly, pressure is pumped into the system and the dolly pulls the coating(s) away.

5. Analysis of Test Results

- The dolly and the coating are examined and evaluated to determine the nature of the coating failure.

Dolly Preparation

1. To remove oxidation and contaminants, place the included abrasive pad on a flat surface and rub the base of the dolly across the pad 4-5 times.
2. As required, remove residue left from the abrading process using a dry cloth or paper towel.

Coating Surface Preparation

1. Lightly roughen the coating using the included abrasive pad

Note: As coating abrasion may introduce flaws, it should only be used when necessary to remove surface contaminants, or when the bond strength between the adhesive and the coating is insufficient for pull testing.

2. To promote the bond between the dolly and the coating, degrease the area of the coating to be tested using alcohol or acetone to remove any oil, moisture or dust.

Note: Ensure that any alternative abrasion techniques, degreasers or adhesives do not alter the properties of the coating. Test by applying a small amount of degreaser or adhesive to a sample area and observing effects.

Adhesive Selection

The adhesive included in the PosiTest Adhesion Tester kit has been chosen as the recommended adhesive due to its versatility. This adhesive has minimal impact on a variety of coatings and a tensile strength exceeding the maximum performance capabilities of the pressure system under ideal conditions. Other adhesives may be preferred based on requirements such as cure time, coating type, working temperature and pull off strength, e.g., quick curing one-part cyanoacrylates (superglues) may be sufficient for painted surfaces, but two-part epoxies are preferred for porous or rough coatings.

Araldite® Adhesive Preparation

Using a wooden stir stick (included), mix equal parts of the 2011/A and 2011/B adhesive on one of the included cardboard mixing palettes until the compound appears homogenous.

Adhering Dollies to Coating

1. Apply a uniform film of adhesive on the base of the dolly (approximately 2-4 mils thick for best results)
2. Attach the dolly to the prepared coating test area.

Note: If the coated surface to be tested is overhead or vertical, a means to hold the dolly in place during the cure time may be required, i.e. removable tape.

3. Gently push down on the dolly to squeeze out excess adhesive. Do not twist or slide the dolly back and forth on the coating as air bubbles may be generated.
4. Carefully remove excess adhesive from around the edges of the dolly.
5. Allow to cure per the adhesive manufacturer's instructions

Note: Many adhesives cure faster and provide a stronger bond when cured with heat. Similarly, cold environments may cause a longer cure time and weaker bond strength.

Final Dolly Preparation

Cutting Instructions:

1. Cut through the coating around the edges of the dolly with the 20 mm cutting tool, removing any excess adhesive.
2. Clear away any debris from the cutting process.

Note: Cutting may induce coating surface flaws such as microcracking that may alter test results.

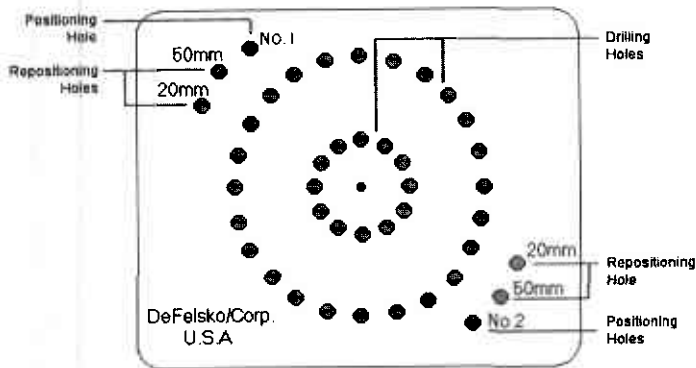
Note: For coatings with strong lateral bonding it is recommended to cut completely through the coating down to the substrate.

Drilling Instructions:

1. Place template on the coating to be tested. With a hand-drill (using a 5/32" / 4.0 mm drill bit) drill the first positioning hole into the coating through the hole marked No.1. While drilling always hold template firmly against the coating. After drilling remove the template and remove debris from surface.
2. Reposition the template and insert one of the two attached pins through the template hole marked No.1 and into the first drilled positioning hole.
3. Drill the second positioning hole into the coating through the template hole marked No.2. After drilling, remove the template and remove debris from surface.

4. Reposition the template and insert the two attached pins through the template holes marked No.1 and No.2 and into the two drilled positioning holes.
5. The template is now positioned to drill either the 20mm or 50mm circle of holes (depending on dolly size) into the coating.
6. After all holes have been drilled into the coating for the chosen circle size, remove the template and clean debris from the surface.
7. To complete the drilling process and remove all material between existing holes, place the template back onto the surface but rotate so the drilled positioning holes line up with the template repositioning holes labeled 20mm or 50mm, as appropriate. Replace positioning pins and repeat steps 5 & 6.

Note: Make sure all holes for the chosen circle size are drilled completely through the coating to the substrate surface.

