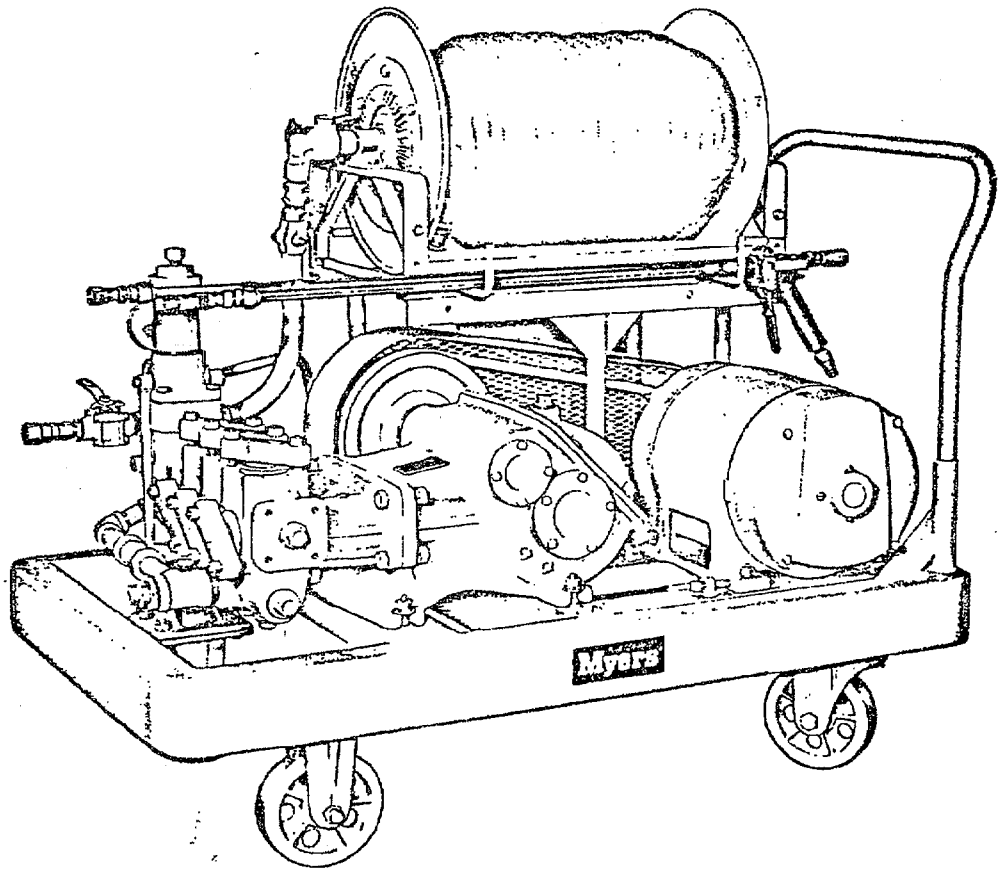
INSTRUCTIONS

FOR INSTALLATION, OPERATION AND SERVICE

Myers

MC30-12M HYDRAULIC CLEANER UNIT



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XIII. SAFETY CONSIDERATIONS

The use of Myers Hydraulic Cleaner Systems poses no unusual or new safety problems. Even at maximum pressure of 1200 PSI, the direct impingement of jets will not penetrate or cut the skin. The result of a direct hit at close range, although painful, will not cause serious injury, except perhaps to the eyes or ears.

A primary safety consideration is concerned with the effect of the water itself on surroundings such as electrical equipment and fragile components or material which might be damaged by water jets or sprays.

These problems can be met by use of waterproof components or by utilizing coverings or shields of waterproof materials before beginning work. The proper provision for drainage of the water from the working area is, of course, a part of the planning for each job.

Protection of the operator is easily provided by conventional water-proof protective clothing, boots, hats, gloves, and face shields. Such protective clothing and devices must be used to insure the protection of the operator from any potentially harmful materials which might be picked up by the water jets, and at the same time, make the job more confortable. At all times, proper eye protecting equipment must be worn by the operator and others working in the immediate area.

The use of the Myers foot operated valve as a "dead man" control is recommended for protection of the operator when working in confined quarters, on hazardous footing, on scaffolding, or in other particularly hazardous locations.

The addition of the foot operated valve provides an automatic shut-off should the operator slip, fall or lose his balance. In certain cases it may be desired to have the foot operated valve attended by a backup man who observes the course of the work and shuts off the high pressure water if a potential hazard should develop unknown to the operator.

