

**Laboratory Test Report
for
Royal United**

Turbo vs. Goyen Diaphragm Comparison

Report Date: May 9, 2019



ETS, INC.

***Pollution Control Consultants Specializing
In Testing, Training, Troubleshooting and
Testimony***

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ETS CONTRACT NUMBER 18-2792-L

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CLIENT: Royal United

LOCATION: Winchester, VA

ETS CONTRACT NO: 18-2792-L

PROGRAM: Diagnostic

DATE: May 9, 2019

APPLICATION: Pulse Valve

VALVE TYPE: Goyen CA45T000-301

REPLACEMENT DIAPHRAGM:
Turbo G45

1.0 INTRODUCTION

1.1 Background: ETS, Inc. was retained by Royal United of Winchester, Virginia to conduct a side by side analysis of two new 1 1/2" Goyen pulse valves purchased from Goyen Valve LLC directly by ETS and then replace one diaphragm with a Turbo replacement kit G45. After installing the test rig manufactured by Turbo in Milan, Italy the two valves were installed and the sequencer/timer (manufactured by Turbo) was wired to each valve. Photos of the test rig and associated components are located in Appendix B and a diagram of the test rig provided by Royal United is located in Appendix C. ETS was required to pulse both valves a minimum of one million pulses at 90 PSI. ETS provided clean dry air for the valves with an Eaton Polar Air rotary screw 58CFM compressor with a built in dryer. After the testing was concluded, ETS was required to disassemble both valves, conduct a visual inspection, and report on the condition of both diaphragms and associated springs.

1.2 Objective: To document useful life equivalency through one million cycles of the two manufacturers diaphragms (Turbo and Goyen) under a controlled and equal operating environment.

1.3 Test Program: Testing began at ETS's facility in Roanoke, VA on July 31st 2018 and the testing ran 24 hours a day 7 days a week (except for compressor maintenance and one power outage) through March 8th 2019. Appendix A contains a test log generated by ETS. The valves were pulsed on an alternating 10 second interval to allow the test rig to recover its air pressure, with each valve pulsing every 20 seconds. The electric on-time (EOT) setting for pulse duration was 100 milliseconds. Each 1^{1/2}" valve being pulsed at 90 PSI received just over one million pulses during the test program. On March 8th 2019 testing concluded and both valves were removed from the test rig and disassembled so visual inspection and photos could be taken by ETS of the diaphragms and associated springs. Appendix B contains photographs taken by ETS.

2.0 VISUAL INSPECTION

The inspection of both diaphragms and associated springs showed very little wear of the components. Normal minor wear at the main flex point was noted around the outer circumference where the diaphragms are attached to the aluminum valve housing.

3.0 CONCLUSIONS:

Overall, both the Goyen diaphragm and the Turbo diaphragm held up very well to the one million plus pulses and were pulsing strongly when the test was concluded. No damage to the diaphragms was found during the visual inspection other than the normal wear around the circumference where the diaphragm attaches to the aluminum pulse valve housing. Likewise the springs and associated hardware revealed no damage during the visual inspection. Based on the laboratory test conducted at ETS, Inc., the Turbo G45 replacement diaphragm kit is deemed to be equivalent to the original Goyen diaphragm.

APPENDIX A

TEST LOG

ROYAL UNITED 18-2792-L

<u>DATE/TIME</u>	<u>ACTION</u>	<u>NOTES</u>	<u>COUNTER</u>	<u>TECH</u>
7-31-18 9:15 AM	Start	10 second pulse	0	TW/KG
8-1-18 11:00 AM	Check	Counter Disabled	Set to 1	TW
8-2-18 7:00 AM	Check	Not sure if counter is working restart		TW
8-2-18 1:38 PM	Check on Counter		63?	TW
8-3-18 8:00 AM	Check	Counter is good	82	TW
8-6-18 7:05 AM	Check		157	TW
8-7-18 6:50 AM	Check		182	TW
8-8-18 7:57 AM	Check		208	TW
8-9-18 7:44 AM	Check		234	TW
8-10-18 7:34 AM	Check		259	TW
8-13-18 7:08 AM	Check		334	TW
8-14-18 8:58 AM	Check		361	TW
8-15-18 9:30 AM	Check		387	TW
8-20-18 9:17 AM	Check		514	TW
8-21-18 6:45 AM	Check		536	TW
8-21-18	Change Compressor Oil, Filter, Air Filter		539	KG
8-22-18 8:55 AM	Check		560	TW
8-23-18 8:36 AM	Check		585	TW
8-24-18 9:16 AM	Check		611	TW
8-25-18 7:58 AM	Check		685	TW
8-28-18 8:13 AM	Check		711	TW
8-29-18 7:44 AM	Check		734	TW
8-30-18 7:55 AM	Check		760	TW
8-30-18 11:35 AM	Set F2 to .05	All appears good		TW
	Set F3 to 5 seconds Set back to 10 second	Compressor cannot keep up with 5 sec.		
9-5-18 8:37 AM	Check		913	TW
9-6-18 8:14 AM	Check		937	TW