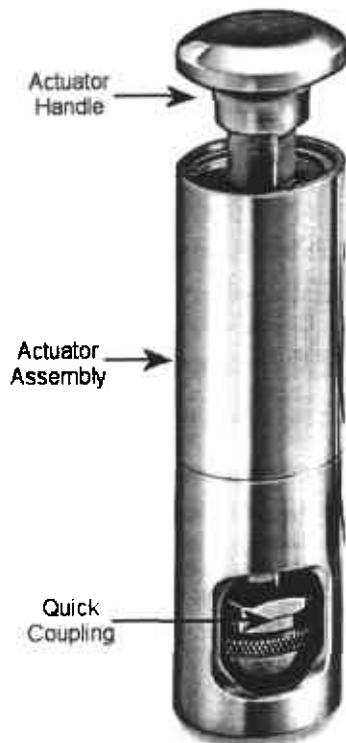


Pull Testing

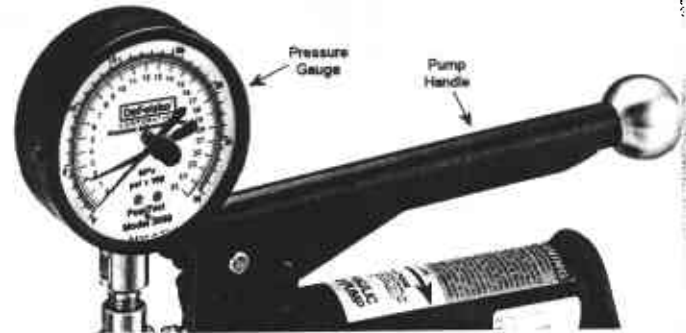
1. Ensure the pressure relief valve on the pump is completely open
2. Turn the red "drag" indicator on the pressure gauge to zero.

Note: If the black indicator will not return to zero, check to be sure that pressure has been completely relieved from the system.

3. Push the actuator handle completely down into the actuator assembly.
4. Place the actuator assembly over the dolly head and attach the quick coupler to the dolly by reaching through the holes in the actuator assembly and lifting the quick coupling. Release the quick coupling when the dolly head is completely engaged.
5. **Close the pressure relief valve on the pump tightly.**
6. Ensure the pump is on a well-supported horizontal surface. If it is necessary to place the pump on a vertical surface, position the unit so the pump hose outlet is in the down position to prevent air from being pumped into the actuator.



7. Begin pumping the pump handle until the black indicator on the pressure gauge starts to move. Continue pumping at a uniform rate of no more than 1 MPa (150 psi) per second until the actuator pulls the dolly from the coating.



8. Immediately following the pull, open the pressure relief valve on the pump to release the pressure. The red "drag" indicator on the pressure gauge will maintain the maximum pressure reading.

Note: An imprecise return of the black indicator to zero does not necessarily mean the gauge is out of calibration. If all pressure has been relieved but indicator still does not return to zero, simply tap the gauge on its case with a finger or elevate pressure and release again.

9. Record the pull off pressure and mark the dolly for future qualitative analysis.

Analyzing Results

Test results can be considered 100% valid when the coating is completely removed from the substrate and remains adhered to the adhesive on the dolly. When only a portion of the coating is removed, specific results should be analyzed including the fracture pattern to determine the cohesive properties of the coating and adhesion properties between the dolly and adhesive, adhesive and coating, distinct coating layers, and coating and substrate.

Maintenance

Refer to the Pump Operating Instructions (included) for maintenance information.

Warranty

The manufacturer fully warrants its products against defects in workmanship or materials for a period of one year from date of purchase. In the event that a tester is found to be defective, return the product with proof of purchase to your dealer, and the defective product will be repaired or replaced at the manufacturer's option.

No responsibility is assumed for incidental or consequential damages.

The warranty is voided if the tester or its components have been disassembled or tampered with.

Data subject to change without notice



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The Measure of Quality

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C O R P O R A T I O N

DeFelsko Corporation
802 Proctor Avenue, P.O. Box 676
Ogdensburg, New York 13669-0676 USA

Certificate of Calibration

Certificate Number: 03-47360

Nomenclature: Adhesion Tester
Manufacturer: DeFelsko
Model: PosiTest AT-CM
System Serial No: 1508AF19801

Test Method: This adhesion tester was designed to fully meet the intentions of ASTM D4541 and ISO 4624. The adhesion tester pressure system was calibrated to manufacturer's specifications according to internal procedure MP 2570 using a Load Cell Asset #00609 traceable to NIST.

Laboratory Environment
Temperature: 23 ± 5°C
Relative Humidity: Up to 95%

Pressure System Gauge (psi)	Load Cell (psi)	Full Scale Accuracy (%)
500	493	- 0.23
1000	982	- 0.58
1500	1487	- 0.42
2000	1998	- 0.06
2500	2507	0.23
3000	3025	0.81

Date of Calibration:

Oct. 17, 2003

Measurement Performed by:

Travis Moore
Technician

DeFelsko Corporation operates under Management Procedures intended to implement the requirements of ISO 9001, ISO 10012-1, MIL STD 45662A and ANSI/NCSL Z540-1. Traceability is maintained through a Load Cell that has been calibrated by an accredited laboratory and is traceable to NIST (National Institute of Standards and Technology) in the United States. The Load Cell has been certified to -.01% full scale, with a resolution of 0.1 lbs. This document certifies that the pressure system identified above has met the published specification of ±1% full scale. This certificate shall not be reproduced, except in full, without the written approval of DeFelsko Corporation.

Management Form 2007.03-11/2000



Declaration of Conformity

Application of Council Directive: 89 / 336 / EEC EMC
Standards to which Conformity is declared: EN61326 : 1998



Manufacturer: DeFelsko Corporation
Address: 802 Proctor Avenue
Ogdensburg, NY USA 13669

Type of Equipment: Handheld Inspection Equipment
Model No.: 6000, 100, DPM & UTG Series
Year of Manufacturer: 2003

