

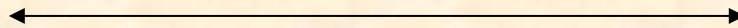
# **Fire Test Report**

**ANSI/API Standard 607, 7th Edition, 2016**  
**ISO 10497: 2010**

*Performed for*

**Cornerstone Valve**

[www.cornerstonevalve.com](http://www.cornerstonevalve.com)



6 inch Class 600 Soft Seated  
Cryogenic Floating Ball Valve  
Valve Code: FBC2-0600F-00600-00

Project Number: 216451  
Test Date: December 14, 2016



*Performed by*

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**YARMOUTH RESEARCH AND TECHNOLOGY, LLC**

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North Yarmouth, ME 04097 USA  
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[www.yarmouthresearch.com](http://www.yarmouthresearch.com)

# Yarmouth Research and Technology, LLC

**Customer:** Cornerstone Valve

**Date:** 12/14/2016

**Specification:** ANSI/API Standard 607, Seventh Edition, 2016

ISO 10497: 2010

**Product Description:** 6 inch Class 600 Soft Seated Cryogenic Floating Ball Valve

**Valve Code:** FBC2-0600F-00600-00

**Project Number:** 216451

**Yarmouth Engineer:** Matthew J. Wasielewski, P.E.

**Equipment Confirmed to be in Calibration to NIST Standards:** Yes

***Burn and Cool Down Test***

Burn Start Time:	9:19:00	
Average Pressure During Burn:	1089	psig
Seat Leak Rate During Burn:	0	ml/min
Allowable Seat Leak Rate:	2400	ml/min
External Leak Rate During Burn/Cool Down:	0	ml/min
Allowable External Leak Rate:	600	ml/min
Amount of Time of Avg. Cal. Blocks > 650 deg. C:	20.3	minutes
Were Test Conditions Within Compliance?	Yes	
Were the Valve Leakages Below the Allowables?	Yes	

***Post-Burn Seat Test***

Average Pressure During Test:	30	psig
Seat Leak Rate:	0	ml/min
Allowable Seat Leak Rate:	240	ml/min
Was the Leakage Below the Allowable?	Yes	

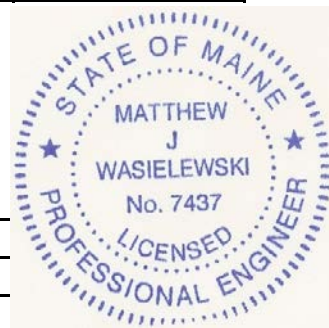
***Operational Test***

Average Pressure During Test:	1123	psig
External Leak Rate After Operating:	0	ml/min
Allowable External Leak Rate:	150	ml/min
Was the Leakage Below the Allowable?	Yes	
<b>Does Valve Pass or Fail the Test Standard?</b>	<b>PASS</b>	

*Certified by*



Matthew J. Wasielewski, PE  
 President and Manager  
 Yarmouth Research & Technology, LLC



