



# SMITH PUMPS

## The Portable Tank Evacuation Unit

In order to qualify for LP-Gas "tank evacuation" service, a low capacity LPG transfer unit has to be light weight and self-contained. It must be portable, versatile, simple to maintain, rugged, and have its own independent power source, which is not considered by safety authorities to be a point of ignition. Such a unit is the Smith "E-Series" pump mounted to its pull-started, safety-modified, manually adjusted, internal combustion engine, with shielded ignition and spark-arresting muffler. The pump advantages include the Smith Standard Safety Coupling "VC-30" or "VC-20" (5/8" x 3/4"), with coupling guard ("CG-E"), a built-in large capacity strainer ("E-21"), an internal bypass valve in a replaceable cartridge form ("E-20 ASSY" or "E-20H ASSY"), a large easy-access cover ("E-2" or "E-2H"), large bolts with extra thread depth, a "heavy-duty" state-of-the-art mechanical seal-shaft-and-ball-bearing assembly ("E-100Z" or "E-100HZ"), and only two working parts, the "free-floating" gears ("EG-5/EG-6" or "EC-5H/EC-6H"). See Catalog "CP-3" and Assembly View "PI-1" for additional information.

*The seals, the gears, the strainer, and the bypass valve, can be separately accessed, without disturbing each other, and without removing the inlet or outlet piping. Please refer to the diagram on page 6, for additional information. The key to successful use of this unit is (1) proper maintenance, and (2) careful attention to installation at the different sites.*

*In the course of inevitable circumstances following the application of this unit to "Tank Evacuation Service", it is possible that it will not always be connected to the service in an ideal manner (see Bulletin "AL-3"). Frequent inspections and periodic maintenance are absolutely necessary to insure an acceptable longevity under these potential conditions. The strainer may have to be cleaned daily. The gears may have to be replaced much more often than in "standard" services. The bypass valve may require frequent cleaning. All of the aforementioned depend heavily upon the results of these frequent routine inspections, which are highly recommended.*

**(A) Connecting the Pump to the Service.** *Keep the inlet line as short and as direct as possible, preferably less than ten feet in total length. Be sure that the inlet line is at least the same size as the pump inlet port. Connect the pump inlet line to the tank liquid outlet with the least possible restriction, preferably a bottom outlet if available (do not connect the pump inlet to a vapor outlet). All tank connections should be properly made. Use the appropriate unloading adapters for container evacuation as required (see manufacturer's catalogs and safety codes for additional information).*

Be sure that all hoses are in good condition, and free from kinks. Make sure that the pump occupies the lowest point in the inlet system. Make sure that the pump is full of liquid before it is started. Observe all applicable safety codes and procedures.

**(B) Running the Pump.** Always run the pump as slow as possible. Shut down the engine immediately after the tank is vacated, or if you must stop pumping for any reason. Check for seal leaks from the leak detection port ("seal bleed port"- see page 5, and Bulletin "IS-10"). If the seal is found to be leaking, do not continue to use the unit. Replace the shaft-seal assembly ("E-100Z" or "E-100HZ").

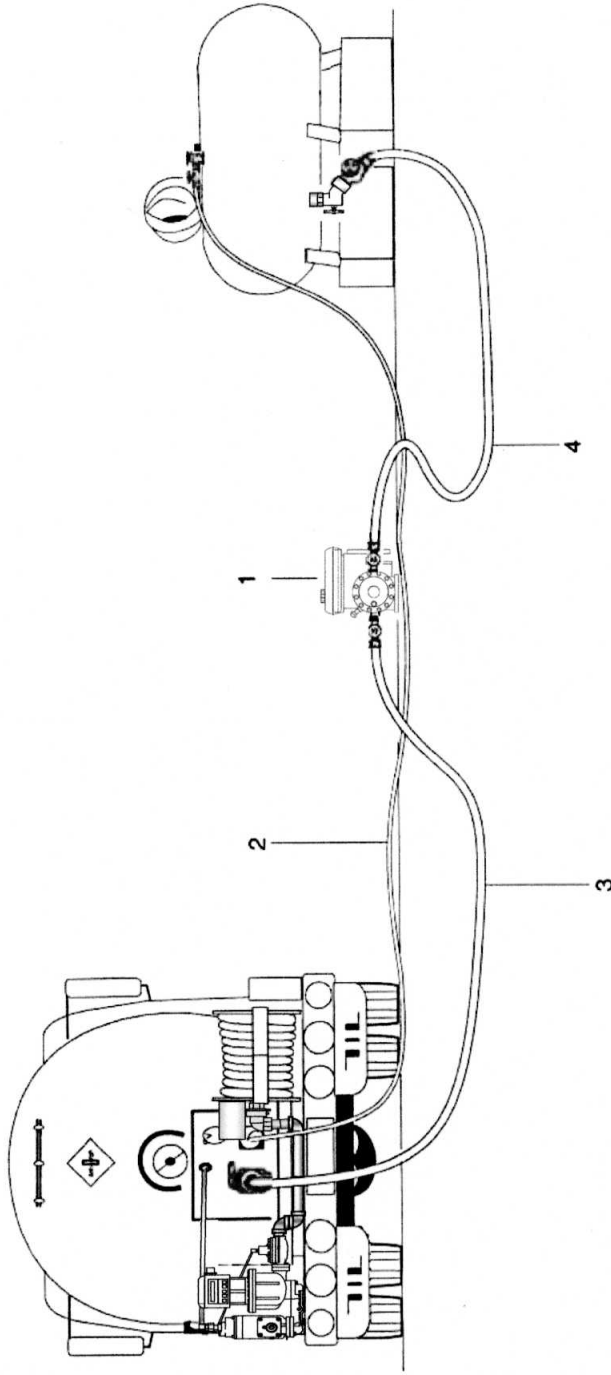
*Given the RPM range of the pump, there are relatively wide limitations on possible running speeds, during these operations. If the differential pressure can be kept to less than 100 PSID, the unit can be driven as slowly as 1500 RPM (somewhat less than half speed), which drops the nominal output of an "EG-1Z", for example, from 10 USGPM to 4 USGPM. This can be an advantage when utilizing inlet line connections causing greater restrictions than normally observed in more standard transfer operations with small capacity pumps. See "AL-17A" and "Booklet A (AL-36)".*

