

# **Fugitive Emission Test Report**

*Performed for*

## **Teadit**

558 Garden Oaks  
Houston, TX 77018

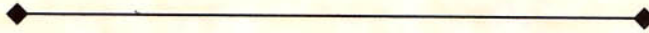


## **Style 2000 IC Packing**

Tested in a 6" Class 300 Gate Valve

Project Number: 20260

January 2003



*Performed by*

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## **YARMOUTH RESEARCH AND TECHNOLOGY**

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# Yarmouth Research and Technology

## PROJECT SUMMARY

**Project Number:** 20260

**Customer:** Teadit NA

**Contact:** Rodney Roth

**Date(s) of Test:** 1/7/03 – 1/15/03

**Product(s) Tested:** Style 2000IC packing in a 6" Class 300 Gate Valve

**Purpose of Test:** The test was conducted to evaluate the valve's stem sealing performance when measured according to the test specification and 40 CFR Part 60, Appendix A, Method 21.

**Test Procedure:** ARCO Fugitive Emission Test Specification  
With the following parameters

- 3500 mechanical cycles
- 3 thermal cycles from ambient to 350 deg. F
- leakage measurements before and after each thermal cycle and every 100 cycles.
- 645 psig test and cycling pressure.
- Max. allowable leakage of 100 PPMv.
- Valves cycled and leak tested with 99% methane using a Foxboro OVA 128.

**Conclusion:** The packing was originally compressed by 20% of its original height.

The packing successfully completed the test with five packing nut adjustments throughout the 3500 mechanical cycles to maintain leakage below 100 PPMv.

See attached data sheets for more information.

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Test Witness:



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Matthew J. Wasielewski, P.E., President  
YARMOUTH RESEARCH AND TECHNOLOGY



# Yarmouth Research and Technology

## DATA SUMMARY

**Customer:** Teadit

**Date:** 16-Jan-03

**Product Description:** Style 2000IC packing in a 6" Class 300 Gate Valve

**Test Standard:** ARCO Fugitive Emission Test Specification

**Project Number:** PN20260

**Test Pressure:** 645 psig

**Test Media:** 99% Methane

**Test Results:** The average and maximum leakage results shown below were calculated from 60 readings measured during a minute duration.

*See data sheets for more detailed information.*

Cycle Number	Temperature (F)	Stem Seal Leakage (PPMv)			
		With Stem Static		With Stem in Motion	
		Avg.	Max.	Avg.	Max.
<b>Packing initially compressed 20%.</b>					
0	Ambient	28	69	70	81
100	Ambient	>1000			
<b>Packing compressed 26%.</b>					
101	Ambient	15	26	17	35
200	Ambient	5	9	4	6
300	Ambient	3	5	5	8
400	Ambient	3	8	3	10
500	Ambient	18	45	19	35
502	350	19	24	19	28
600	350	13	18	17	34
700	350	11	13	12	18
800	350	11	15	16	45
900	350	26	51	32	60
1000	350	16	23	19	30
1002	Ambient	35	92	72	196
1100	Ambient	84	98	126	146
1200	Ambient	136	157		
<b>Packing compressed 30%.</b>					
1201	Ambient	15	17	16	21
1300	Ambient	77	88	86	131
1400	Ambient	58	68	81	115
1500	Ambient	68	81	115	167
1502	350	56	68	69	99
1600	350	47	55	64	90
1700	350	67	74	85	123
1800	350	72	98	99	191
1900	350	77	92	101	195
2000	350	80	99	104	188

