

General Guidelines For Squeezing Off Polyethylene Pipe in Water, Oil and Gas Applications

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Foreword

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1.0 INTRODUCTION

Squeeze-off is a technique used to control the flow of fluids including oil, dry or wet gas, multiphase fluids, non-potable oilfield water or potable water in polyethylene pipe by compressing the pipe between parallel bars until the inside surfaces make contact. The flexibility and toughness of polyethylene pipes allow the pipe to recover from a properly made squeeze-off without a measurable loss in service life. When properly performed, the operator can obtain a complete flow shut-off. Squeeze-off can be useful for making installation tie-ins, performing maintenance to system components, as well as for emergency repairs.

2.0 OPERATOR EXPERIENCE

Squeeze-off should only be performed by persons that have received training from an authorized instructor and that have a strong working knowledge of polyethylene and squeeze-off procedures. The operator should have training on the size of equipment being used to perform the squeeze-off. This document is a guide only, and should not be used in place of training by an authorized squeeze-off instructor. Failure to follow proper procedures can result in pipe failure or leakage due to compressively over strained pipe from improper squeeze-off. If following manufacturers procedures, ensure that the tool/procedure were qualified using ASTM F1734 Standard Practice for Qualification of a Combination of Squeeze Tool, Pipe, and Squeeze-Off Procedures to Avoid Long Term Damage.

3.0 GUIDELINES FOR SQUEEZE-OFF OF PE PIPES

Tool Location – Center the squeeze-off tool squarely on the pipe. This will allow the pipe to flatten freely without coming in contact with the tool frame or abutments. Locate the squeeze-off tool a minimum distance of 3x the pipe diameter, or 12 inches, whichever is greater, from any fusion joint, mechanical connection, prior squeeze-off point, or second squeeze-off tool.

Tool Operation – Operate the squeeze-off tool at a rate slow enough to allow stress relaxation in the pipe to occur. ASTM F1041 Standard Guide for Squeeze-Off of Polyolefin Pressure Pipe and Tubing recommends a maximum compression rate of 2 inch per minute or less is appropriate. See Table 1 for example squeeze times. This slow rate is particularly helpful when pipe becomes stiff in cold weather. Squeeze the pipe until flow ceases or the mechanical stop is contacted, whichever comes first. Continuing to operate the squeeze-off tool beyond this point can cause pipe or tool damage.

Tool Removal – Remove the squeeze off tool in a controlled manner. Avoid sudden release of mechanical or hydraulic pressure. Controlled release is necessary so flow control may be quickly reestablished if required. ASTM F1041 recommends a maximum release rate of 0.5 inch per minute or less is appropriate. See Table 1 for recommended release times. Rerounding the pipe is an option which should be exercised on the basis of improvement in flow or other concerns, rather than damage mitigation. If rerounding is performed, reround the pipe by rotating the squeeze-off tool 90° and applying enough force to round the pipe or by using a special tool designed for this purpose. Do not exceed the maximum compression rate when re-rounding the pipe.

Post Squeeze-off Considerations – After the squeeze-off tool has been removed, inspect the squeezed section for any damage. Procedures should include actions to be taken if damage is found. Procedures should not allow the same area to be squeezed off more than once. When an emergency condition requires squeeze-off without regard for possible pipe damage, the procedure should include actions to be taken based on the likelihood the pipe has been damaged and may require a reinforcement clamp or similar to be installed on the squeezed pipe section.

Other conditions may require a second squeeze-off tool in line to achieve complete flow shut-off. Squeeze-off is not suitable for repeated flow control at the same location or to throttle or partially restrict flow. Valves or other flow control devices are more suitable for those situations. ASTM standards F1041, F1563 and F1734 provide guidance and requirements for squeeze-off tools, operating procedures, and qualification procedures.