Always follow all engine manufacturer's recommendations, and exercise all safety precautions. These particular manually operated pull-start engines, unlike electric motors, can be continually adjusted for speed and efficiency. They can run on gasoline, or can be modified to use LPG as a fuel. They also start turning the pump very slowly, and gradually build-up maximum speed, which results in a less abrupt initial liquid acceleration in the pump inlet line. Provided the pump inlet line is full of liquid when the pump is started, this means that there is less potential for vapor-locking conditions or pump cavitation stress during these operations.

In contrast, the more conventional direct-driven, AC single-phase, "pump-electric motor unit", runs at a constant speed, and attains that speed immediately, even under maximum load. This could actually cause the electric motor drive to be more potentially detrimental to the pump in a tank evacuation application, than its use with this engine, especially under certain bad conditions possibly occurring within the market.

**(C) After Using the Pump.** *Drain the pump thoroughly after each use, especially if heavy residues are suspected in the liquid handled by the pump. Removing the back plate ("Gear End Cover") facilitates this operation. Check and clean the internal strainer element at this time, and inspect the gears as well as the bypass valve cartridge. Fill the pump with automotive engine oil before storage, to prevent internal corrosion from residual impurity accumulations out of the tanks being evacuated.*

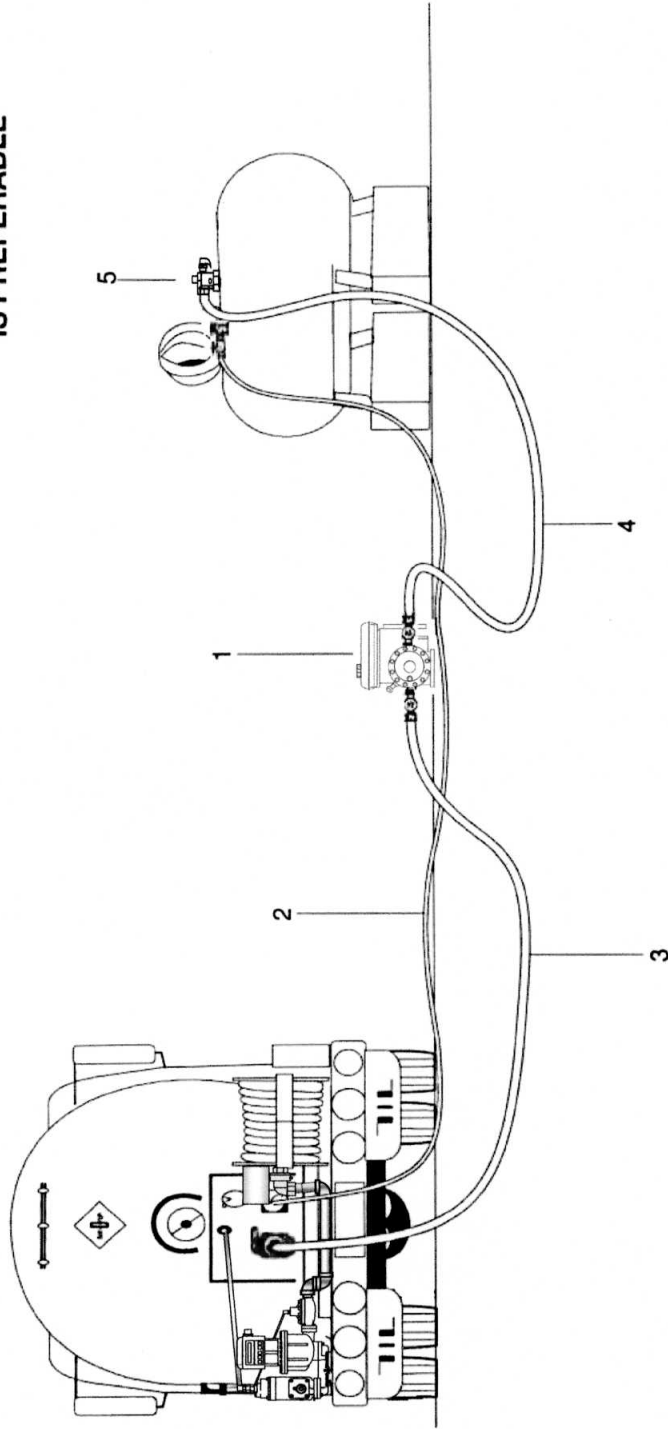
# CONNECTING THE PUMP TO THE SERVICE



- 1. TANK EVACUATION UNIT
- 2. VAPOR EQUALIZATION LINE
- 3. PUMP LIQUID OUTLET LINE
- 4. PUMP LIQUID INLET LINE

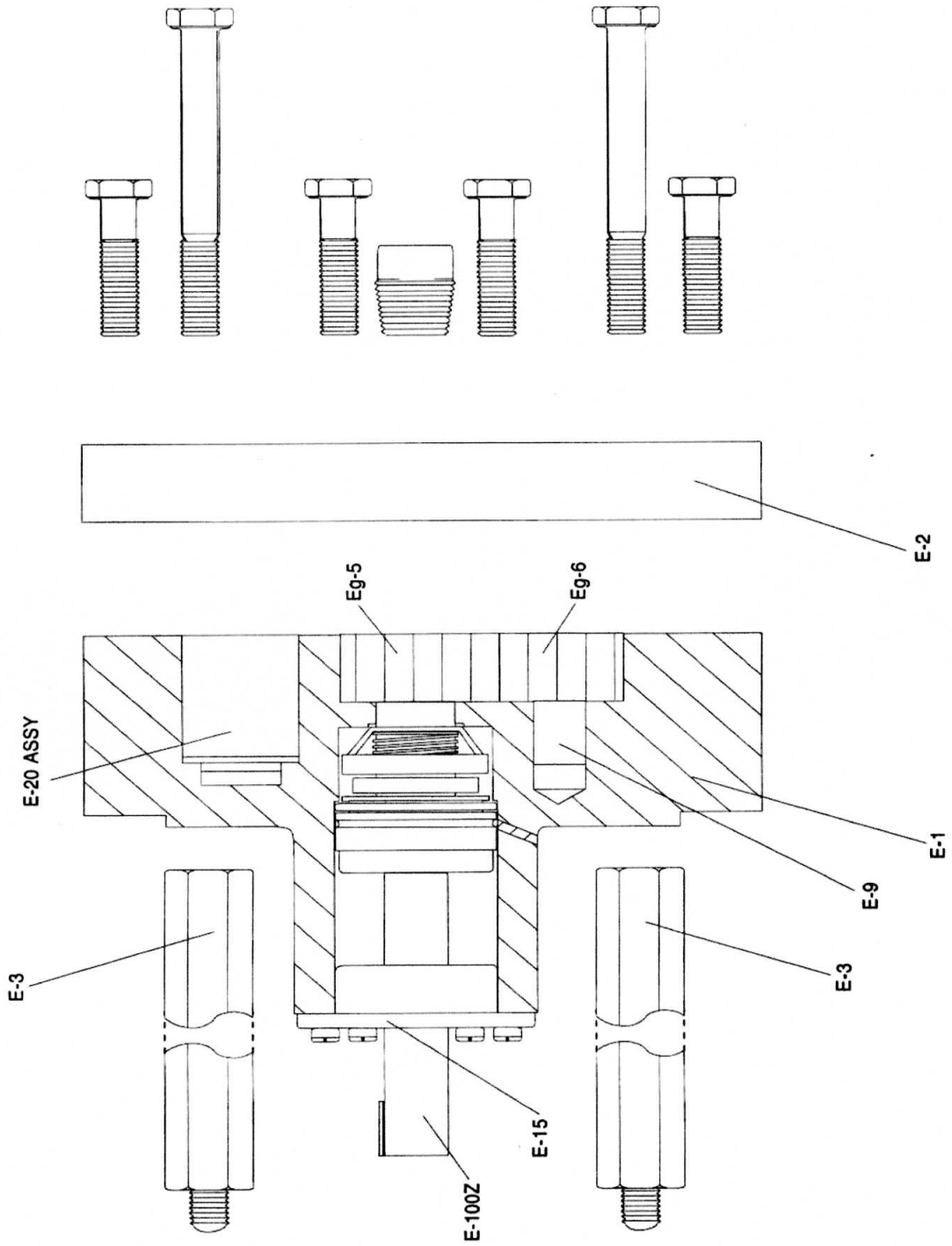
# CONNECTING THE PUMP TO THE SERVICE TOP OUTLET

**NOTE: BOTTOM LIQUID OUTLET  
IS PREFERABLE**

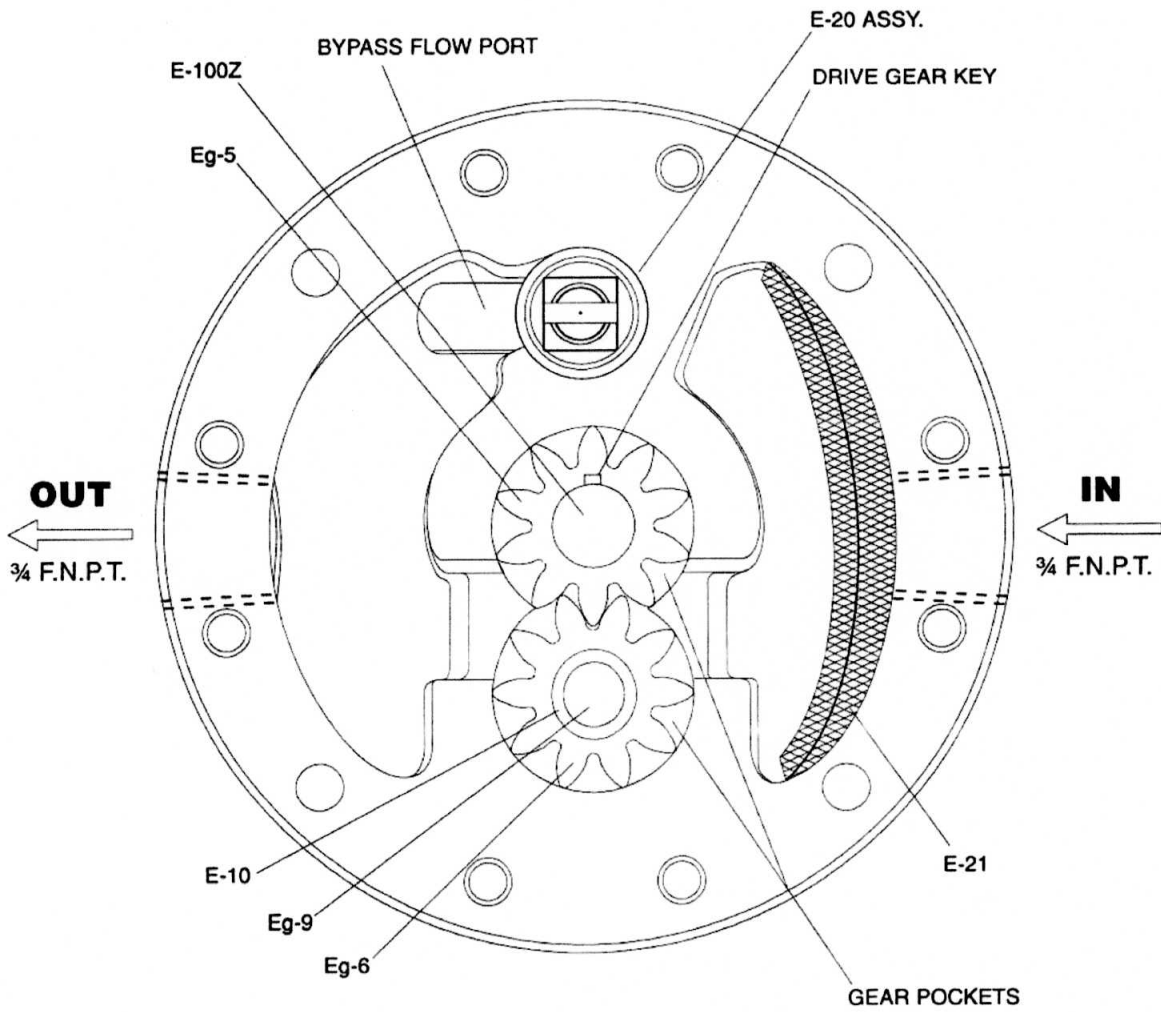


- 1. TANK EVACUATION UNIT
- 2. VAPOR EQUALIZATION LINE
- 3. PUMP LIQUID OUTLET LINE
- 4. PUMP LIQUID INLET LINE
- 5. UNLOADING ADAPTER