***The undersigned, hereby declares that the equipment specified above
conforms to the listed Directive and Standards***


Signature

David E. Snyder - Chief Inspector

January 1, 2003

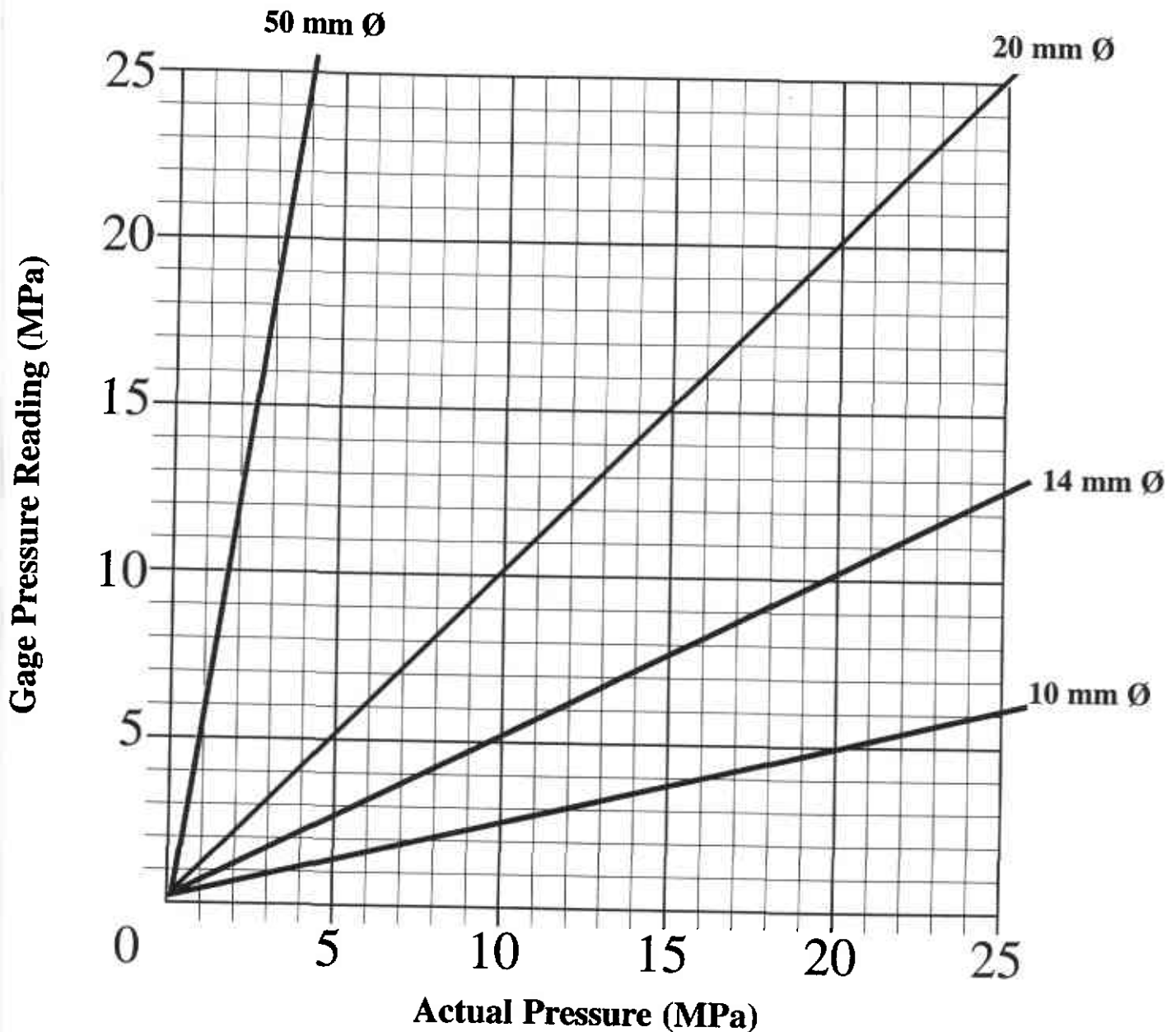
Date

Ogdensburg NY USA



DeFelsko® PosiTest® Adhesion Tester

Conversion Chart for Dolly Sizes (MPa)