ROYAL UNITED 18-2792-L

<u>DATE/TIME</u>	<u>ACTION</u>	<u>NOTES</u>	<u>COUNTER</u>	<u>TECH</u>
9-7-18 7:07 AM	Check		962	TW
9-10-18 6:45 AM	Check		1037	TW
9-11-18 8:38 AM	Check		1064	TW
9-12-18 12:32 PM	Check		1094	TW
9-13-18 11:41 AM	Check		1118	TW
9-17-18 8:07 AM	Check		1216	TW
9-19-18 7:37 AM	Check Adjust air pressure		1266	TW
9-21-18 11:48 AM	Check		1321	TW
9-24-18 8:21 AM	Check		1393	TW
9-28-18 12:52 PM	Check		1499	TW
10-1-18 9:22 AM	Check		1571	TW
10-4-18 2:47 PM	Check		1653	TW
10-8-18 1:44 PM	Check		1753	TW
10-10-18 11:16 AM	Check		1801	TW
10-16-18 11:00 AM	Check		1953	TW
10-19-18 12:56 PM	Check		2031	TW
10-23-18 1:11 PM	Check		2132	TW
10-26-18 9:51 AM	Check		2205	TW
10-29-18 1:31 AM	Check		2285	TW
11-2-18 3:31 PM	Check Adjust air pressure		2387	TW
11-8-18 10:32 AM	Check		2535	TW
11-12-18 8:53 AM	Check Adjust air pressure		2635	TW
11-14-18 8:45 AM	Check		2685	TW
11-15-18 8:20 AM	Check		2710	TW
11-16-18 1:23 PM	Check		2741	TW
11-26-18 2:29 PM	Check Adjust air pressure		2995	TW
11-30-18 11:02 AM	Check		3093	TW

APPENDIX B

PHOTOGRAPHS



TURBO DESIGNED AND MANUFACTURED TEST RIG



PRESSURE GAUGE ON AIR LINE AT TEST RIG INDICATING 90 PSI

BY: ETS Inc.
SITE: Roanoke, VA

FOR:
ETS PROJECT:
DATE:

Royal United
18-2792-L
June 14, 2018



TURBO SECONDARY DIAPHRAGM REPLACEMENT



REASSEMBLY OF GOYEN VALVE WITH TURBO DIAPHRAGM REPLACEMENT KIT

BY: ETS Inc.
SITE: Roanoke, VA

FOR:
ETS PROJECT:
DATE:

Royal United
18-2792-L
June 14, 2018



APPEARANCE OF TURBO PRIMARY DIAPHRAGM PRIOR TO TESTING



APPEARANCE OF VAVLES ATTACHED TO TEST RIG

BY: ETS Inc.
SITE: Roanoke, VA

FOR:
ETS PROJECT:
DATE:

Royal United
18-2792-L
June 14, 2018



GOYEN PULSE VALVE WITH TURBO G45 REPLACEMENT DIAPHRAGM KIT



NEW 1 1/2" GOYEN PULSE VALVE UNALTERED

BY: ETS Inc.
SITE: Roanoke, VA

FOR:
ETS PROJECT:
DATE:

Royal United
18-2792-L
June 14, 2018



TURBO MANUFACTURED SEQUENCER SERIES E1T



WIRING OF TURBO SEQUENCER SERIES E1T

BY: ETS Inc.
SITE: Roanoke, VA

FOR:
ETS PROJECT:
DATE:

Royal United
18-2792-L
June 14, 2018



**GOYEN VALVE WITH TURBO DIAPHRAGM REPLACEMENT KIT
DISASSEMBLED AFTER TESTING**



GOYEN VALVE DISASSEMBLED AFTER TESTING

BY: ETS Inc.
SITE: Roanoke, VA

FOR:
ETS PROJECT:
DATE:

Royal United
18-2792-L
March 8, 2019



APPEARANCE OF SECONDARY TURBO DIAPHRAGM AFTER TESTING



APPEARANCE OF SECONDARY GOYEN DIAPHRAGM AFTER TESTING

BY: ETS Inc.
SITE: Roanoke, VA

FOR:
ETS PROJECT:
DATE:

Royal United
18-2792-L
March 8, 2019



APPEARANCE OF PRIMARY TURBO DIAPHRAGM AFTER TESTING



APPEARANCE OF PRIMARY GOYEN DIAPHRAGM AFTER TESTING

BY: ETS Inc.
SITE: Roanoke, VA

FOR:
ETS PROJECT:
DATE:

Royal United
18-2792-L
March 8, 2019



APPEARANCE OF SEAT SIDE OF GOYEN PRIMARY DIAPHRAGM



APPEARANCE OF SEAT SIDE OF TURBO PRIMARY DIAPHRAGM

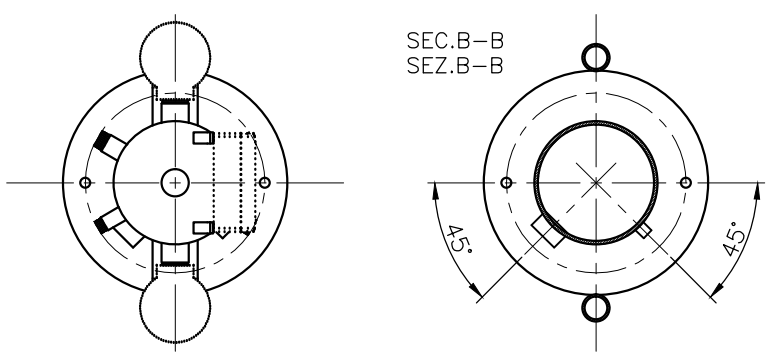
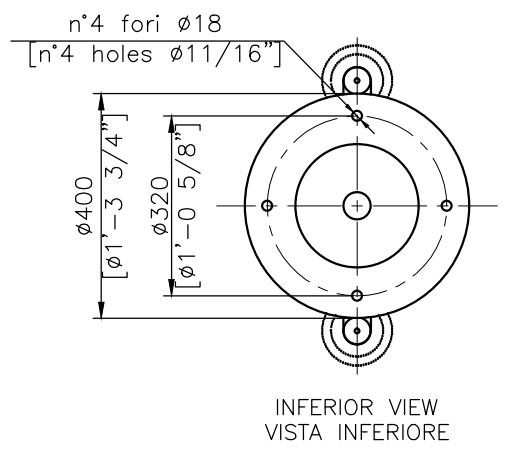
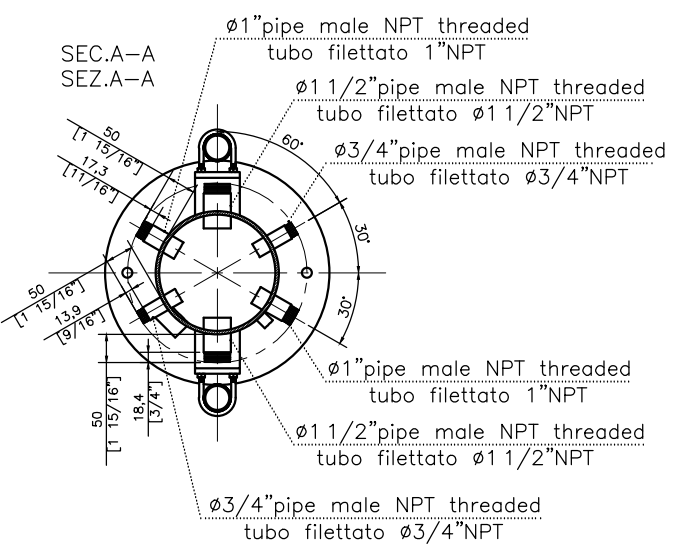
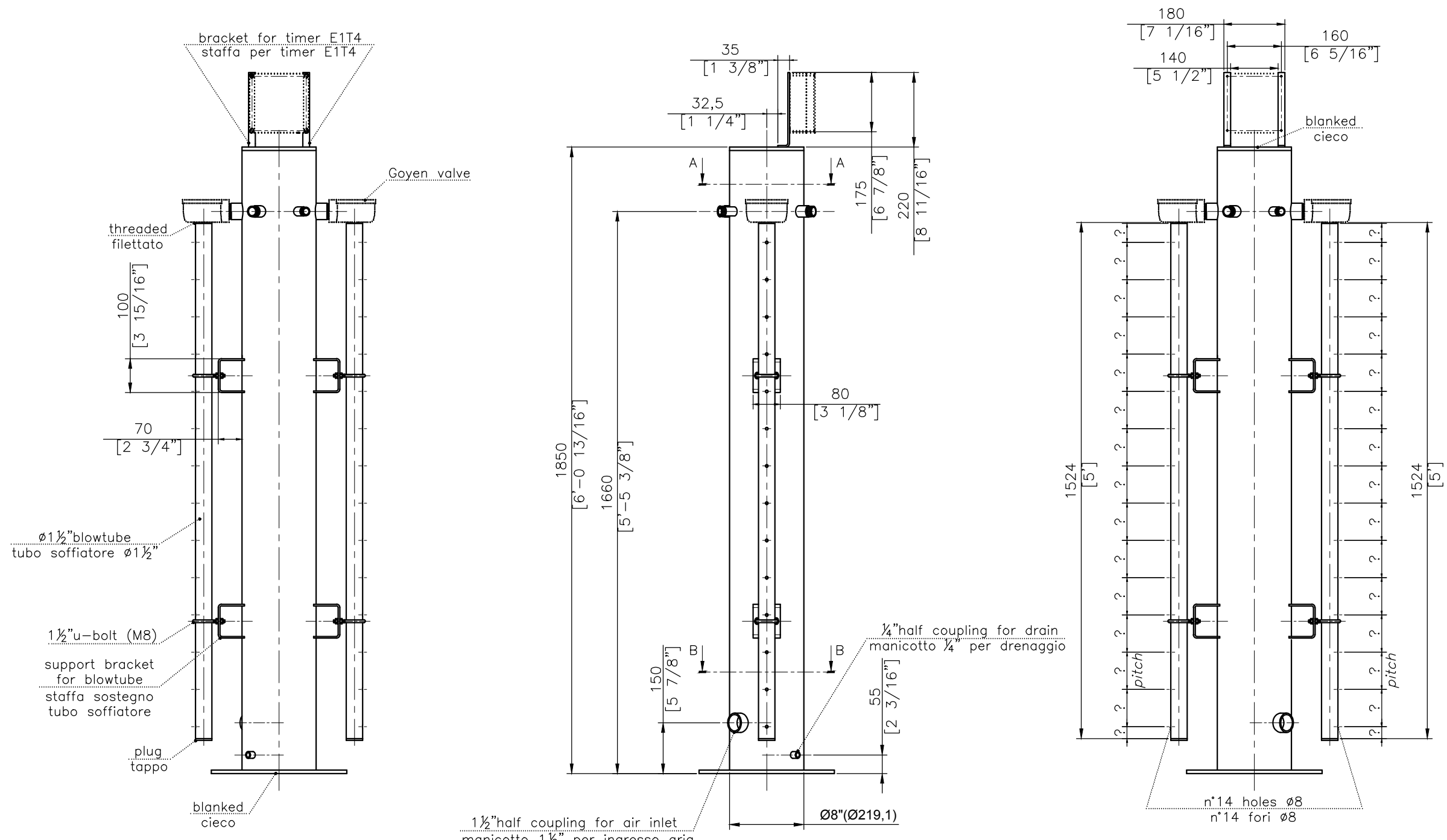
BY: ETS Inc.
SITE: Roanoke, VA

FOR:
ETS PROJECT:
DATE:

Royal United
18-2792-L
March 8, 2019

APPENDIX C

CLIENT SUPPLIED DOCUMENTS



descrizione/description		colore/color	cliente/customer
TEST TANK 8"		5012	ROYAL
dis./drawn		app./approved	
D.P.		F.M.	
data/date		capacità/capacity	
02.03.18		lt 64.7	
n.disegno/dwg no.		rev.	
DP25180		0	



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