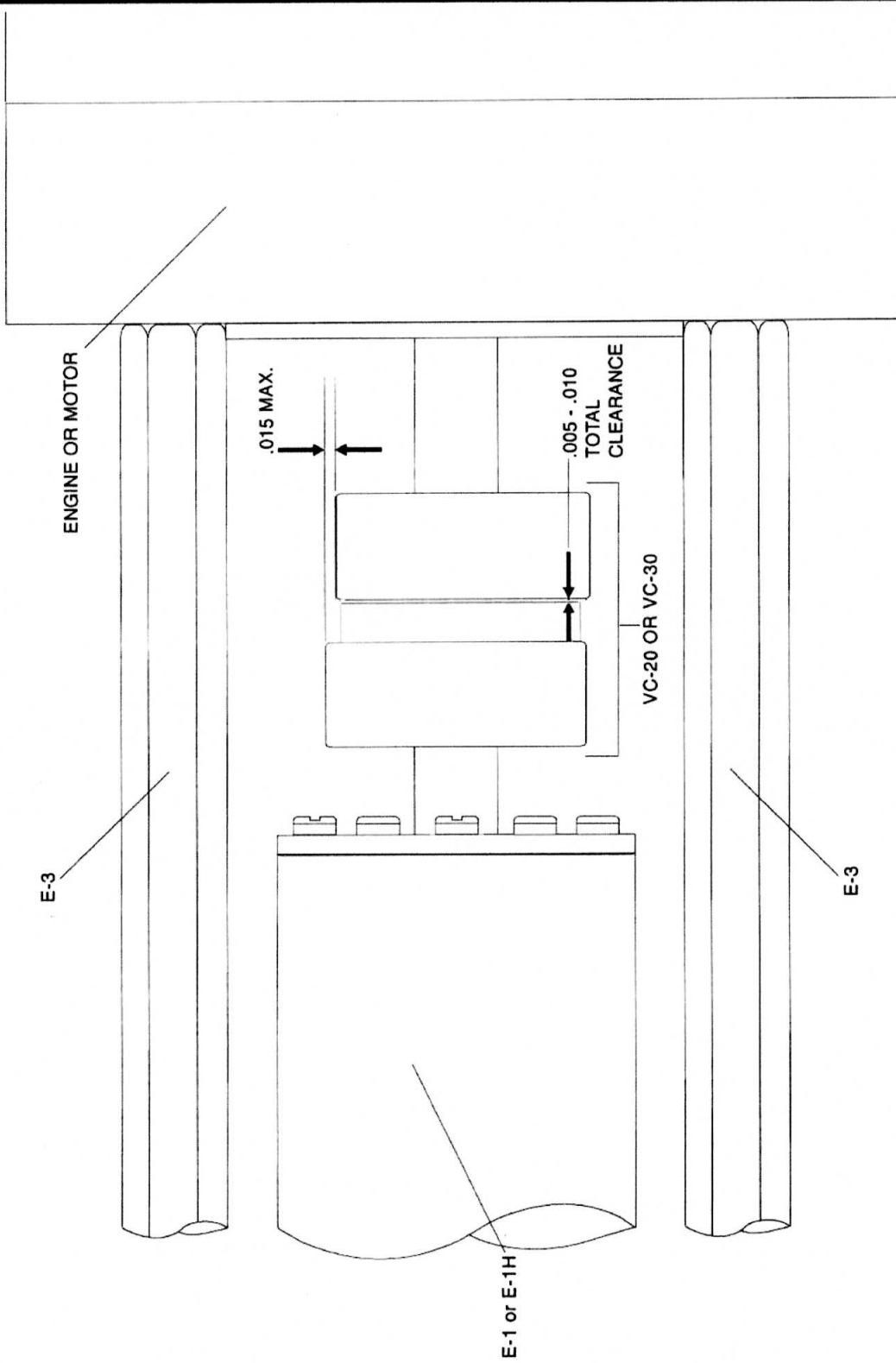
**MODEL EG-1 Z SIDE VIEW**



# MODEL EG-1Z END VIEW



# SMITH SAFETY COUPLING RUN-OUT AND INSERT CLEARANCE SPECIFICATIONS



*The gears are the "heart" of the pump, and must always be in good condition. They should be checked frequently, and replaced immediately if found to be worn beyond acceptable limitations. The gears should be checked by eyesight, and also by determining the backlash with a simple feeler gauge. Always replace the gear set. Never replace just one gear.*

Initially, when checking by eye, observe the curvature of the left and right sides of a typical tooth. If any difference between the "working" and "non-working" sides can be observed, the gear set must be replaced. Also, there should be no visible signs of gear end, or "face", wear. If there are indications of wear on the ends, or "faces", both gears should be replaced.

If the gear set appears to look like it is in good condition, verify the total wear in the rest of the adherent parts by taking-up all the backlash with a feeler gauge, before putting the cover back on the pump, again. Use a 0.020" thick blade. If it can be inserted between meshing gear teeth, the least that will have to be done is to replace the gear set. Replace the gears. When they have been replaced, if the 0.020" blade still fits between the meshing gear teeth, the idler gear shaft and/or the mechanical shaft-seal assembly will also have to be replaced. See assembly view "PI-1". Do not use the pump if the backlash remains more than 0.020" after replacing these parts. Trade it in, for an "exchange" pump. See Bulletin "AL-1" and Catalog "CP-3".

*When replacing or checking the gears at this time, carefully check the corresponding areas on the gear end cover and the main housing. Make sure that both "pockets" (gear bores) are exactly the same proper depth, and that they are flat on the bottom. Observed diametral wear on the "pockets" (gear bores) should not be visible more than half-way around the diameter wall. The gear end cover and the bottom of the pockets should not have any wear on them by the gear faces.*

The idler gear shaft, "E-9", should have no visible wear by the idler gear bushing. The fit of the idler gear on the idler gear shaft should be a "tight sliding fit" (0.002"-0.003" clearance), and the gear should never contact the bore diameter even when the clearance is totally taken-up on one side.

*The drive gear should have a "tight sliding fit" onto the drive shaft end, and should slide easily across the corresponding drive key. Be careful that the drive key does not slip out of its keyway during assembly. Never pound on the gear, or force it in any way, onto the drive shaft. Likewise, never pound on, or force, the shaft-seal assembly into position for any reason.*

The shaft and seal assembly should also slide easily into the corresponding bore in the front of the pump assembly, after removing the bearing retainer plate, and carefully removing the old assembly. See Bulletin "IS-10", and Manual "ED-1", for additional information. Be sure that the old gear drive key and stationary seal o-ring



are removed when extracting the old seal assembly. Do not pound on, or force, the drive shaft to assemble it to the pump.

**Do not pound on the coupling to assemble or disassemble it from the drive shaft, as it should slide easily into place.** If the old coupling half will not easily slide off of the shaft end, use the appropriate puller to remove it. If the new coupling half will not easily slide onto the shaft, dress the keyway with a small file, replace the drive key, remove any build-up of rust, or paint, and/or remove any interfering minor high spots from the drive shaft, in the proper manner. Please refer to "AL-17A" "ED-1", "IS-10", and other Smith pump literature for additional information. Contact the factory if you have any questions.