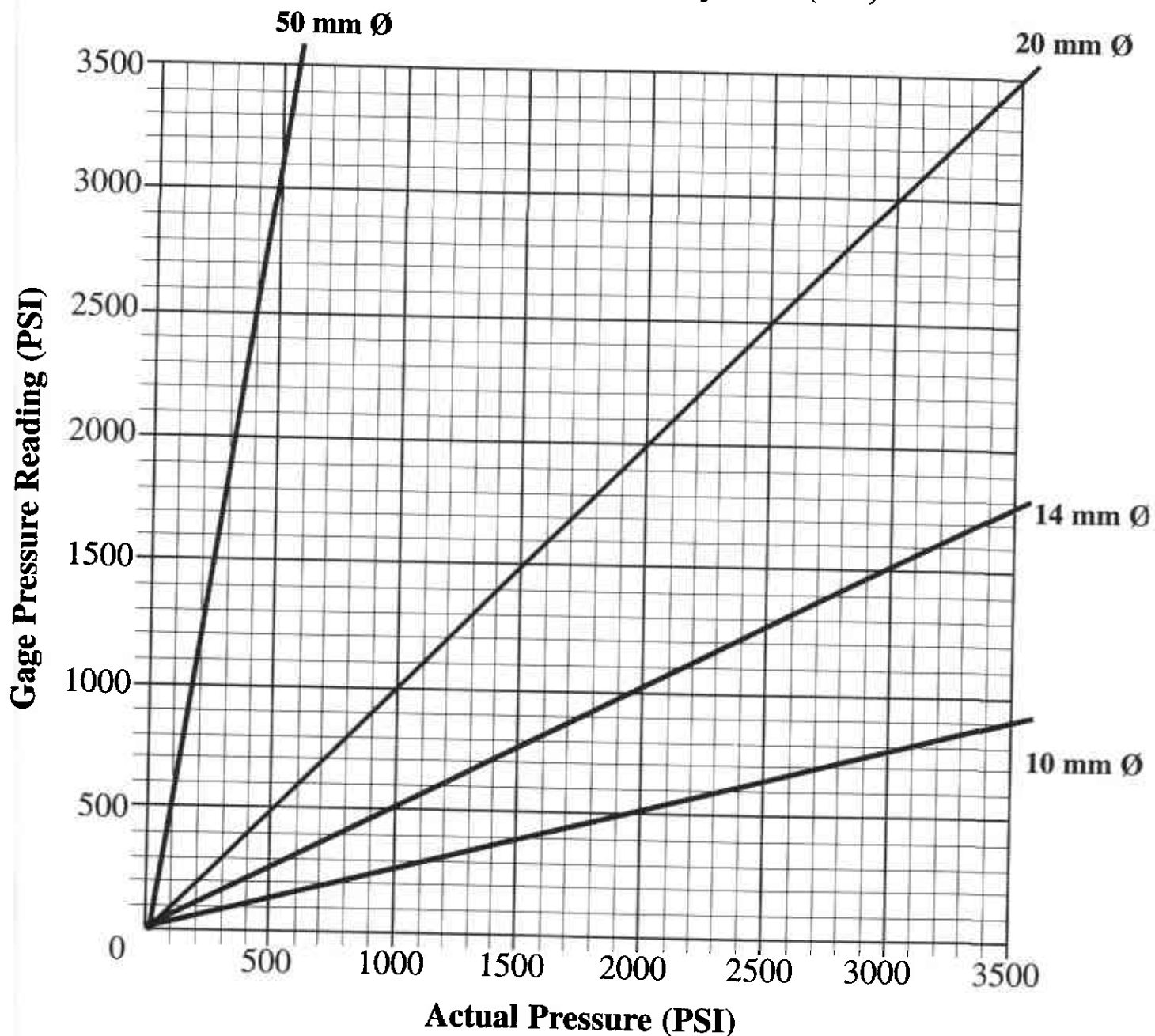
Conversion Calculations for Dolly Sizes

Dolly Diameter	Conversion Ratio	Conversion Formula
10 mm	1 : 4	Multiply Gage Reading by 4
14 mm	1 : 2	Multiply Gage Reading by 2
20 mm	1 : 1	Gage Reading is Actual
50 mm	6.25 : 1	Divide Gage Reading by 6.25



DeFelsko® PosiTest® Adhesion Tester

Conversion Chart for Dolly Sizes (PSI)



Conversion Calculations for Dolly Sizes

Dolly Diameter	Conversion Ratio	Conversion Formula
10 mm	1 : 4	Multiply Gage Reading by 4
14 mm	1 : 2	Multiply Gage Reading by 2
20 mm	1 : 1	Gage Reading is Actual
50 mm	6.25 : 1	Divide Gage Reading by 6.25

Operating Instructions for:

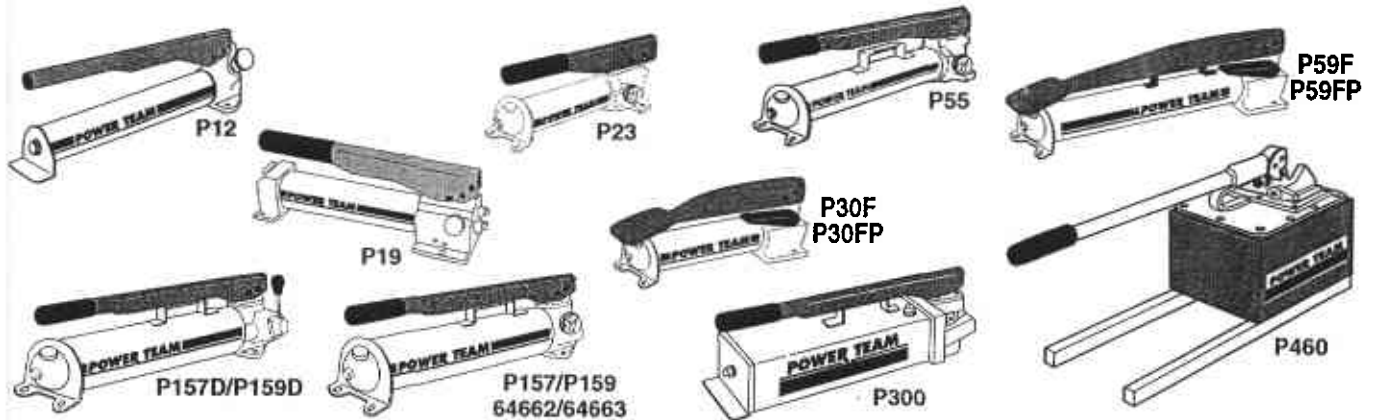
- | | | |
|------------------|----------------------|-----------------|
| 62072 (See P159) | 201338-TID (See P12) | P157 SERIES |
| 62087 (See P55) | P12 SERIES | P157D SERIES |
| 64122 (See P55) | P19 SERIES | P159 SERIES |
| 64215 (See P59) | P23 SERIES | P159D SERIES |
| 64372 (See P55) | P30F SERIES | P300 SERIES |
| 66463 (See P59) | P55 SERIES | P300D SERIES |
| 64662 (See P157) | P59 SERIES | P460 SERIES |
| 64663 (See P157) | P59F SERIES | YM-01 (See P19) |

**SINGLE-STAGE AND TWO-STAGE
HYDRAULIC HAND PUMP**

Max. Pressure: See Pump Data Plate

Definition: A hydraulic hand pump delivers hydraulic fluid under pressure by directly applied manual effort.

Note: Illustrations depict general pump configurations.