IMPORTANT

The MC30-12M Cleaner Unit has been engineered to give maximum performance. All the components in this unit have been matched. Any deviation or substitution of any of these components may cause erratic operation and possible damage to the system itself. Any deviations or substitutions of components other than MYERS components will void any warranties concerning this unit.

INSTRUCTIONS FOR INSTALLATION, OPERATION AND SERVICE MC30-12M HYDRAULIC CLEANING UNIT

ELECTRICAL SUPPLY

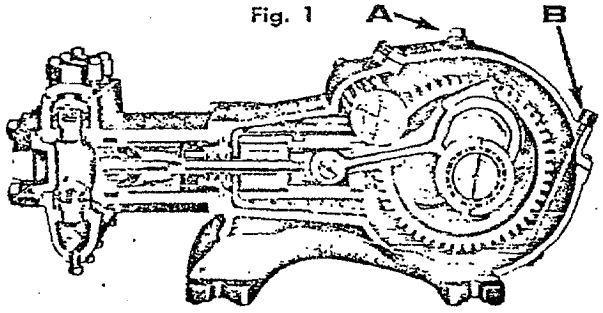
Unit will normally be shipped with starter and motor wired for 460V-60 Hertz 3 phase operation. (If 230V-60 Hertz 3 phase supply will be used, order magnetic coil 18695A and appropriate heaters.) Other voltage and 50 Hertz will be supplied if ordered, together with proper starter and heaters. Customer will supply lead wire from starter box to power supply.

WATER SUPPLY

Customer will supply inlet hose and connections to meet installation requirements. A flexible suction hose must be used. Hose 1½" I.D. x 25 ft. long is recommended with a minimum pressure of 20 P.S.I. at pump inlet with nozzle operating. Inadequate water supply will cause cavitation and excessive pump wear.

Hot water up to 180°F. maximum may be used.

Fig. 1



PUMP PRE-OPERATION SERVICE

1. Pump crankcase has been filled thru filler plug on top (Point A—Figure 1) with 3½ qts. of SAE 40 oil to which has been added 6 fluid ounces of Molykote Fluid Concentrate. (Add 6 ounces of Molykote Fluid Concentrate to oil at every oil change.) Check with oil level mark on dip stick (Point B—Figure 1).

INSTALLATION & OPERATION PROCEDURES

When unit is first placed in operation all of the following steps are necessary. Subsequent usage may omit steps for purging air.

1. Unreel the first of two 50-ft. sections of ¾" hose on reel and couple the two sections together.
2. Attach cleaning gun to hose sections.
3. Turn on water supply and open gun trigger to purge air from pump and system. (Note: If water pressure is turned on before quick connect-disconnect fittings are attached pressure in lines will make it difficult or impossible to connect.)
4. Shut off gun and start pump motor.
5. Operate gun @ 1200 PSI and purge system at operating pressure.
6. With all sections of hose filled with water they may be used in combinations to suit operating requirements.

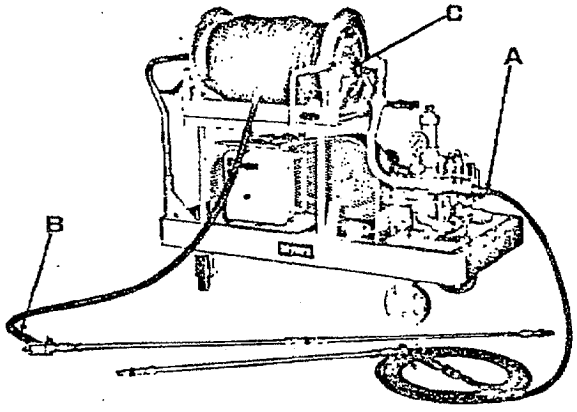


Fig. 2

REEL & HOSE USAGE

When operating use as few feet of hose as possible.

Every unnecessary foot of hose used reduces pressure and flow available for cleaning. (See Gun instructions for other information.)

Hose should not be allowed to drape over sharp and

abrasive edges when in use. Repeated surging with pressure changes can result in severe, localized wear of the hose cover.

For operation within 20 ft. of machine: Use 1 10-ft. or 2 10-ft. lengths of ½" hose coupled at Point A—Figure 2.