**The drive shaft of the pump, and the drive shaft of the motor, must always be in proper alignment.** Be sure to use the proper Smith Standard Safety Coupling. With this coupling installed, you can check the alignment of the shafts by setting a straight edge across the coupling halves, first at top dead center, and then off 90 degrees to the left or right. Measure the differences in heights between the two halves with a feeler gauge. This difference should never be more than 0.015". If it is, first, make sure that the lock screws have not come loose; then, loosen the mounting bolts that fasten the pump to the four hexagonal spacers on the engine face, and align the two coupling halves to within less than 0.015" as measured from the top and sides. Tighten the bolts, and recheck the alignment, to be sure it is correct. Take proper steps to relieve any tension, such as that caused by tightening piping or bolting the engine to a base, which could adversely affect the shaft alignment.

The coupling and corresponding insert should be frequently checked for visible signs of excessive wear. The pins should not be pitted or worn, and the clearance holes for the pin ends from the opposite corresponding coupling half should not be visibly worn in an "egg shaped" fashion. The insert should never have a sloppy fit onto the pins. The coupling condition can easily be determined by loosening the set screws and moving the coupling halves away from the insert. Replace the coupling, or its insert, as necessary, at the first signs of excessive wear. Be sure that there is no tension between the two coupling halves and the coupling insert. Once properly assembled and aligned, there should be a 0.005" - 0.010" total gap between the insert and the coupling halves, as measured with a feeler gauge by taking-up all the clearance.

There are two types of couplings available for this application, the "VC-20" for the model "EG-1Z", and the "VC-30" for the model "EC-HZ". Under usual, expected conditions, the standard insert will last reasonably well. If the use situation calls for more of a heavy-duty application, the "Teflon ®" insert is recommended.

(D) Other Uses. Up to this point, the "Portable Tank Evacuation Unit" has been discussed only in the light of emptying small containers, into a much larger one. There is no reason why the same unit could not be used for offloading the larger tank, as well. In the previous illustrations shown, our small-capacity, gasoline-fueled, "EG-1Z/No. 7" assembly is being used to pump from a small tank into a mobile system; but it can also be used to pump out of the bobtail, either as an emergency back-up pump, or as a means to fill small tanks or cylinders without having to resort to using the truck-mounted pump. Also, the continuous-duty, three-gear "GC-1 Series" pumps could be utilized under similar circumstances, with the same engine. (See Catalog "CP-3" and Manual "GM-1").

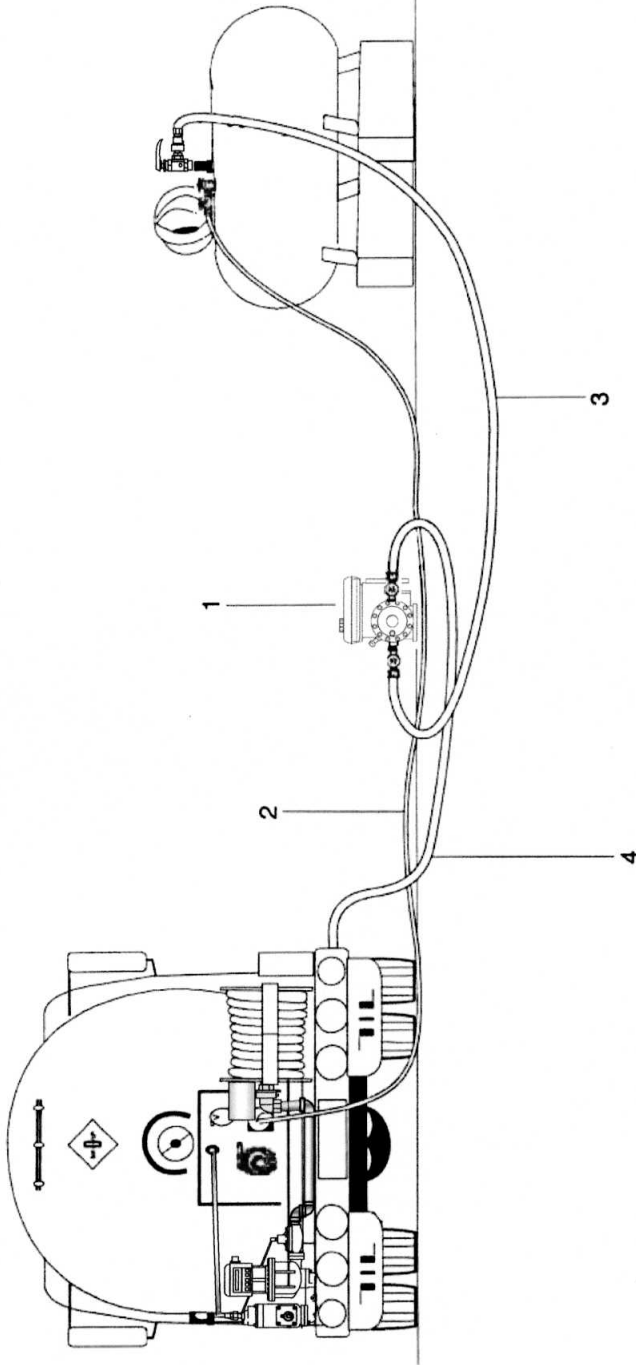
Obviously, a high-capacity truck pump has way too much output for filling even 100 lb. cylinders, or automotive fuel tanks. The use of an excessively large pump would cause continual liquid recirculation, and could increase the chances of accidental overfilling. This type of non-recommended bobtail pump utilization would also aggravate internal wear factors by (1) causing the pump to continually function at its maximum differential pressure setting, and (2) forcing most of its output through the back-to-tank bypass system. This action commonly results in several extreme conditions beyond those considered to be caused by "normal average use" of a bobtail pump: (1) more tank turbulence, (2) more heat injected into the liquid handled by the pump, and (3) more unsettling of accumulated debris and other heavy impurities which may have been collecting in the bottom of the tank. Ultimately, this type of use causes undue premature wear.