## Yarmouth Research and Technology

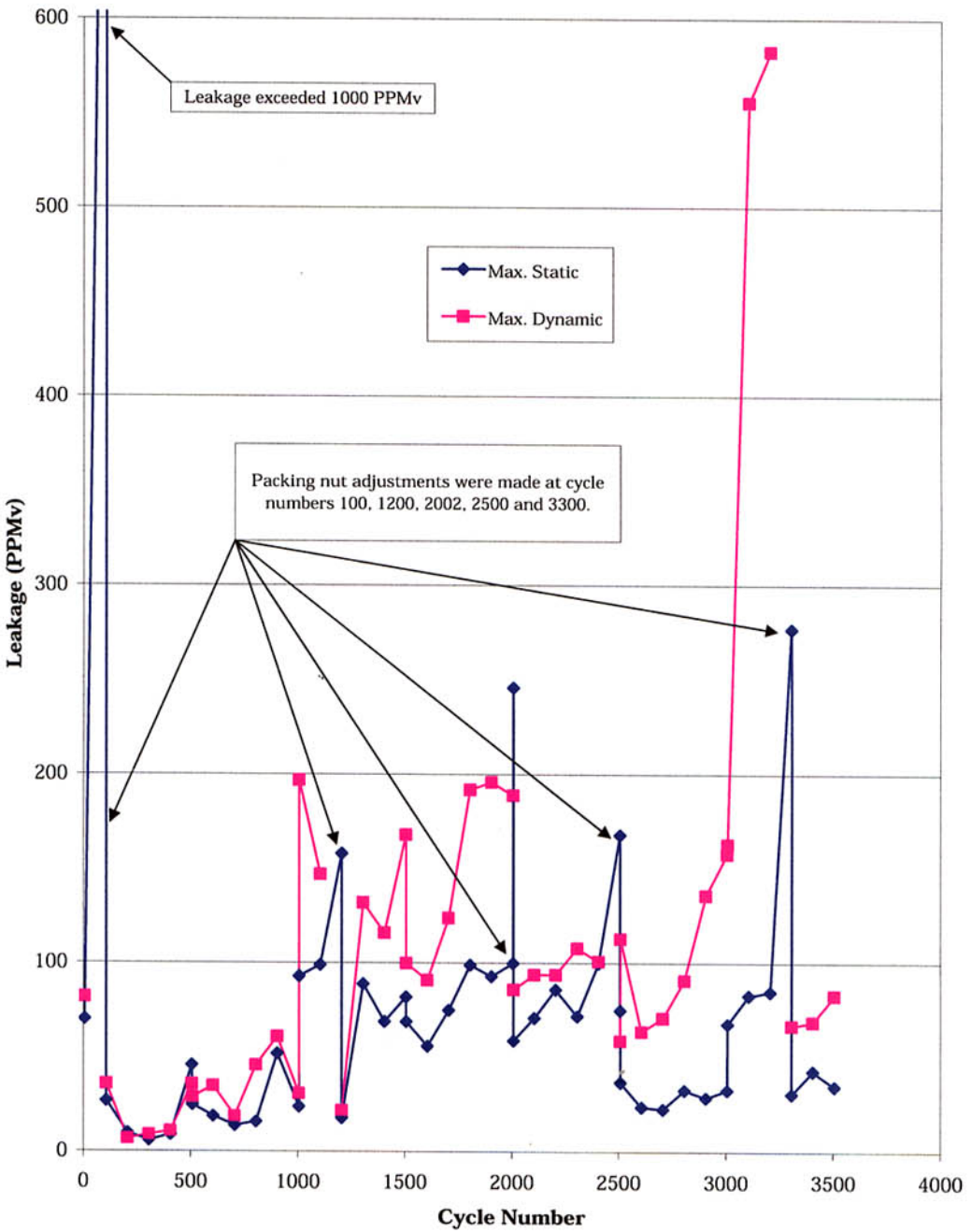
2002	Ambient	217	245		
<b>Packing compressed 32%.</b>					
2003	Ambient	49	58	62	85
2100	Ambient	57	70	65	93
2200	Ambient	61	85	65	93
2300	Ambient	59	71	76	107
2400	Ambient	81	99	78	100
2500	Ambient	117	167		
<b>Packing compressed 36%.</b>					
2501	Ambient	62	74	36	58
2502	350	33	36	53	112
2600	350	20	23	31	63
2700	350	20	22	37	70
2800	350	28	32	47	90
2900	350	25	28	61	135
3000	350	27	32	60	157
3002	Ambient	57	67	121	162
3100	Ambient	71	82	215	555
3200	Ambient	75	84	240	582
3300	Ambient	242	276		
<b>Packing compressed 39%.</b>					
3301	Ambient	21	30	38	66
3400	Ambient	28	42	40	68
3500	Ambient	26	34	45	82