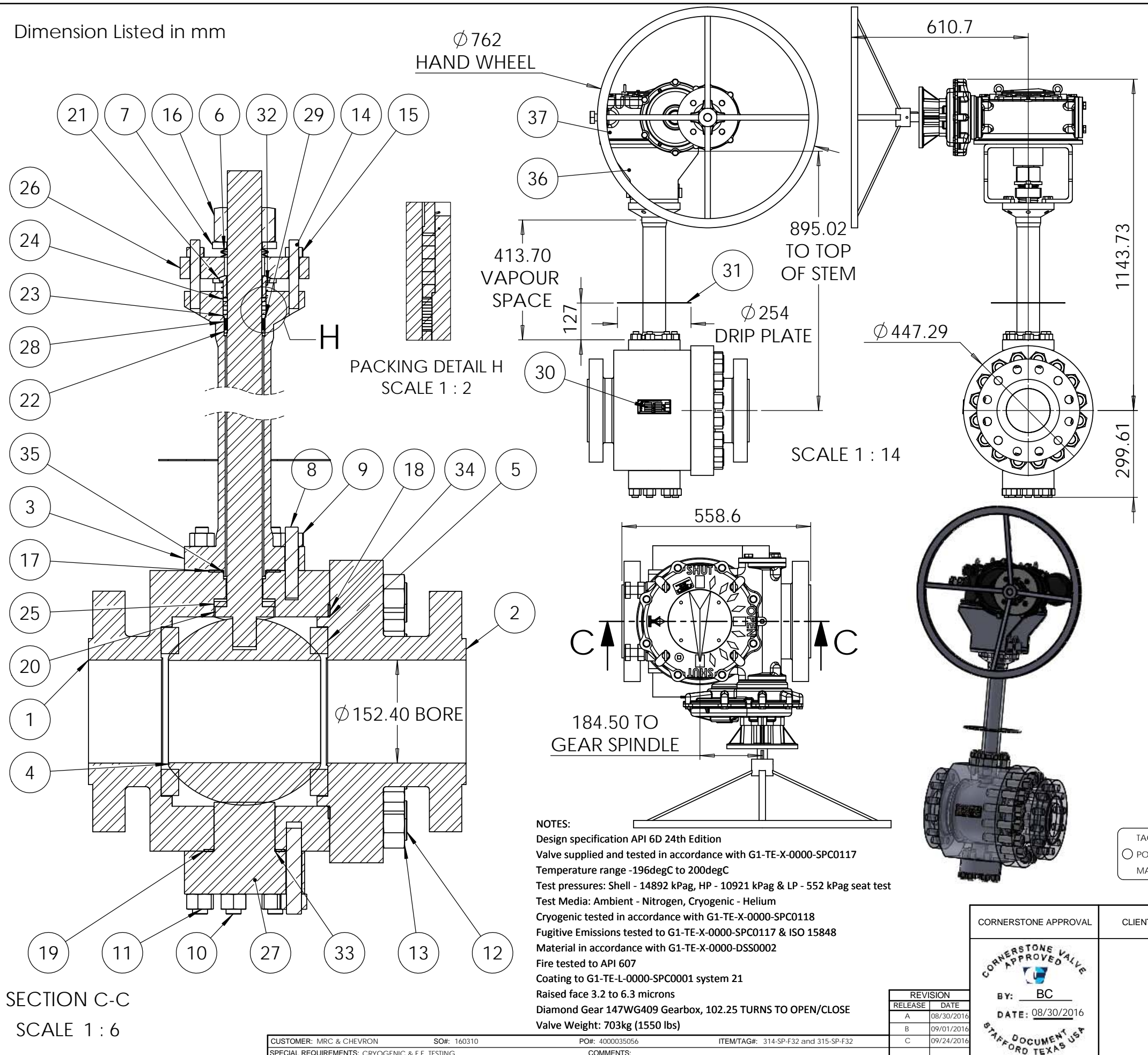
YARMOUTH RESEARCH AND TECHNOLOGY, LLC

**Fire Test Information Sheet**

Fire Test Specification and Revision: (ie. API 607 6th, API 6FA 3rd, etc)	API 607 7TH EDITION
Yarmouth Proposal/Quote Number:	216451A
Customer Purchase Order Number:	16173
Customer's Contact Name:	ASHISH AGRAWAL
Valve Manufacturer's Name (used in test report as specified):	CORNERSTONE VALVE
Company Web Address for Report Cover:	<a href="http://WWW.CORNERSTONEVALVE.COM">WWW.CORNERSTONEVALVE.COM</a>
Valve Manufacturer's Address:	13124 TRINITY DR. STAFFORD TEXAS 77477
Did valve meet all required hydrostatic, leakage and other production pressure tests?	YES
Valve Description for Report Cover:	Soft Seated Cryogenic Floating Ball Valve
Valve Product Code:	FBC2-0600F-00600-00
<b>Valve Description</b>	
Size:	6"
Pressure Rating/Class:	600#
Pressure Rating at 100F:	1440 psig
Type:	Floating Ball Valve
Weight:	1550 lbs
Reduced or Full Bore:	Full Port
Body/Bonnet Material:	A182 F316
Trim Material:	A182 F316
Seat Material:	Virgin PEEK
Stem Seal Material:	PTFE/Graphite
Body Seal Material:	Spiral Wound Graphite
Bolting Material:	A193/A320 B8 CL2
Is valve considered "Soft-Seated"?	Yes
<b>Valve Markings</b>	
Nameplate Information:	FBC2-0600F-00600-00
Casting Markings:	N/A
Assembly Drawing Number / Revision / Date of Issue:	FBC2-0600F-00600-00 REV-C 9/1/16
Emailed (PDF) to Yarmouth: Date:	12/9/2016
If valve is fitted with gearbox, state gearbox manufacturer, model number and mechanical advantage:	Yes, Diamond, 147WG409, 102.3
If valve is non-symmetric, state direction of flow for test:	Symmetric
For double-seated valves, state maximum allowable cavity pressure:	2160 psig
Form Submission Date:	12/12/2016