For operation 50 to 100 feet from machine: Unreel 50 foot length of hose from reel and couple at Point B—Figure 2. 10 foot lengths of ½" hose can be attached to ¾" hose. 25 and 50 foot lengths are available as optional equipment.

For operation 100 to 120 feet from machine: Unreel and couple both 50 foot sections of ¾" hose. Couple 10 foot sections of ½" hose to ¾" hose. (Point B—Figure 2).

For operation above 120° F. and up to 180° F. special cylinders and packing are installed in the pump. Pressure must be maintained above the vapor pressure of the water at all times in order to prevent cavitation damage to the pump cylinders and packing. It may be necessary to add a booster pump to the suction line if the system supply pressure is below 50 P.S.I. If the supply system line is not large enough to permit this kind of installation, it may be necessary to install a holding tank with sufficient capacity in addition to the booster pump.

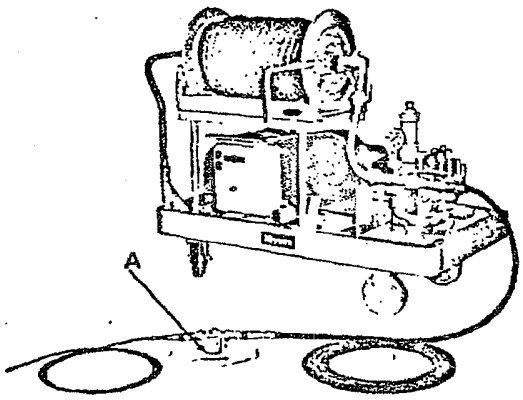


Fig. 3

TUBE AND PIPE CLEANING

Position foot operated valve for operator convenience in relation to the work, Point A—Figure 3. Insert hose with rear jet nozzle into tube or pipe before stepping on valve pedal. Allow hose to feed into tube or pipe. Pull back while under pressure for maximum cleaning until hose is nearly to the end. Release foot pedal before withdrawing hose!!!!

HEAT EXCHANGER CLEANING

Heat exchangers may be cleaned in place by opening one end. Usual practice is to clean bottom two rows of tubes so dislodged material from closed end can flow out. These tubes may be re-run from time to time so they do not plug.

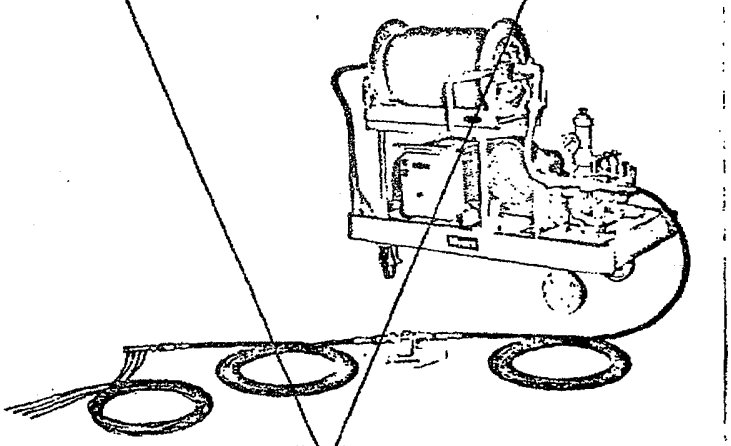


Fig. 4

MANIFOLD 4 HOSE ASSEMBLY OPERATION

(Optional Accessory)

Grasp four hoses near the nozzles and insert in tubes 4 to 6 inches. Turn on pressure by stepping on foot operated valve pedal. (Figure 4).

Feed all hoses at the same rate. Withdraw under pressure to flush maximum amount of debris from tubes. If one nozzle meets an obstruction and cannot advance retain all hoses in one hand. With other hand pull retarded hose/nozzle back from obstruction. Allow to surge forward and impact against blockage. Repeat until impact breaks obstruction and allows hose to catch up with others. Continue until all hoses exit from opposite end.

When nozzles are completely through, pull hoses simultaneously (with pressure on) to flush out all material. Shut off pressure before nozzles emerge from tube bundle!!!!

(If nozzles catch on far end of tube rotate assembly ½ to ¾ turns with pressure off. When nozzles are pulled inside tubes re-open foot operated valve.)

SERVICE NOTES

If inlet supply valve is closed or even partially closed it will interfere with the flow of water to the pump suction to such an extent that the pump will not perform to full capacity. If the valve is partially closed it may cause severe knocking and vibration of the pump because the water cannot flow into the cylinder cavities fast enough.