Witness

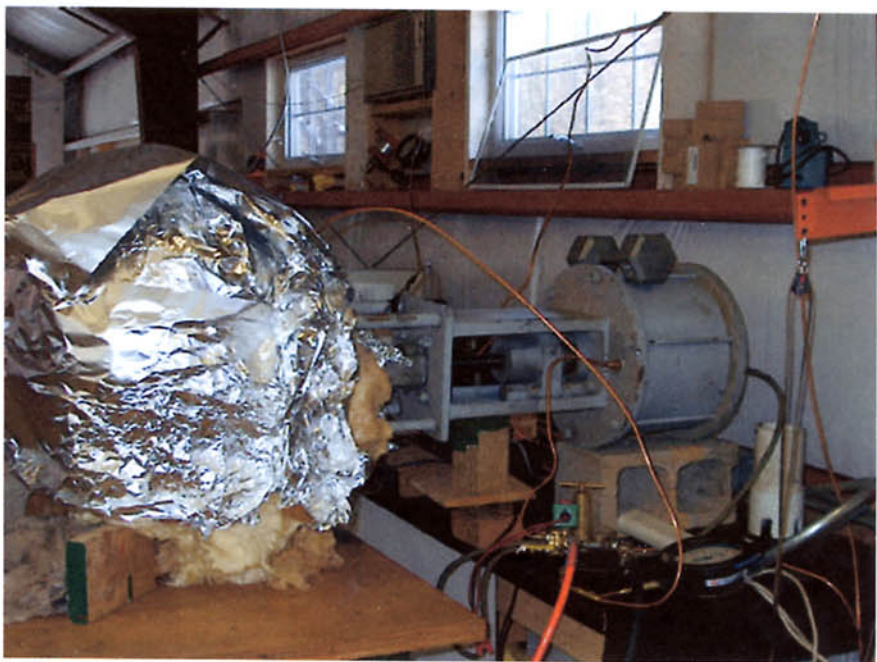
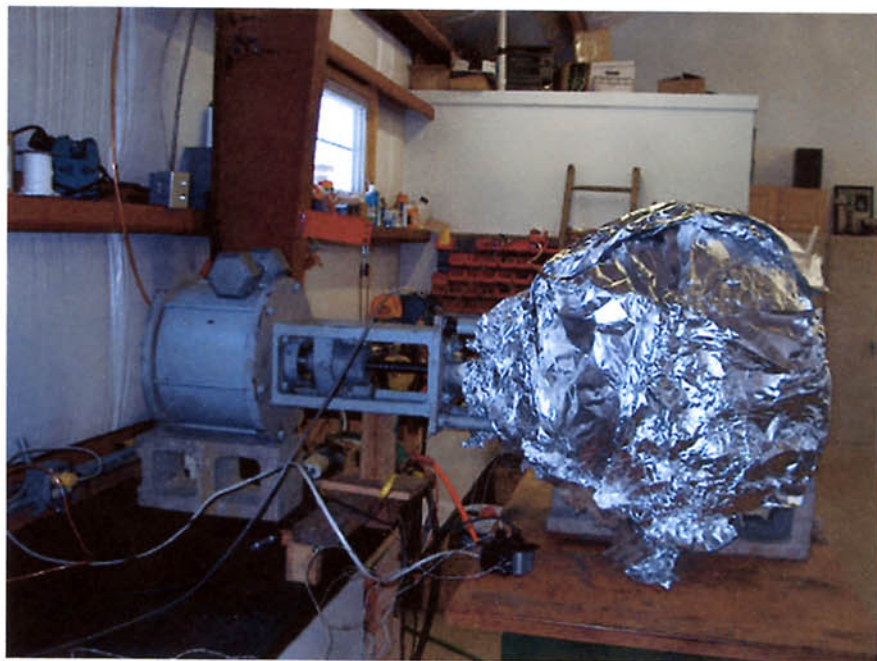
*Matthew J. Wasielewski*