**PLEASE RETURN AS AN EXCEL DOCUMENT**

Dimension Listed in mm



ITEM NO.	PART NUMBER	DESCRIPTION	GA/ QTY.
1	BODY	ASTM A182 316/316L	1
2	TAILPIECE	ASTM A182 316/316L	1
3	BONNET	ASTM A182 316/316L	1
4	**BALL	ASTM A182 316/316L	1
5	**SEAT	VIRGIN PEEK	2
6	**SPRING SET	300 SERIES STAINLESS	1
7	STOP PLATE	NITRONIC 60	1
8	BONNET STUD	ASTM A193 B8 CL2	7
9	BONNET HEX NUT	ASTM A194 GR8	7
10	TRUNNION STUD	ASTM A193 B8 CL2	7
11	TRUNNION HEX NUT	ASTM A194 GR8	7
12	TAILPIECE STUD	ASTM A193 B8 CL2	16
13	TAILPIECE HEX NUT	ASTM A194 GR8	16
14	PACKING STUD	ASTM A193 B8 CL2	2
15	PACKING HEX NUT	ASTM A194 GR8	2
16	STEM HEX NUT	ASTM A194 GR8	1
17	*BODY GASKET	INCONEL 718/GRAPHITE	1
18	*TAILPIECE GASKET	INCONEL 718/GRAPHITE	1
19	*TRUNNION GASKET	INCONEL 718/GRAPHITE	1
20	STEM	INCONEL 718	1
21	PACKING FOLLOWER	ASTM A182 316/316L	1
22	STEM WASHER	ASTM A182 316/316L	1
23	PACKING WASHER	ASTM A182 316/316L	1
24	*GRAPHITE PACKING	GRAPHITE	4
25	**THRUST WASHER	VIRGIN PEEK	1
26	PACKING FLANGE	ASTM A182 316/316L	1
27	TRUNNION PLUG	ASTM A182 316/316L	1
28	*PTFE PACKING	PTFE	10
29	*STEM ANTI X RING	VIRGIN PEEK	2
30	VALVE TAG	316SS	1
31	DRIP PLATE	316SS	1
32	STATIC SPRING	300 SERIES STAINLESS	1
33	*TRUNNION RING	VIRGIN PEEK	1
34	*TAILPIECE RING	VIRGIN PEEK	1
35	*BONNET RING	VIRGIN PEEK	1
36	MOUNTING BRACKET	CARBON STEEL	1
37	DIAMOND GEAR 147WG409	CARBON STEEL	1

\*RECOMMENDED COMMISSIONING SPARE PARTS  
\*\* 2 YR RECOMMENDED REPAIR COMPONENTS

Cornerstone Valve, Stafford, TX - USA 281-880-8188		DATE	
PART #	FBC2-0600F-0600-00	MOP PSIG	1025 AT 400 °F MAX
SIZE/CLASS	6.0" ANSI 600	MOP PSIG	1440 AT -320 °F MIN
BODY	A182 316SS	E.T.E.	22.00"
PLUG	A182 316SS	SEAT	PEEK
TRIM	316SS/INC 718	ENDS	B16.5 RF
TAG # 314-SP-F32 & 315-SP-F32		SR. #	