SERVICE CHART

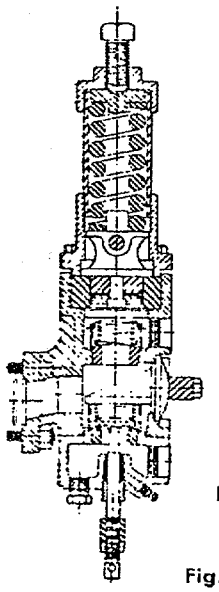
SERVICE PROBLEM

A Failure of pump to build pressure with discharge closed
B Failure to hold pressure with discharge open
C Pump is noisy
D Pump gets hot
E Pressure gauge shows abnormal fluctuation
F Unloader and Regulator chatter

POSSIBLE CAUSE OF PROBLEM	F	E	D	C	B	A
1. Pump not primed						X
2. Valve closed in suction line						X
3. Pressure regulator valve badly worn					X	X
4. Pressure regulator not properly adjusted					X	X
5. Pump Plunger cups or valves badly worn					X	
6. Pump cylinder body cracked					X	X
7. Over capacity nozzle					X	
8. Small air leak in suction line					X	
9. Insufficient supply line capacity				X		
10. Water in crankcase			X			
11. Worn connecting link bearings			X	X		
12. Lack of oil in crankcase			X			
13. Regulator plunger sticking		X				
14. Regulator stuffing box nut too tight		X				
15. Regulator stuffing box nut too loose or needs packing	X					
16. Foreign matter under pump valve		X			X	
17. Loose piston rod				X		
18. Main bearing lock rings out			X			
19. Air in hose line on reel	X					
20. Undersize nozzle	X					

The unloading valve, Figure 5, must be properly adjusted for it to function properly. (See Instructions—18240D1—Unloader.)

Badly worn plunger cups or valves and valve seats in the pump (see Figure 1) will cause a serious drop in capacity. Worn plunger cups are very easy to detect because of the leakage past the cups. The plunger cups should be replaced just as soon as this leakage is noticed. If it is allowed to continue some of the liquid may work past the plunger rod seals into the pump crankcase. Water in the pump crankcase will cause severe corrosion of the bearings. Worn valves can only be detected by visual examination of each valve assembly.



18240D1 Unloader and Regulator

Fig. 5

Pump cylinder bodies must withstand an extreme amount of shock and pulsation while the pump is in operation. If the pump is allowed to freeze, the cylinder body walls may be cracked. If the crack should occur on the suction valve or cylinder portion of the body it may allow a small amount of air to enter on the suction stroke and cause noisy operation or a decrease in pumping capacity. If the crack develops in the walls between the cylinder cavities or discharge valve cavity it may allow the water to flow from one cavity to the adjacent cavity and rob the pump of its effective displacement. This will not cause noisy operation but will reduce the pump capacity and may show up as a drop in pressure when the discharge is open.

Water may accumulate in the pump crankcase from two sources; the most prevalent being leakage of the plunger cups as explained previously. The other means of accumulation being a condensation of moisture inside the crankcase due to changes in weather or the repeated heating and cooling of the pump due to its normal usage. Pumps that are used rather consistently and run for a considerable period of time to heat the oil and other working parts will not normally accumulate water by condensation. If the plunger cups are replaced as soon as they start to leak it will be impossible for water to enter the crankcase from this cause.

Worn connecting link bearings will develop because of unusual or adverse operating conditions. They will, however, be seriously affected by corrosion if water is present in the crankcase and they will wear out from overheating if adequate oil is not provided in the crankcase. For this reason we recommend thorough draining, cleaning and refilling with new oil prior to any storage period. Replace bearings as soon as any damage is discovered to avoid possible damage to crankshaft. (See Lubrication instructions page 5.)

Noisy pump operation will sometimes be caused by a piston rod being loose in the crosshead.

This will become evident if the rod becomes so loose that some end motion can be found between the piston rod and crosshead. A noise of this kind usually has a regular cadence timed with each stroke of the plunger. When this condition occurs it is always necessary to replace both the piston rod and the crosshead because the two parts are fabricated into a single unit.

The crankshaft main bearings are held in place by the end bearing caps. If bearing cap retaining bolts should become loosened, the bearing can shift which may cause bearing to run exceptionally hot. See Section 1650, Page 164.

QUICK CONNECT-DISCONNECT SERVICE

If a leak should develop at a quick disconnect coupling it should be replaced promptly. A leaking connector will cause rapid cycling of the pressure regulator-unloader during off periods.