For Use With	Order No.	Volume & Pressure				Handle or Foot Lever Effort		Reservoir				Product Weight			
		Stage	Volume per Stroke		Maximum Pressure			Type	Oil Capacity		Usable Oil Capacity				
			in. ³	cm ³	psi	bar	lbs.		kg	in. ³	cm ³	in. ³	cm ³	lbs.	kg.
Single-Acting Cylinders (Pump includes 2-Way Valve)	P12	1	0.069	1.1	10000	700	75	34.0	A	12	197	9	148	5.7	2.6
	P19	1	0.305	5	325	22	8.5	3.8	B	24.4	400	20	328	6.6	3
		2	0.091	1.5	10000	700	98.5	44.7							
	P23	1	0.160	2.6	3000	200	70	31.8	B	23.8	390	20.3	333	12.0	5.4
	P30F	1	0.216	3.5	325	22	125	56.7	B	31	508	27	443	10.0	4.5
		2	0.054	0.9	10000	700									
	P30FP	1	0.216	3.5	325	22	125	56.7	B	31	508	27	443	10.0	4.5
		pop-off	0.054	0.9	10000	700									
	P55	1	0.160	2.6	10000	700	145	65.8	B	55	901	45	738	15.8	7.2
		2	0.160	2.6	10000	700									
	P59	1	0.662	10.8	325	22	145	65.8	B	55	901	45	738	17.2	7.8
		2	0.160	2.6	10000	700									
	P59F	1	0.550	9.0	325	22	120	54.5	B	55	901	45	738	14.0	6.4
		2	0.130	2.1	10000	700									
P59FP	1	0.550	9.0	325	22	145	65.8	B	55	901	45	738	14.0	6.4	
	pop-off	0.130	2.1	10000	700										
P157	1	0.650	10.7	1400	97	140	63.5	B	152	2491	137	2245	26.0	11.8	
	2	0.160	2.6	10000	700										
P159	1	2.600	42.6	325	22	140	63.5	B	152	2491	137	2245	26.0	11.8	
	2	0.160	2.6	10000	700										
P300	1	2.600	42.6	325	22	140	63.5	C	1.5 gal.	5.7 l	310	5081	55.3	25.1	
	2	0.160	2.6	10000	700										
P460	1	7.350	120.5	325	22	90	40.8	D	2.5 gal.	9.5 l	460	7539	54.9	24.9	
	2	0.294	4.6	10000	700										
Double-Acting Cylinders	P157D	1	0.650	10.7	1400	97	140	63.5	B	152	2491	137	2245	28.8	13.1
		2	0.160	2.6	10000	700									
P159D	1	2.600	42.6	325	22	140	63.5	B	152	2491	137	2245	27.9	12.7	
	2	0.160	2.6	10000	700										
P300D	1	2.600	42.6	325	22	140	63.5	C	1.5 gal.	5.7 l	310	5081	57.0	25.9	
	2	0.160	2.6	10000	700										
P460D	1	7.350	120.5	325	22	90	40.8	D	2.5 gal.	9.5 l	460	7539	57.9	26.3	
	2	0.294	4.6	10000	700										

3/8 NPTF oil port(s) on all pumps

Table 1

SAFETY EXPLANATIONS

Two safety symbols are used to identify any action or lack of action that can cause personal injury. Your reading and understanding of these safety symbols is very important.

 **DANGER** - Danger is used only when your action or lack of action will cause serious human injury or death.

 **WARNING** - Warning is used to describe any action or lack of action where a serious injury can occur.

IMPORTANT - Important is used when action or lack of action can cause equipment failure, either immediate or over a long period of time.

Pictogram Definition



Do not remove this component. For service only. Pressure must be released.

 **WARNING:** It is the operator's responsibility to read and understand the following safety statements,

- Only qualified operators should install, operate, adjust, maintain, clean, repair, or transport this machinery.
- These components are designed for general use in normal environments. These components are not specifically designed for lifting and moving people, agri-food machinery, certain types of mobile machinery or special work environments such as: explosive, flammable or corrosive. Only the user can decide the suitability of this machinery in these conditions or extreme environments. Power Team will supply information necessary to help make these decisions.
- Do not use equipment if damaged, altered, or in poor condition.
- All safety decals must be replaced when unreadable.

These instructions are intended for end-user application needs. Most problems with new equipment are caused by improper operation or installation. Detailed service repair instructions or parts lists can be obtained from your nearest Power Team facility.

SAFETY PRECAUTIONS



WARNING: To help prevent personal injury,

- Before operating the pump, all hose connections must be tightened with the proper tools. Do not overtighten. Connections need only be tightened securely and leak-free. Overtightening may cause premature thread failure or high pressure fittings to split at pressures lower than their rated capacities.
- Should a hydraulic hose ever rupture, burst, or need to be disconnected, immediately shut off the pump and shift the control valve twice to release all pressure. Never attempt to grasp a leaking hose under pressure with your hands. The force of escaping hydraulic fluid could cause serious injury.
- Do not subject the hose to any potential hazard such as fire, extreme heat or cold, sharp surfaces, heavy impact. Do not allow the hose to kink, twist, curl, or bend so tightly that the fluid flow within the hose is blocked or reduced. Periodically inspect the hose for wear because any of these conditions can damage the hose and result in personal injury.
- Do not use the hose to move attached equipment. Stress may damage the hose and cause personal injury.
- Hose material and coupler seals must be compatible with the hydraulic fluid used. Hoses also must not come in contact with corrosive materials such as creosote-impregnated objects and some paints. Consult the manufacturer before painting a hose. Never paint the couplers. Hose deterioration due to corrosive materials may result in personal injury.
- All components in the hydraulic system must match the maximum pressure rating of the pump.