TAG # 314-SP-F32, 315-SP-F32  
○ PO# 4000035056  
MATL. HDR: VB129ADIIGZ507

**NOTES:**  
Design specification API 6D 24th Edition  
Valve supplied and tested in accordance with G1-TE-X-0000-SPC0117  
Temperature range -196degC to 200degC  
Test pressures: Shell - 14892 kPag, HP - 10921 kPag & LP - 552 kPag seat test  
Test Media: Ambient - Nitrogen, Cryogenic - Helium  
Cryogenic tested in accordance with G1-TE-X-0000-SPC0118  
Fugitive Emissions tested to G1-TE-X-0000-SPC0117 & ISO 15848  
Material in accordance with G1-TE-X-0000-DSS0002  
Fire tested to API 607  
Coating to G1-TE-L-0000-SPC0001 system 21  
Raised face 3.2 to 6.3 microns  
Diamond Gear 147WG409 Gearbox, 102.25 TURNS TO OPEN/CLOSE  
Valve Weight: 703kg (1550 lbs)

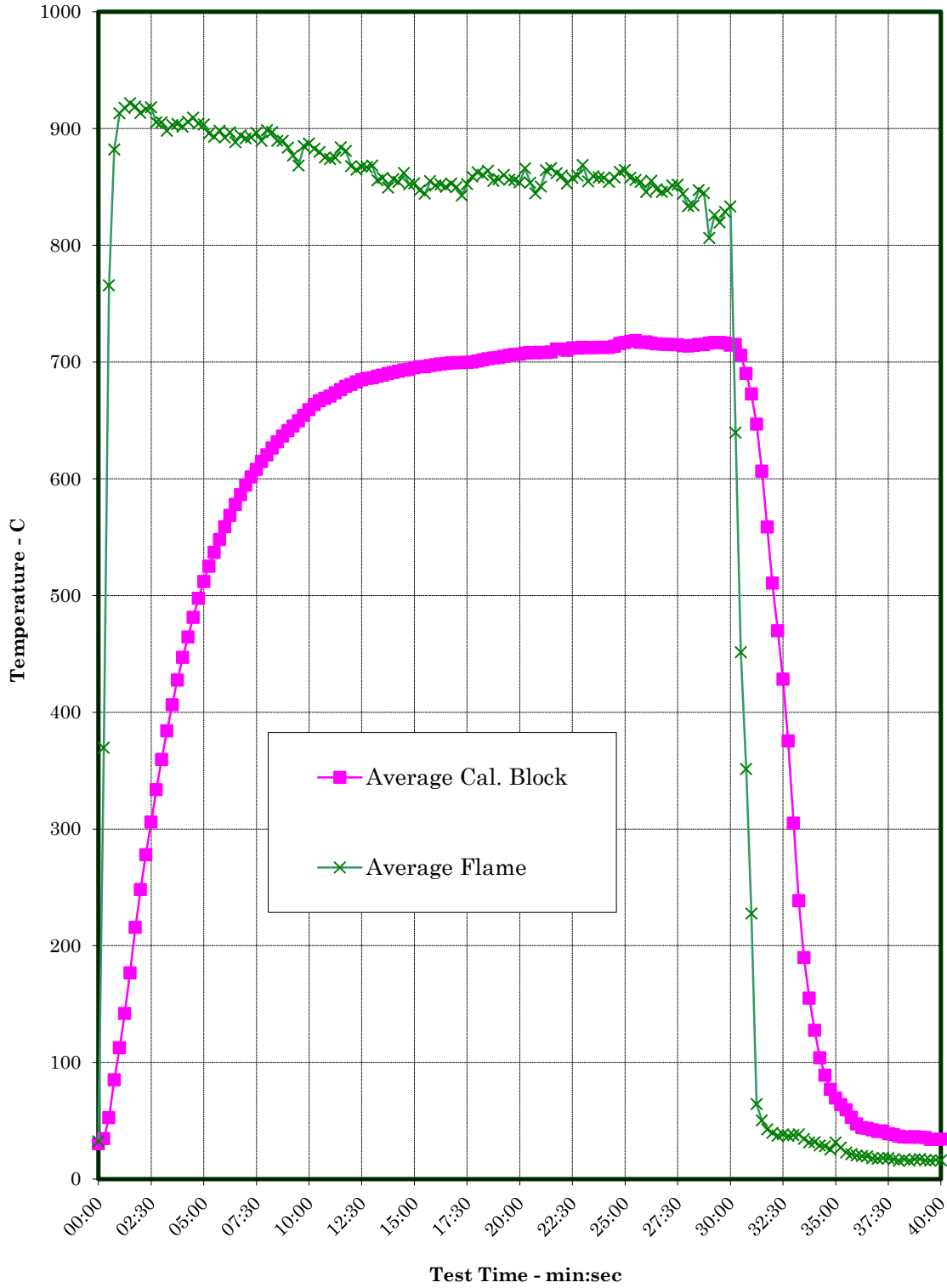