HOSE & HOSE FITTINGS

Use of hose and couplings other than supplied by Myers voids the warranty.

Myers MOBILE HYDRAULIC CLEANER
Model MC30-12M

WINTERIZING PROCEDURE
Storage below 32°F

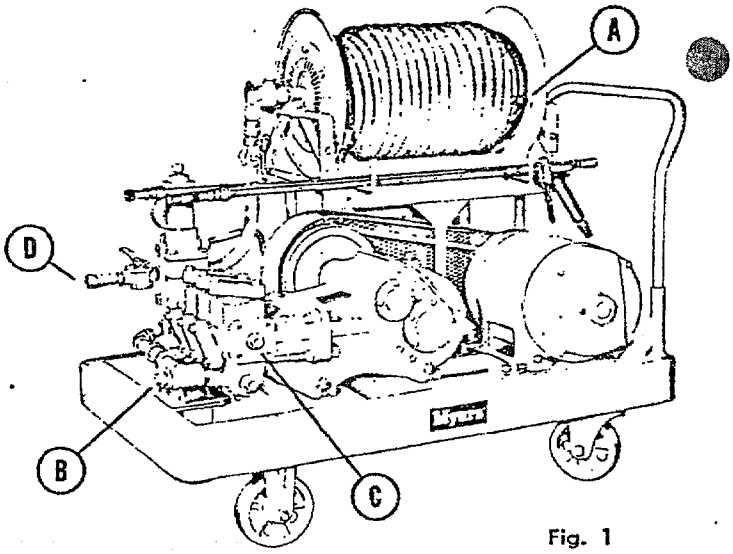


Fig. 1

STEP 1

REEL HOSE — To empty water from ¾" reel hose, attach air line at B, attach gun at A. Open gun (lock) and pressurize system with air until water is out of hose.

STEP 2

INDIVIDUAL HOSES — Attach individual hoses at D, attach gun at discharge end of hose, pressurize system as in Step 1. Repeat as necessary for all hoses used in cleaning operation. Remove air line.

STEP 3

PUMP WITHOUT VALVE LIFTERS

1. Remove plug C. (Fig. 1)
2. Remove suction drain plugs #10. (3 plugs)
3. Remove cylinder drain plugs #11. (3 plugs)

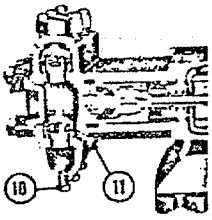


Fig. 2

PUMP WITH VALVE LIFTERS (13015A)

1. Remove plug C. (Fig. 1)
2. Turn handwheels on each cylinder valve lifter.

NOTE: Leave all plugs out when unit is not being used or is in storage.

STEP 4

To drain water from regulator-unloader remove plug A. (Fig. 3) Make sure plug C (Fig. 1) is removed to properly drain unloader.

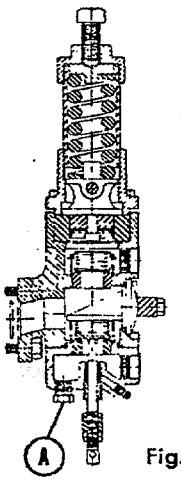


Fig. 3

STEP 5

DRAINING FOOT OPERATED VALVE — Remove male quick disconnect — connect coupling to drain water from valve body cavity.

STEP 6

Alternate guns while pressurizing unit to insure that water has been forced from both gun mechanisms.

SUGGESTED MAINTENANCE SCHEDULE — Myers Model MC30-12M Mobile Hydraulic Cleaner

SERVICE	GEAR CASE LUBRICATION (CHANGE) (1)	REPLACE PLUNGER PACKING (2)	REBUILD UNLOADER, CYLINDER LINERS, PACKING, VALVES, PISTON ROD SEALS (3)	REVERSE MOTOR ROTATION DIRECTION	DISASSEMBLE GEAR END, INSPECT AND REPLACE ALL WORN PARTS — REPLACE CRANKSHAFT & PINION DRIVE SHAFT SIMULTANEOUSLY	ELECTRIC MOTOR BEARINGS (4)
HEAVY DUTY (90-100 Hrs. Wk.)	2 Wks.	8 Wks.	6 Mo.	6 Mo.	1 Yr.	1 Yr.
NORMAL (48-50 Hrs. Wk.)	4 Wks.	16 Wks.	1 Yr.	1 Yr.	2 Yrs.	3 Yrs.