*On the other hand, if the portable pump were put into small container filling service, it would be used within its normal design and installation parameters. It can be stated then, that the incorporation of the "Portable Tank Evacuation Unit" with a bobtail, actually enhances the off-loading capability into small tanks, making it more practical and potentially safer. It takes the strain off of the larger pump, allowing it to be used for the more appropriately-sized, larger tanks. See "Booklet A (AL-36)" for additional information on this, and other related subjects of concern.*

Exclusive off-loading with a small pump for low-capacity filling would result in less required maintenance, than the use of the same unit, for continual tank evacuation, only. However, remember that routine preventive maintenance in any case is still the key to success. Do not wait until the pump, and its coupling, fail, before replacing parts. Parts should always be replaced before they fail. The frequency of replacement depends upon observed wear determined by routine repetitive inspection. The use conditions upon these pumps are expected to be highly variable and we cannot overemphasize the importance of safe, proper installation, operation, and periodic inspection to determine preventive maintenance scheduling.

Several additional pieces of Smith pump literature have been mentioned. These should be read and thoroughly understood before the pump is placed into service.

**OTHER USES  
OFF-LOADING/FILLING SMALL TANKS**



- 1. TANK EVACUATION UNIT
- 2. VAPOR EQUALIZATION LINE
- 3. PUMP LIQUID OUTLET LINE
- 4. PUMP LIQUID INLET LINE

*These include, but are not necessarily limited to, the following: "AL-1", "AL-3", "AL-17A", "Booklet A (AL-36)", "AL-47", "CP-3", "ED-1", "GM-1", "IS-6", "PI-1". Also, read the literature from other equipment manufacturers, pertinent to these operations. Consult with the appropriate safety authorities in your area, and carefully read all recommended safety literature. Always follow the recommended procedures for handling LPG. Use the "Portable Tank Evacuation Unit" in the prescribed manner, only for handling Butane / Propane liquid on an intermittent use basis. Never evacuate vapor with this unit. Contact the manufacturers if there are any questions.*



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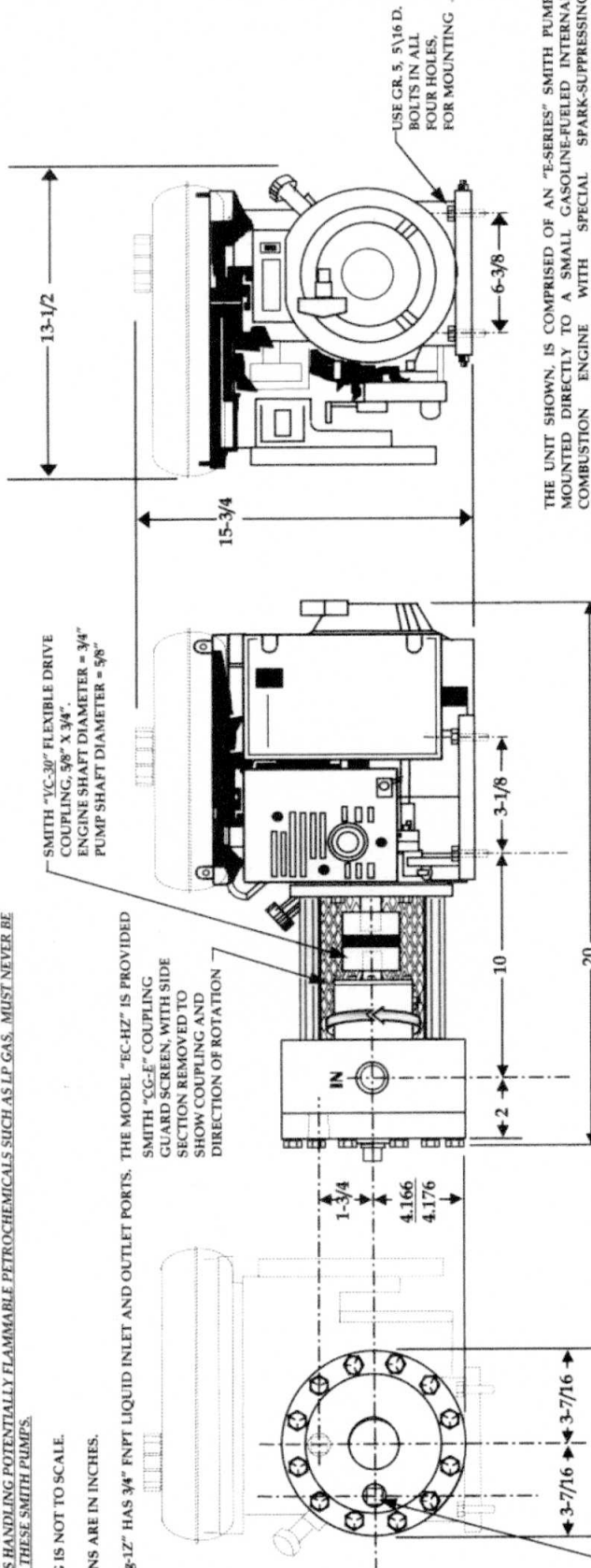
THIS DRAWING IS INTENDED EXCLUSIVELY FOR USE WITH THE SMITH MODEL "EG-1Z" AND "EC-HZ" BUTANE / PROPANE PUMPS, WHEN MOUNTED TO A SPECIALLY MODIFIED LPG-FUELED INTERNAL COMBUSTION ENGINE ("NO. 8"), OR A SPECIALLY MODIFIED GASOLINE-FUELED INTERNAL COMBUSTION ENGINE ("NO. 7"). ALL "E-SERIES" PUMPS UTILIZED EXCLUSIVELY IN INTERMITTENT LIQUERIED BUTANE / PROPANE TRANSFER SERVICE CAN BE DRIVEN BY THESE PARTICULAR ENGINES, EITHER ONE OF WHICH IS SUPPLIED AS ORIGINAL EQUIPMENT BY SMITH PRECISION PRODUCTS COMPANY, ONLY THROUGH AUTHORIZED DISTRIBUTION CHANNELS. PUMP/ENGINE COMBINATION COMPLIES WITH NFPA - 58.