Table 1. Example Polyethylene Pipe Squeeze-Off Compression & Release Times

		AVG ID	Squeeze Time	Squeeze Time <32° F	Release Time	Release Time <32° F
IPS SIZE	DR	(in.)	(2 in./min.)	(1 in./min.)	(0.5 in./min.)	(0.25 in./min.)
1	9	1.005	0.5 min	1.0 min	2.0 min	4.0 min
	11	1.062	0.5 min	1.1 min	2.1 min	4.2 min
2	9	1.816	0.9 min	1.8 min	3.6 min	7.3 min
	11	1.917	1.0 min	1.9 min	3.8 min	7.7 min
	17	2.079	1.0 min	2.1 min	4.2 min	8.3 min
3	9	2.676	1.3 min	2.7 min	5.4 min	10.7 min
	11	2.825	1.4 min	2.8 min	5.7 min	11.3 min
	17	3.064	1.5 min	3.1 min	6.1 min	12.3 min
4	9	3.440	1.7 min	3.4 min	6.9 min	13.8 min
	11	3.633	1.8 min	3.6 min	7.3 min	14.5 min
	17	3.939	2.0 min	3.9 min	7.9 min	15.8 min
6	9	5.064	2.5 min	5.1 min	10.1 min	20.3 min
	11	5.348	2.7 min	5.3 min	10.7 min	21.4 min
	17	5.799	2.9 min	5.8 min	11.6 min	23.2 min
8	9	6.593	3.3 min	6.6 min	13.2 min	26.4 min
	11	6.963	3.5 min	7.0 min	13.9 min	27.9 min
	17	7.549	3.8 min	7.5 min	15.1 min	30.2 min
10	9	8.218	4.1 min	8.2 min	16.4 min	32.9 min
	11	8.678	4.3 min	8.7 min	17.4 min	34.7 min
	17	9.409	4.7 min	9.4 min	18.8 min	37.6 min
12	9	9.747	4.9 min	9.7 min	19.5 min	39.0 min
	11	10.293	5.1 min	10.3 min	20.6 min	41.2 min
	17	11.160	5.6 min	11.2 min	22.3 min	44.6 min
14	9	10.702	5.4 min	10.7 min	21.4 min	42.8 min
	11	11.302	5.7 min	11.3 min	22.6 min	45.2 min
	17	12.254	6.1 min	12.3 min	24.5 min	49.0 min
16	9	12.231	6.1 min	12.2 min	24.5 min	48.9 min
	11	12.916	6.5 min	12.9 min	25.8 min	51.7 min
	17	14.005	7.0 min	14.0 min	28.0 min	56.0 min
18	9	13.760	6.9 min	13.8 min	27.5 min	55.0 min
	11	14.531	7.3 min	14.5 min	29.1 min	58.1 min
	17	15.755	7.9 min	15.8 min	31.5 min	63.0 min
20	9	15.289	7.6 min	15.3 min	30.6 min	61.2 min
	11	16.145	8.1 min	16.1 min	32.3 min	64.6 min
	17	17.506	8.8 min	17.5 min	35.0 min	70.0 min
22	9	16.818	8.4 min	16.8 min	33.6 min	67.3 min
	11	17.760	8.9 min	17.8 min	35.5 min	71.0 min
	17	19.256	9.6 min	19.3 min	38.5 min	77.0 min
24	9	18.347	9.2 min	18.3 min	36.7 min	73.4 min
	11	19.375	9.7 min	19.4 min	38.7 min	77.5 min
	17	21.007	10.5 min	21.0 min	42.0 min	84.0 min

Note 1: Squeeze and Release Times are Calculated off of the Inside Diameter.

Note 2: For Size Classes (DIPS, CTS), Diameters and DR's Not Shown Please Contact the Manufacturer.

4.0 PREVENTING PIPE DAMAGE

Tests have shown that when squeeze-off is performed correctly and the tools used meet the ASTM guidelines and requirements found in F1563 Standard Specification for Tools to Squeeze-Off Polyethylene (PE) Pipe and Tubing, squeeze-off can be performed without compromising the expected service life of the pipe. However, the installer or operator must take care during the squeeze-off procedure to prevent damage to the pipeline. The list below contains some areas that require extra attention during squeeze-off to prevent pipe damage.

- Ensure the tool meets the requirements of ASTM F1563 and that the tool is installed square to the pipe with the squeeze plates parallel to each other.
- Verify that the squeeze-off tool is sized appropriately for the diameter and DR of pipe to be squeezed off. The squeeze-off tool should contain stops that limit the squeeze as to not over stress the pipe. Make sure the correct stops are installed in the tool before starting.
- After the squeeze-off tool has been removed, the pipe should be closely inspected for any signs of damage. Any pipe suspected of damage during a squeeze-off should be reinforced, replaced or removed from service. The area of the squeeze-off should be marked on the pipe and also in the GIS software if appropriate.
- Cold weather increases the pipe's susceptibility to damage. Compression and release times should increase by double in cold weather (32°F and below). For pipe that is in above ground applications, consideration may be given to pre-warming the pipe, however this should not replace the increase in compression and release times.

5.0 SAFETY CONSIDERATIONS

Jobsite safety requirements should be fully understood and observed. This guideline does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user of this guideline to establish and follow the appropriate safety and health practices.

Ensure the squeeze-off tool, and its 'STOPS', meet the requirements of ASTM F1563 and that it is sized appropriately for the diameter and DR of pipe being squeezed. Visibly inspect the pipe for cuts, scrapes or gouges before installing the squeeze off tool onto the pipe. Do not squeeze on pipe sections containing deep scratches (>10% of pipe wall thickness). Do not squeeze the pipe in the same place more than once.

5.1 Static Electricity Concerns for Gas Squeeze-Off

Polyethylene pipe is a poor conductor of electricity. As a result polyethylene pipe builds up a static charge when it is in gas service (distribution or gathering) due to the gas flow across the inside surface of the pipe. During squeeze-off, the velocity of the gas flowing through the flattening section increases. This increases the rate and amount of static charge build-up.

In addition to the potential for pipe damage due to static discharge, the buildup of a static charge represents an explosion hazard. Where there is a flammable or combustible environment in conjunction with static charges, arc preventing safety precautions are necessary. Additional information on arc prevention and tool grounding is available through the AGA Plastic Pipe Manual (www.AGA.org) and through the squeeze-off tool manufacturers. It is recommended that all operators performing squeeze-off have grounding procedures in place to be used during squeeze-off, and that all personnel involved in squeeze-off operations receive training on those procedures and understand the hazards involved.