(1) 3½ Qts. SAE #40 Crankcase Oil plus 6 oz. Molykote Fluid Concentrate.
(2) Inspect frequently for packing leakage and replace when leakage from any cylinder exceeds 10 drops/min.
(3) Unloader regulator. Inspect for leakage regularly and replace cup or packing when needed.
(4) Lubricate with GE #D6A2C5 Grease.

NOTE A: Eliminate any pressure system leaks which cause unloader to cycle.
B: Maintain operative pressure gauge and do not exceed 1200 P.S.I.

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I. CLEANING WITH PLAIN WATER JETS

Surface cleaning by the action of plain water jets is sometimes called "water blasting" or "hydrodynamic cleaning." The process is characterized by a violent almost instantaneous stripping and flushing away of the soil. Large areas, irregularly shaped pieces, and cracks and crevasses may be quickly cleaned. Where applicable, it is one of the most efficient, economical and widely used cleaning methods.

II. MECHANISM OF CLEANING

In the impact areas of the water jet, strong physical forces are created which cut, shatter, or chip the soil from the surface to be cleaned. Some of the soil may also be dissolved or softened by the water, but these reactions are usually minor due to very short contact time at any point. Soft, weak materials are easily blasted away, but hard, strong materials may withstand the direct impingement of the jet. Even these strong soils or scales may be broken loose from the workpiece by hydrostatic forces set up in cracks and fissures in the soil itself, or at the interface between soil and workpiece. Thus, the strength of the soil layer and the strength of bond between soil and surface are critical factors to be considered in separation of the two. Once loosened, the soil must be flushed away by the water to complete the cleaning process. As will be seen later, there is a proper balance of pressure and volume to accomplish each cleaning job in the most efficient manner.

III. EFFECT OF PRESSURE

Theoretically, almost any material, no matter how hard or strong, may be broken up and removed from a surface by a jet if sufficient pressure is available. For each cleaning situation, there is a minimum pressure value, or threshold value, at which cleaning begins and above which the cleaning rate increases with pressure. The ability to flush away accumulated debris increases only slightly with pressure, since the energy of the jet is quickly dissipated upon impact with a surface. Generally speaking, the optimum pressure for a given job is as far above the threshold value as is consistent with safety to the workpiece, the operator and surroundings.

IV. EFFECT OF FLOW RATE

At pressures below the threshold value, varying the flow rate will have little or no effect and no cleaning can be done. At pressures above the threshold value, the cleaning rate will increase with flow since the size of the impact area of the jet increases. The ability to flush away or move the accumulated debris also increases directly with the flow rate. In most cases, once the pressure threshold is exceeded, it is more practical and economical, in terms of power consumption and safety, to increase the work rate by increasing the flow rate rather than pressure.

V. LIMITATIONS OF THE PROCESS

Due primarily to violent nature of the hydrodynamic cleaning process, it has a number of limitations. Soil and workpiece are subjected to the same physical forces and if the workpiece is the weaker of the two, it will be damaged or destroyed in the cleaning. Such materials as wood, plaster, and thin sectioned assemblies of rubber, plastics, insulation, and other fragile parts can be easily damaged by high pressure water jets. In the multi-thousand PSI range, they are quickly destroyed and are, thus, not candidates for cleaning at these pressures which might be necessary to strip the soil from their surface.

Certain categories of industrial soils show remarkable resistance to removal by water jets and in any practical pressure range are almost completely unaffected. These include oily films, rust, chemical stains, heavy tars, and many carbonized or catalyzed materials. Most industrial soils contain one or more of them. As a result, hydrodynamic cleaning in many cases leaves behind a residue of some material which renders the job incomplete from a metallurgical, chemical, sanitary, or appearance viewpoint.

VI. CLEANING WITH CHEMICAL SOLUTIONS

The development and application of chemical cleaning compounds is a highly developed art and their use in conjunction with hydrodynamic cleaning offers a unique approach to many cleaning problems. By chemical modification of the soiling material, the removal of many otherwise stubborn soils can often be made a relatively easy task. Generally speaking, the cleaning is facilitated by changing the soil to a soluble form, putting it into suspension, or by weakening the bond which holds it to the surface. Since the cleaning is dependent upon completion of a chemical reaction, the cleaning process is affected by temperature and concentration of the cleaning solution and requires an appreciable period of time to complete. In addition to cleaning in the usually accepted sense, various other surface treatments are possible with chemical solutions of commercial cleaners. Among these are degreasing, metal brightening, pretreatment of metals prior to painting, rust inhibiting, etching, paint stripping, rust removal, sanitizing and deodorizing.