Pump

- Do not exceed the PSI rating noted on the pump nameplate or tamper with internal high pressure relief valve. Creating pressure beyond rated capacities may result in personal injury.
- Before adding hydraulic fluid, retract the system to prevent overfilling the pump reservoir. An overfill may cause personal injury due to excess reservoir pressure created when cylinders are retracted.
- The load must be under operator control at all times.
- Do not connect pump to hydraulic system powered by another pump.

Cylinder

- Do not exceed rated capacities of the cylinders. Excess pressure may result in personal injury.
- Do not set poorly-balanced or off-center loads on a cylinder. The load may tip and cause personal injury.
- Stay clear of lifted loads and keep others away.
- Extensions are not recommended for lifting applications.

SET-UP

Hydraulic Connections

IMPORTANT: Seal all hydraulic connections with a high grade, nonhardening thread sealant. Teflon tape may also be used to seal hydraulic connections if only one layer of tape is used. Apply the tape carefully, two threads back, to prevent it from being pinched by the coupler and broken off inside the pipe end. Any loose pieces of tape could travel through the system and obstruct the flow of fluid or cause jamming of precision-fit parts.

1. Clean all areas around the fluid ports of the pump and cylinder. Clean all hose ends, couplers, and union ends. Remove thread protectors from the hydraulic fluid outlets, and connect the hose assembly. Couple hose to cylinder.
2. The use of a hydraulic pressure or tonnage gauge (not included) is strongly recommended. Remove the pipe plug from the gauge port of the valve, thread the gauge into this port and seal as noted above.



WARNING: To help prevent personal injury,

- The gauge must have the same pressure rating as the pump and cylinder. Personal injury can result if the wrong gauge is used.
- Release hydraulic pressure **BEFORE** removing or tightening hose couplings.

Sheet No. 2 of 4

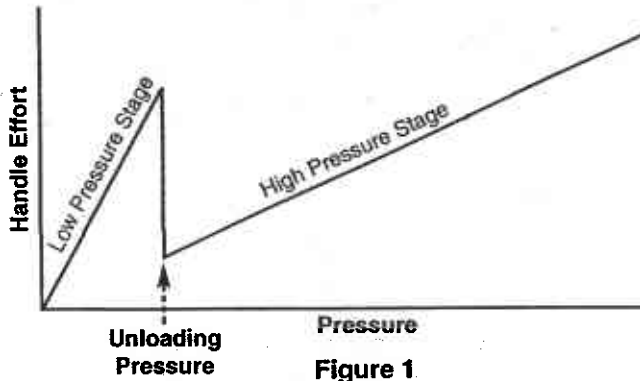
Rev. 9 Date: 30 April 2003

OPERATION

The P460 can be operated only in the horizontal position. All other hand pumps can be operated in a horizontal position or in a vertical position with head pointing downward.

Refer to Table 1 and your pump name plate to determine your style of pump.

IMPORTANT: Figure 1 illustrates the *normal* drop of handle effort experienced when all (except P59) two-stage pumps shift from low pressure stage to high pressure stage.



Two-way Valve

Pumps with a two-way valve are for use with single-acting cylinders.

1. To extend the cylinder, turn the valve knob counterclockwise to a closed (seated) position. **Note: Hand tight only!** Work the pump handle up and down to build pressure.
2. To release pressure, open the valve slowly by turning the knob clockwise to control the load.

Four-way Valve

Pumps with a three-position, four-way valve are for use with double-acting cylinders. The hose connection for extending a cylinder can be made to either port. With the handle in the forward position, the fluid is directed to the top fluid port. To maintain (hold) pressure, stop the pumping action. When the valve handle is in the center position, fluid flow is blocked to both ports.



WARNING: The operator should always release the pressure slowly.

PREVENTIVE MAINTENANCE

IMPORTANT: Any repair or servicing that requires dismantling the pump must be performed in a dirt-free environment by a qualified technician.



Lubrication

Apply lubricant regularly to all pivot and rubbing points.
Use a good grade of No. 10 motor oil or grease. Do not use dry lubricants.

Next
Page

Bleeding Air From the System

Air can accumulate in the hydraulic system during the initial set-up or after prolonged use, causing the cylinder to respond slowly or in an unstable manner. To remove the air:

1. Position the cylinder at a lower level than the pump, and turn the cylinder rod end down.
2. Extend and retract the cylinder several times without putting a load on the system. Air will be released into the pump reservoir. Follow the fluid level instructions for your reservoir type to release the air from the reservoir and top off the fluid supply.

Bleeding Air From The Pump

When the pump is first put into use, or after refilling the pump's reservoir it may be necessary to bleed any trapped air from the pump. If this is not done the pump will not function properly (will not build pressure or has very spongy operation).

To bleed air from the pump, turn the pressure control knob counterclockwise (CCW) and operate the pump handle up and down approximately twenty times. Turn the pressure control knob clockwise (CW) to its full stop position. The pump should now be bled of air and ready to use.

PREVENTIVE MAINTENANCE -CONTINUED

Hydraulic Fluid Level

⚠ WARNING: Cylinder(s) must be fully retracted before checking the fluid level. Release all system pressure before breaking any hydraulic connection in the system.

Check the hydraulic fluid level in the reservoir periodically. Use a funnel with a filter to add hydraulic fluid if needed.

Refer to Table 1 for your reservoir type.