AS A NECESSARY SAFETY PRECAUTION WHEN HANDLING THESE LPG FRACTIONS UNDER ANY CIRCUMSTANCES, ENGINES OTHER THAN THOSE SPECIFICALLY MODIFIED FOR USE IN CLOSE PROXIMITY TO PIPING SYSTEMS HANDLING POTENTIALLY FLAMMABLE PETROCHEMICALS SUCH AS LP GAS, MUST NEVER BE USED TO DRIVE THESE SMITH PUMPS.

THIS DRAWING IS NOT TO SCALE.  
ALL DIMENSIONS ARE IN INCHES.

THE MODEL "EG-1Z" HAS 3/4" FNPT LIQUID INLET AND OUTLET PORTS. THE MODEL "EC-HZ" IS PROVIDED

SMITH "CG-E" COUPLING GUARD SCREEN, WITH SIDE SECTION REMOVED TO SHOW COUPLING AND DIRECTION OF ROTATION



THE UNIT SHOWN, IS COMPRISED OF AN "E-SERIES" SMITH PUMP, MOUNTED DIRECTLY TO A SMALL GASOLINE-FUELED INTERNAL COMBUSTION ENGINE WITH SPECIAL SPARK-SUPPRESSING MODIFICATIONS. THIS SPECIAL ENGINE CAN ALSO BE SET-UP TO UTILIZE LPG AS A FUEL IN WHICH CASE THE GASOLINE TANK IS ELIMINATED (SEE ABOVE DRAWING). THE APPEARANCE OF THE ACTUAL ENGINE IS NOT EXACTLY AS THE REPRESENTATIVE CONFIGURATION SHOWN, ABOVE. SEE TECHNICAL BULLETIN "AL-101". PUMP DRIVE SPEEDS SLOWER THAN MAXIMUM (3600 RPM) WILL HELP REDUCE NOISE, AND WILL ALSO PROLONG USEFUL SERVICE LIFE. SEE OTHER LITERATURE FOR ADDITIONAL INFORMATION.

IF THE PUMP IS INSTALLED AS ORIGINALLY SHIPPED FROM THE FACTORY, THIS PORT REMAINS UNUSED. THE FACTORY-SUPPLIED STEEL PIPE PLUG REMAINS IN THE COVER AT THE "900 POSITION" AS SHOWN, AND THE INTERNAL BYPASS VALVE DISCHARGES INTERNALLY. IF THE PLUG IS REMOVED, AN APPROVED BYPASS RETURN LINE AT LEAST THE SAME SIZE AS THE PLUG INSTALLED IN ITS PLACE, AND THE END COVER REPOSITIONED ON THE MAIN HOUSING SO THAT THE OUTLET IS DIRECTLY OVER THE INTERNAL BYPASS VALVE (AT THE "1200 POSITION", INDICATED BY DOTTED LINES ABOVE), THE INTERNAL BYPASS VALVE WILL ONLY DISCHARGE EXTERNALLY THROUGH THE END COVER PORT. THE EXTERNAL BYPASS LINE MUST RUN BACK TO THE TANK BEING VACATED BY THE PUMP. THE SIZE OF THE END COVER OUTLET IS 3/4" NPT ON THE "EC-HZ", AND 1/2" NPT ON THE "EG-1Z". IT IS UTILIZED IN THE SAME MANNER WITH BOTH MODELS. (SEE OTHER LITERATURE FROM SMITH PRECISION FOR IMPORTANT ADDITIONAL

### DIMENSION DRAWING

E-SERIES PUMPS MOUNTED DIRECTLY TO "NO. 7" OR "NO. 8" INTERNAL COMBUSTION ENGINE

SMITH PRECISION PRODUCTS CO.  
1299 LAWRENCE DRIVE  
NEWBURY PARK, CA 91320

RSS 7-20-01

E-SERIES  
IN OUT  
NOT REVERSIBLE

# D-EE