The diversity of these processes points out the versatility of the chemical cleaning approach and the complex nature of the state of the art of chemical cleaning. It is vitally necessary that manufacturer's recommendations be followed regarding their application to each cleaning problem and the techniques to be used. All cleaners are chemically active and if wrongly applied, can produce unwanted effects and hazards to the workpiece, personnel, and surroundings. The use of volatile and flammable solvent cleaners, or those compounds which are highly caustic or acid can be extremely hazardous except under carefully controlled conditions.

Only those cleaners specifically approved and recommended by the manufacturer for use in spray application should be used with Myers Hydraulic Cleaning System.

VII. USE OF CHEMICAL INJECTOR

The removal of many industrial soils, particularly oily or oxide films, carbonized products, and stains and soils, and soils imbedded in porous surfaces is not possible by high pressure jets of plain water. In many cases, the addition of a suitable cleaning compound to the water is desirable and necessary to accomplish an acceptable cleaning job. In addition, such diverse operations as metal brightening, degreasing, sanitizing and deodorizing are possible with chemical solutions applied by the Myers Chemical Injector.

The Chemical Injector itself is made of stainless steel and with accompanying rinse nozzle attaches to the gun barrel in the same way as other nozzles. The appropriate cleaning solution is pre-mixed in the five gallon plastic container at 10 times the final concentration desired on the work piece. In passing through the injector nozzle, the concentrated solution is diluted 10 to 1 and is thus applied at the correct concentration to the work. For example, a detergent recommended by the manufacturer to be used at 1 oz. per gallon of water should be pre-mixed in the 5 gallon plastic container at 10 ozs. per gallon.

Because of the very great variety of industrial soils and the corresponding variety of cleaning solution offered for sale, it is imperative, in all cases, that the cleaning chemical be selected and used strictly in accordance with the manufacturer's recommendations.

Only those specifically recommended for spray application by the manufacturer should be used.

In general, the following procedure will produce the best results.

1. Remove all heavy accumulations possible with the rinse nozzle, leaving as little of the soil on the workpiece as possible.
2. Apply cleaning solution using Myers Injector Nozzle following manufacturer's recommendation as to type and concentrations.
3. Allow solution to remain on the work for a period of a few minutes, or per manufacturer's specific recommendations.
4. Flush away the soil using rinse nozzle and clear water.
5. Repeat as necessary.

XI. PIPE AND SEWER CLEANING

Pipes, sewers, and other conduits, ranging in diameter from about 5/8" to 18", may be successfully cleaned using Myers self-propelled cleaning nozzles and flexible hoses.

High pressure jets inclined at a rearward angle propel the jet and hose forward, scour the walls, and flush out the soil when the hose is withdrawn. A single forward-directed jet clears a path for the nozzle and hose and assists in breaking through complete stoppages.

Various sizes of hose and nozzle combinations are available and all may be controlled from foot operated valve by operator.

Although it is impossible to prescribe the hose and nozzle combination for a particular job without an actual trial, Table 1 will serve as a guide for selection.

Nozzle Size Inch	Nozzle Discharge Rate, GPM at 1200 PSI.	Size of Line Cleaned, Inches	Maximum Reach, Straight Run, Feet
3/4	30	4 - 18	400
1/2	20	2 - 12	300
1/4	10	1 - 8	200
1/8	5	5/8 - 1	25

A good rule to follow is to use the largest nozzle that will traverse the line. This will result in the fastest and best cleaning action. The ability to traverse bends and angle fittings in the line depends to a great extent on the types of fitting used in the line. Flanged and welded joints offer the least resistance and as many as three or four 90° elbows may be passed. In straight runs with water in the line, nozzle

Myers

OPERATING AND SERVICE INSTRUCTIONS FOR TRIGGER GUN CONTROL MECHANISM NO. 18701C

MAY 1, 1973

OPERATING INSTRUCTIONS

Practice pulling trigger before actually using gun under pressure. Be sure trigger is released and gun is shut off before presurizing system.

BE PREPARED. Grip gun securely with both hands and assume a balanced stance with firm footing. Recoil and continual thrust of a high pressure gun can be disconcerting unless the operator is prepared. When gun is used with foot operated shut off valve (18706D), position valve so gun thrust will not impel operator off balance.