SECTION C-C  
SCALE 1 : 6

CUSTOMER: MRC & CHEVRON SO#: 160310 PO#: 4000035056 ITEM/TAG#: 314-SP-F32 and 315-SP-F32  
SPECIAL REQUIREMENTS: CRYOGENIC & F.E. TESTING COMMENTS:

REVISION	
RELEASE	DATE
A	08/30/2016
B	09/01/2016
C	09/24/2016

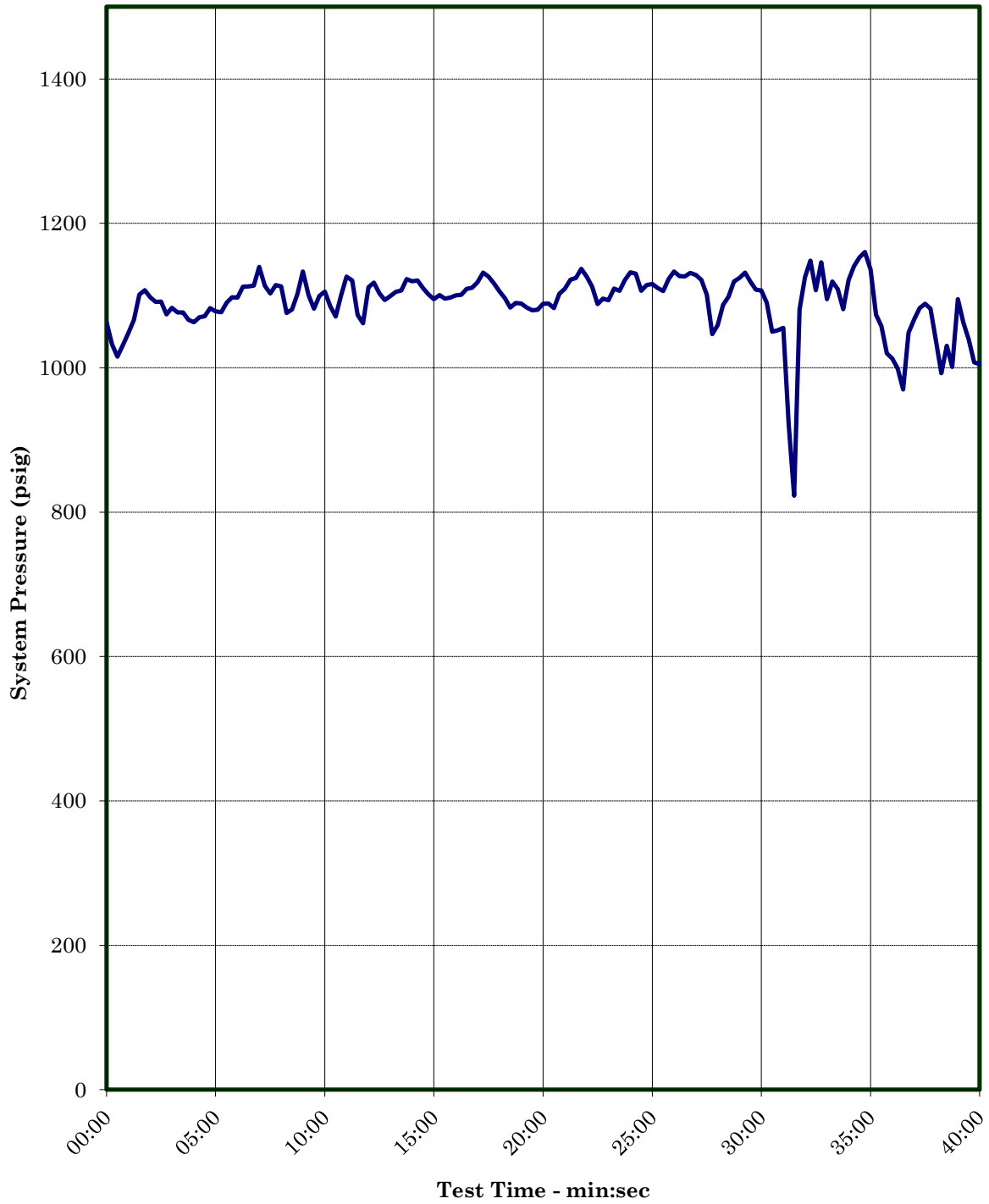
CORNERSTONE APPROVAL	CLIENT APPROVAL	COPYRIGHTED CAD GENERATED DRAWING, DO NOT MANUALLY UPDATE	13124 Trinity Drive, Stafford, TX, 77477 281-880-8188 www.cornerstonevalve.com
 BY: BC DATE: 08/30/2016 STAFFORD TEXAS USA		APPROVALS	DATE
		DRAWN BC	08/30/2016
		CHECKED GC	09/01/2016
		RESP ENG	
APPROVED		TITLE	DN 150 ANSI 600 BI-DIRECTIONAL CAVITY RELIEVING FUGITIVE EMISSION -196C TO +200C FLOATING BALL VALVE
W.O. NUMBER		SIZE DWG. NO.	B FBC2-0600F-00600-00
		SCALE: NTS	SHEET 1 OF 1