For models with Reservoir Type A: Place the pump in a vertical position with the pump head facing upward. Unscrew and remove the pump head from the reservoir. The fluid level within the reservoir should come to the fluid level mark indicated on the reservoir body decal. Before replacing the pump head, visually inspect the o-ring which seals the pump head/reservoir assembly. Replace this o-ring if it is worn or damaged. Reinstall pump head to reservoir and tighten securely. Check for leaks.

For models with Reservoir Type B: Remove the filler cap. The fluid level should come to the bottom edge of the filler hole when the pump is level and resting horizontally on its base and the cylinders are retracted (see Figure 2).

For models with Reservoir Type C: Remove the filler cap. The fluid level should be 1/2 inch (12.7 mm) from the filler hole when the pump is level and resting horizontally on its base and the cylinders are retracted.

IMPORTANT: The pump sight gauge indicates the presence of hydraulic fluid only. It does not determine correct fluid level.

For models with Reservoir Type D: Remove the filler cap. The fluid level should be 1/2 inch (12.7 mm) from the cover plate when the pump is level and resting horizontally on its base and the cylinders are retracted.

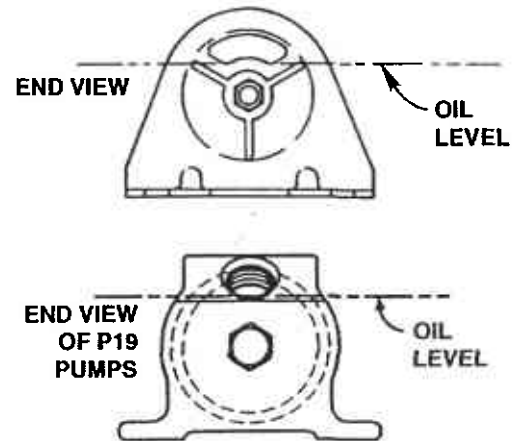


Figure 2

Draining And Flushing The Reservoir

Drain, clean and replenish the reservoir with high-grade, approved Power Team hydraulic fluid yearly or more often if necessary. The frequency of fluid change will depend upon the general working conditions, severity of use and overall cleanliness and care given the pump.

IMPORTANT: Clean the exterior of the pump first. After draining and flushing the reservoir, drain and clean the other hydraulic system components (hoses, cylinders, etc.) before connecting them to the pump again. This will help prevent contaminated fluid from entering the pump.

Refer to Table 1 for your reservoir type.

For models with Reservoir Type A:

1. Unthread and separate the pump head from the reservoir. Drain the reservoir of the used hydraulic fluid.
2. Flush out reservoir with a small amount of clean hydraulic fluid. Clean the pump intake filter.
IMPORTANT: Removing the filter from the pump assembly could result in its breakage. Attempt to clean it as well as possible with it installed.
3. Refill the reservoir and reassemble the pump head to the reservoir. Tighten securely. Check for leaks.

For models with Reservoir Type B & C:

1. Remove the filler cap. Drain the hydraulic fluid through filler hole.
2. Remove the nut from the tie rod. Separate the reservoir from the pump body. Clean the reservoir and filter.
IMPORTANT: Removing the filter from the pump assembly could result in its breakage. Attempt to clean it as well as possible with it installed.
3. Reassemble and fill the reservoir with Power Team hydraulic fluid. Replace the filler cap.

For models with Reservoir Type D:

1. Remove the ten screws fastening the reservoir cover to the reservoir, and lift the pump and valve assemblies off.
2. Drain all hydraulic fluid and flush reservoir with a small amount of clean hydraulic fluid.
3. Remove the pump assembly filter, rinse it clean, and reassemble.
4. Refill the reservoir with Power Team hydraulic fluid. Place the pump and valve assembly (with gasket) on the reservoir, and thread the ten screws. Tighten securely and evenly.

TROUBLESHOOTING GUIDE



WARNING: To help prevent personal injury, always release pump pressure and disconnect hoses(s) from pump before making repairs.

Refer to the appropriate pump parts list during trouble-shooting. Repairs must be performed in a dirt-free environment by qualified personnel familiar with this equipment.

PROBLEM	CAUSE	SOLUTION
Pump losing pressure	<ol style="list-style-type: none"> 1. System components leaking 2. Directional control valve leaks or not adjusted properly 3. Fluid leaking past outlet check seat(s) 	<ol style="list-style-type: none"> 1. Repair or replace as necessary 2.* Reseat, repair, or replace directional control assembly and correctly adjust 3.* Check for dirt. Reseat pump body and/or replace poppet(s) or ball(s)
Handle rises after each stroke	<ol style="list-style-type: none"> 1. Fluid leaking past outlet check seat(s) 	<ol style="list-style-type: none"> 1.* Check for dirt. Reseat pump body and/or replace poppet(s) or ball(s)
Pump not delivering fluid	<ol style="list-style-type: none"> 1. Low fluid level in reservoir 2. Intake filter is dirty 3. Seats worn and not seating properly 	<ol style="list-style-type: none"> 1. Check fluid level per instructions 2. Remove reservoir and clean 3.* Repair seats or replace pump body
Pump does not reach full pressure	<ol style="list-style-type: none"> 1. Low fluid level in reservoir 2. System components leaking 3. Directional control valve leaks or not adjusted properly 4. Improperly adjusted relief valve 5. Fluid leaking past inlet or outlet checks or high pressure piston seal damaged 	<ol style="list-style-type: none"> 1. Check fluid level per instructions 2. Repair or replace as necessary 3.* Reseat, repair, or replace directional control assembly and correctly adjust 4.* Readjust 5.* Reseat or repair inlet or outlet checks or replace high pressure piston seal
Pump handle can be pushed down (slowly) without raising the load	<ol style="list-style-type: none"> 1. Inlet checks are not seating 2. Damaged piston assembly or piston seals leaking 	<ol style="list-style-type: none"> 1.* Check for dirt and/or reseat valve seats 2.* Replace piston assembly and/or piston seals
Pump handle operates with a spongy action	<ol style="list-style-type: none"> 1. Air trapped in system 2. Too much fluid in reservoir 	<ol style="list-style-type: none"> 1. Position cylinder lower than pump. Extend and return cylinder several times. Follow bleeding instructions. 2. Check fluid level per instructions
Pump handle effort drops significantly after some pressure has been obtained	<ol style="list-style-type: none"> 1. This is normal operation on most two-stage hand pumps 	

*Power Team recommends these hand pump repairs be performed by an Authorized Hydraulic Service Center.