Change nozzles or extensions by pulling knurled sleeves of connect-disconnect coupling toward gun handle. Pull nozzle out of socket. Hold knurled sleeve back and insert nozzle. Release sleeve, pull and turn nozzle to be sure of postive connection. (Sleeve should return to end of socket when released. Occasional lubrication of sleeve and balls beneath sleeve with water resistant grease is desirable).

Use 3ft. extension (18707B2) on end of either 3ft, or 5ft. gun barrel. Position nozzle near work for most effective cleaning. Hydraulic cleaning power is increased by close range application of water stream.

Barrel Part 18707B1 (5ft. long) can be used in place of barrel Part 18707B (3ft. long). When exchanging barrels it is desirable to lubricate "O" rings. Water may be used.

CLEANING SUGGESTIONS

Use fan nozzles (18751A, 18751A1) for general cleaning. Nozzles may be rotated in socket for most effective fan angle.

Use extensions to position fan nozzles near work piece whenever possible. Use straight stream nozzles (18750A1, 18750A2) for maximum mechanical action when nozzle cannot be positioned near work.

Use flat nozzle (18752A) to reach under or around objects.

Use radial jet nozzles (18749A, 18749A1) for circular spray pattern to clean deep tanks or vessels. Use injector attachments (18705B10) for adding chemicals to surfaces when chemical action is necessary.

SERVICE AND MAINTENANCE

If leak develops between valve and seat, proceed as follows:

To replace valve seat (12) and "O" ring (13).

1. Trigger (19) should be held back to release spring pressure on seat (12).
2. Loosen set screw (14) and unscrew adapter (15)
3. Remove "O" ring (13) and seat (12).
4. Replace new seat (12) and "O" ring (13) in reverse order. NOTE: (Lubricate "O" ring (13) preferably with water resistant grease).
5. Screw adapter (15) all the way in.
6. Release trigger (19) and unscrew adapter (15) 1/2 turn so valve will center seat (12).
7. Now tighten adapter (15) and lock with set screw (14).

To replace valve (9) and packing (6).

1. Remove stem nuts (2).
2. Remove shoulder screws (11).
3. Remove yoke (3).
4. Unscrew packing nut (4).
5. Slide stem (1), spring (8) and valve (9) from housing.
6. Remove old packing (6) and unscrew valve (9) from stem (1).
7. Screw new valve (9) on stem (1).
8. Assemble spring (8) against valve (9), then washer (7) on valve stem (1). See Illustration.
9. Wind 20" of packing (7924A39) evenly around stem in 3 layers approximately 5/8" long.
10. Insert stem (1) and packing (6) into packing nut (4) and screw into housing. Make sure washer (7) pushes packing completely into packing nut before insertion into housing.
11. Screw nut tight against gasket (5).
12. Reassemble yoke, shoulder screws and lock nuts.

Adjust lock nuts on stem so trigger will move yoke 1/32" to 1/16" between housing and nut. This insures valve seating and maximum valve opening.

If gun leaks at packing nut gasket (5), tighten. If leak persist replace gasket (5).

If gun leaks at adapter (15), "O" ring (17) must be replaced. Replace Teflon Back Up Ring (16) if undue wear is evident.

If gun leaks around stem (1), replace packing (6).

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travel will equal or exceed the distance in Table 1. In the case of vertical pipes of lines, such as boiler tubes and processing lines, the nozzles will travel as much as 150' vertically.

The types of deposits which may be removed are many and exclude only hard, tightly-adhering scales and sticky insoluble materials. Among the most common materials removed are:

1. Boiler scale.
2. Lime deposits in water line.
3. Slime and algae growths.
4. Mud, sand and gravel.
5. Calcium and magnesium salts.
6. Coke deposits.
7. Flue dust.
8. Soot or fly ash
9. Cement deposits.
10. Sludge.
11. Sewage deposits.
12. Water line tuberculations.
13. Processing materials.

Particularly in the case of large pipe or sewers with heavy deposits it is helpful to clean the line in short sections, beginning at the working opening. When working in manholes it is a good idea to construct and use screens or baffles to catch the debris as it is washed from the line and prevent it being carried into the lines below. In many cases, the use of mirrors and strong lights to observe the actual conditions in the line and the progress of the work will eliminate guesswork and assure a faster and better cleaning job.