**Temperature verses Time Chart**





**Pressure versus Time Chart**



Yarmouth Research and Technology, LLC



Valve Markings



Test Setup Prior to Burn

Yarmouth Research and Technology, LLC



Test Valve during Burn



## Yarmouth Research and Technology, LLC

### Fire Test Information

**Customer:** Cornerstone Valve

**Date:** 12/14/2016

**Product Code:** 6 inch Class 600 Soft Seated Cryogenic Floating Ball Valve

**Project Number:** 216451

### *Fire Test Raw Data*

Time	Pressure (psig)	Water Volume (mls)	Cal. Block 1 Temp-C	Cal. Block 2 Temp-C	Avg. Cal Block Temp-C	Bonnet Flame Temp-C	Body Flame Temp-C	Average Flame Temp-C
9:19:00	1063	43146	31	29	30	27	37	32
9:19:15	1033	43174	32	38	35	307	432	369
9:19:30	1015	43171	44	61	53	793	738	766
9:19:45	1031	43175	83	87	85	941	823	882
9:20:00	1048	43162	119	106	113	977	849	913
9:20:15	1066	43159	160	124	142	986	850	918
9:20:30	1101	43211	211	142	177	989	854	922
9:20:45	1107	43170	263	168	216	983	854	919
9:21:00	1098	43165	307	189	248	983	844	913
9:21:15	1091	43169	345	211	278	984	849	917
9:21:30	1092	43185	378	234	306	996	841	918
9:21:45	1074	43148	407	260	334	979	832	905
9:22:00	1083	43190	435	284	359	984	827	905
9:22:15	1077	43191	460	308	384	976	821	898
9:22:30	1077	43226	482	331	406	971	835	903
9:22:45	1067	43168	503	352	428	973	834	904
9:23:00	1063	43207	522	372	447	972	831	902
9:23:15	1070	43196	539	389	464	976	836	906
9:23:30	1071	43162	555	407	481	976	842	909
9:23:45	1083	43164	570	425	498	977	831	904
9:24:00	1078	43188	583	441	512	975	832	903
9:24:15	1077	43170	595	455	525	959	833	896
9:24:30	1090	43194	605	469	537	952	834	893
9:24:45	1098	43181	614	481	548	963	833	898
9:25:00	1097	43183	623	494	559	954	831	892
9:25:15	1112	43157	632	505	569	959	834	897
9:25:30	1113	43174	641	516	578	941	836	888
9:25:45	1114	43202	647	526	586	947	841	894
9:26:00	1139	43208	654	535	594	953	830	892
9:26:15	1113	43219	660	543	601	956	829	893
9:26:30	1103	43168	665	551	608	962	830	896
9:26:45	1115	43173	670	559	615	946	833	889
9:27:00	1113	43198	674	567	620	955	842	899

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### *Fire Test Data - continued*