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Rev. 9 Date: 30 April 2003

EC Declaration of Incorporationas defined by
European Communities Directive 89/392/EEC, Annex II(B)

MANUFACTURER'S NAME:

SPX POWER TEAM®

MANUFACTURER'S ADDRESS:

5885 11th Street
Rockford, Illinois 61109
USATelephone: 815-874-5556
Fax: 815-874-7853

TYPE OF EQUIPMENT: SINGLE-STAGE and TWO-STAGE HYDRAULIC HAND PUMP.

ORDER NUMBER OR PART NUMBER: P12 Series, P19 Series, P23 Series, P30F Series,
P300 & P300D Series, P157 & P157D Series, P159 & P159D Series, P460 Series,
P55 Series, P59 & P59F Series.

Part numbers which start with the letter "Q" and contain the number listed above.

APPLICATION OF EC COUNCIL DIRECTIVE(S): 89/392/EEC as amended by 91/368/EEC, 93/44/EEC,
and 93/68/EEC.

STANDARD(S) TO WHICH CONFORMITY IS DECLARED: EN292-1 and EN292-2.

I, the undersigned, hereby declare that the equipment specified above conforms to the above European Communities Directive(s) and Standard(s). This product is not to be put into service until the machine has been declared in conformity with the provisions of the European Communities Directive(s).

PLACE: Owatonna, Minnesota USA

DATE: Rev. 16 May 2000
(date / month / year)

(Signature)

Michael S. O'Brien

Director Quality / Technical Services



Product Data

Ciba

Araldite[®] 2011 (AW 106/HV 953) MULTI-PURPOSE ADHESIVE

DESCRIPTION: Araldite 2011 is a multi-purpose, viscous adhesive system suitable for bonding a variety of materials, including metal, ceramic, and wood. This electrically insulating adhesive is easy to apply either manually by spatula and stiff brush or mechanically by metering, mixing, and coating equipment. The adhesive cures at temperatures from 68°F (20°C) to 356°F (180°C) with no release of volatile constituents.

APPLICATIONS:

Metals	Vulcanized rubber
Ceramics	Foams
Wood	Plastics

ADVANTAGES:

- No curing shrinkage
- No release of volatile constituents
- Easy to apply
- Odorless
- Adequate contact pressure
- Semi-rigid to flexible bonds, depending on proportion of hardener used
- Good resistance to static and dynamic loads
- Electrically insulating

TYPICAL PROPERTIES:	Property	Test Method	Test Values ⁽¹⁾	
			Resin	Hardener
	Color/appearance	Visual	Creamy, viscous/liquid	Amber liquid
	Specific Gravity	ASTM D-792	1.17	0.92
	Viscosity (cP)	ASTM D-2393	50,000	35,000

TYPICAL MIXED PROPERTIES:

Property	Test Method	Test Values ⁽¹⁾
Reaction Ratio (by weight)		100R/80H
Reaction Ratio (by volume)		100R/100H
Pot Life (hours) (4 fl. oz. mass)	ASTM D-2471	2
Mixed Viscosity (cP)	ASTM D-2393	45,000

⁽¹⁾Tested @ 77°F (25°C)

RECOMMENDED CURE SCHEDULES:	<u>Temperature</u>	<u>Handling Strength</u>	<u>Minimum Cure Time</u>
	68°F (20°C)	12 hours	15 hours
	77°F (25°C)	7 hours	12 hours
	104°F (40°C)	2 hours	3 hours
	158°F (70°C)	30 minutes	50 minutes
	212°F (100°C)	6 minutes	10 minutes
	302°F (150°C)	4 minutes	5 minutes

**TYPICAL CURED
PROPERTIES:**

Application of Adhesive

The resin/hardener mix is applied with a spatula to the pretreated and dry joint surfaces.

A layer of adhesive 0.002 to 0.004 inches thick will normally impart the greatest lap shear strength to a joint.

The joint components should be assembled and clamped as soon as the adhesive has been applied. Even contact throughout suffices to ensure proper cure.

Standard Test Specimens

Unless otherwise stated, the figures given below were all determined by testing standard specimens made up by lap-jointing 4 x 1 x .06 inch strips of aluminum. The joint area was 0.5 x 1 inch in each case.

<u>Property</u>	<u>Test Method</u>	<u>Test Values⁽¹⁾</u>	
Lap Shear Strength (psi)	ASTM D-1002		
<i>Effects of cure time and temperature</i>			
	<u>Cure Temperature</u>	<u>Time</u>	
	77°F (25°C)	8 hours	710
		15 hours	1990
		24 hours	2130
		72 hours	2280
		5 days	2560
	158°F (70°C)	1 hour	3130
		2 hours	3410
		3 hours	3200
	212°F (100°C)	10 minutes	3700
		20 minutes	3980
		30 minutes	4120
	302°F (150°C)	5 minutes	4270
		10 minutes	4410
		20 minutes	4410

⁽¹⁾Tested @ 77°F (25°C)