**Leakage versus Cycle Chart**



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Valve Setup with Insulation

## ARCO PRODUCTS COMPANY

### VALVE PACKING FUGITIVE EMISSIONS QUALIFICATION TEST PROCEDURE

#### 1.0 SCOPE

The purpose of this test procedure is to standardize a method of testing valves and/or packing systems for fugitive emissions. The issue of fugitive emissions has and will continue to be a major factor in valve and packing systems selection. This procedure is designed to be the standard by which all valve and valve packing systems will be tested for the ARCO Products Company.

#### 1.1 BASIC TEST PARAMETERS

0	Test Media	Methane gas	<i>Class 300</i>
0	Test Pressure	1300 psig minimum	<i>645 psig</i>
0	Test Temperature	350 degrees F	<i>350°</i>
0	No. of Cycles	3500 fully open to fully close	
0	Leak detection method	EPA Method 21	
0	Max. emission (PPM)	100 PPM (static and dynamic)	

#### 1.2 TEST APPARATUS

1.2.1 Testing shall be performed in a test fixture that will retain the valve during multiple cycling while under pressure. There shall be no modifications/alterations of the valve from its original design and mode of operation.

1.2.2 The test valve shall be installed in the orientation which causes maximum displacement of the stem to occur. Typically, this would be for the stem and valve port to be horizontal. To facilitate testing, a power (motor or pneumatic) actuator may be used to open and close the valve. The actuator shall be unsupported by anything other than the bracket mounted to the valve as they would be in actual service.

1.2.3 The shop performing the test shall prepare a schematic diagram of the test system and send it to ARCO for review prior to the test. It shall show the test valve and piping system, methane source and heater, pressure gauges and regulators, thermocouples and placements, safety devices, etc.

### 1.3 TEST VALVE

1.3.1 The test valve shall be a standard production valve made in accordance with API 600, 6" size, class 600 gate valve and shall be new. The valve shall be selected from "off-the-shelf" inventory.

1.3.2 The test valve shall be disassembled and the valve stem and stuffing box shall be dimensionally checked as outlined below. The following information shall be recorded.

**Stem:** Measure stem cylindricity (circularity and taper) in the area in contact with the packing in at least two places one inch apart. Measure stem straightness and surface finish.

**Stuffing box:** Measure stuffing box depth, ID, and surface finish.

**Diametrical clearance:** Measure the diametrical clearances between the stem diameter and stuffing box ID, stem diameter and gland follower ID, gland follower OD and stuffing box ID.

### 1.4 PACKING INSTALLATION

1.4.1 The stuffing box shall be prepared for a maximum of 7 rings, 2 wiper rings (top and bottom) and 3 to 5 middle rings. If the stuffing box is deeper than a 7 ring set, a split bushing made of carbon steel and having the same ID and OD as the gland follower shall be installed to fill the excess depth of the stuffing box. Record the depth of the stuffing box with or without the split bushing.

1.4.2 The test packing shall be procured from normal distribution. If braided packing is used, the packing ring shall be cut from a spool. The ends shall be cut at a 45° angle or as recommended by the packing manufacturer.

1.4.3 The test facility shall install the packing in accordance with the manufacturer's written instructions. The packing manufacturer may not verbally or otherwise assist the test facility personnel in installing the packing.

1.4.4 Actual field installation procedures used shall resemble field procedures. Install the packing one at a time in the stuffing box and then compress with the gland follower.

1.4.5 Record the packing size, quantity of each type of packing, packing material, manufacturer and brand name, 45° or square cut ends, and ease of cutting and installation. If die-formed rings are used, make note of whether the rings are endless or split and the density. Record the torque to compress the packing during the final packing adjustment. After the final packing adjustment is made, make a mark on the stem even with the top of the gland flange. This will be used to measure the packing gland movement later if adjustment is made to stop leak during pressurization and cycle test. Refer to paragraph 1.5.3.5.

## 1.5 TEST PROCEDURE

### 1.5.1 Test Set-up

1.5.1.1 Verify that the valve stem is not backseated when the valve is in the full open position, can be 3/8" off the backseat position. In the close position, the valve wedge can be 3/8" from full close position.

1.5.1.2 Verify that the cycle counter is operating properly.

1.5.1.3 Ensure that the valve stem nut is lubricated properly.

1.5.1.4 Ensure that the heaters, thermocouples, and temperature controller are operating properly and are set for 350°F.

1.5.1.5 Any adjustment to the test set-up after cycling is started shall be recorded.

### 1.5.2 Pressurization

1.5.2.1 Pull vacuum from the valve body and cavities before pressurizing the valve with methane.

1.5.2.2 Pressurize the valve with methane gas, 98% to 100% methane by volume, per EPA Method 21. The test pressure and temperature shall be in accordance with the pressure/temperature charts for standard class valves as shown in ASME/B16.34.

1.5.2.3 Check for leaks in the test apparatus and valve body joints and eliminate any leak.

1.5.2.3 Prior to cycling the valve, a sniff test in accordance with EPA Method 21 shall be performed in the stem and stuffing box area. There shall be zero PPM reading above background reading. The PPM background reading shall be recorded. The packing nut torque reading shall be taken and recorded at this time.

### 1.5.3 Cycle Test

1.5.3.1 The valve shall be cycled from fully closed to fully open (see paragraph 1.5.1.1). A full cycle shall consist of starting the valve from the closed position, opening the valve to full open, and returning to the close position. The speed of opening and closing the valve shall be approximately the same as the speed when the valve is operated by hand and shall be recorded.

1.5.3.2 Leak reading in accordance with EPA Method 21, using a calibrated Foxboro OVA 128, shall be taken at a minimum interval of 100 cycles. All readings shall be taken in still air with the ventilation fan off.

1.5.3.3 Two readings shall be taken at each interval, when the valve stem is in the static position and when the stem is in the dynamic (moving) position. The static reading shall be taken when the

valve is in the closed position and the dynamic reading shall be taken when the stem is approximately at the midpoint of the opening stroke. The readings shall be taken 180° apart at the stem and stuffing box. Record the higher of each two readings.

1.5.3.4 A minimum of three (3) thermal cycles shall be performed. A thermal cycle consist of: a) cooling the valve to ambient temperature every 1000 cycles and PPM reading taken in both static and dynamic stem positions; b) heating the valve to 350 degrees F and the same readings taken.

1.5.3.5 When the static leak rate exceed 100 PPM, adjust the packing to zero PPM reading and continue the cycle. Record the number of cycles and PPM reading at this point. The torque required to tighten the packing nuts shall be taken and recorded. Record the packing gland downward movement.

1.5.3.6 Record any increase in operating torque on the valve during the cycle test and any lubrication or step performed to lower the torque.

#### 1.5.4 Test Results

The test results, both static and dynamic readings, shall be plotted on a chart, leakage in PPM on the vertical axis and number of cycles in the horizontal axis. The number of cycles and PPM readings in each packing adjustment shall be shown on the chart.

#### 1.6 POST TEST VALVE AND PACKING INSPECTION

After the tests, the valve shall be disassembled and the parts inspected. The same measurements as previously taken on the stem, stuffing box, gland follower, etc. shall be taken and compared to the previous measurements. Record any evidence of wearing on these parts, specially on the stem.

#### 1.7 DOCUMENT SUBMITTAL

Results of the leakage readings in graph form, measurements taken on the valve, packing torque readings and other information required by this procedure shall be submitted to ARCO. It is preferred that the document be placed in a binder.