9:27:15	1076	43202	678	574	626	954	840	897
9:27:30	1081	43188	682	581	632	947	832	889
9:27:45	1102	43178	685	588	636	944	834	889
9:28:00	1133	43199	689	593	641	943	824	884
9:28:15	1101	43211	691	599	645	928	826	877
9:28:30	1082	43201	694	605	649	926	811	868
9:28:45	1100	43189	698	610	654	946	824	885
9:29:00	1105	43225	703	615	659	966	809	887
9:29:15	1085	43208	708	619	664	943	822	883
9:29:30	1071	43210	710	623	667	931	829	880
9:29:45	1100	43173	711	627	669	922	828	875
9:30:00	1126	43157	711	631	671	917	831	874
9:30:15	1121	43226	712	636	674	929	821	875
9:30:30	1073	43160	714	639	676	936	832	884
9:30:45	1062	43200	716	643	679	937	825	881
9:31:00	1112	43207	717	645	681	916	820	868
9:31:15	1118	43147	718	648	683	913	817	865
9:31:30	1103	43199	718	651	685	904	831	867
9:31:45	1094	43182	718	654	686	907	827	867
9:32:00	1099	43230	717	656	686	910	827	868
9:32:15	1105	43246	717	658	688	889	822	856
9:32:30	1107	43179	717	661	689	887	828	858
9:32:45	1123	43200	717	663	690	885	814	849
9:33:00	1120	43198	716	666	691	897	816	857
9:33:15	1121	43193	716	668	692	899	809	854
9:33:30	1110	43193	716	670	693	898	826	862
9:33:45	1102	43210	716	671	694	876	828	852
9:34:00	1095	43194	716	674	695	878	828	853
9:34:15	1101	43198	716	676	696	874	820	847
9:34:30	1096	43211	716	676	696	872	817	844
9:34:45	1097	43195	716	678	697	890	820	855
9:35:00	1100	43212	716	679	698	876	827	851
9:35:15	1101	43176	716	681	698	880	824	852
9:35:30	1109	43173	715	682	699	877	823	850
9:35:45	1111	43200	714	684	699	875	831	853
9:36:00	1118	43242	714	685	699	869	831	850
9:36:15	1132	43201	713	686	699	857	828	843
9:36:30	1126	43202	712	688	700	879	826	853
9:36:45	1117	43202	711	689	700	895	823	859
9:37:00	1106	43241	712	689	701	901	824	863
9:37:15	1097	43210	713	690	702	899	821	860
9:37:30	1083	43201	714	692	703	902	826	864
9:37:45	1090	43194	714	692	703	901	810	855

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### *Fire Test Data - continued*

9:38:00	1089	43184	715	693	704	892	822	857
9:38:15	1083	43206	716	694	705	896	825	860
9:38:30	1079	43220	717	695	706	891	821	856
9:38:45	1080	43202	717	696	706	884	827	856
9:39:00	1088	43180	717	696	707	895	813	854
9:39:15	1089	43209	718	697	708	909	822	866
9:39:30	1083	43198	718	698	708	884	823	854
9:39:45	1102	43195	718	697	708	872	817	844
9:40:00	1109	43193	718	698	708	881	820	850
9:40:15	1122	43190	718	698	708	898	830	864
9:40:30	1124	43204	719	698	709	902	831	866
9:40:45	1137	43196	719	703	711	886	838	862
9:41:00	1126	43214	720	702	711	888	832	860
9:41:15	1112	43221	719	701	710	888	818	853
9:41:30	1088	43222	720	704	712	888	828	858
9:41:45	1096	43177	719	704	712	888	832	860
9:42:00	1094	43215	719	706	713	915	822	869
9:42:15	1110	43228	720	704	712	891	818	855
9:42:30	1107	43228	720	704	712	894	824	859
9:42:45	1122	43172	719	706	713	893	823	858
9:43:00	1132	43188	719	706	713	893	823	858
9:43:15	1130	43238	720	705	713	886	822	854
9:43:30	1107	43219	721	706	713	940	776	858
9:43:45	1114	43247	724	708	716	937	788	863
9:44:00	1116	43189	727	707	717	928	801	864
9:44:15	1110	43163	728	707	718	906	809	858
9:44:30	1106	43210	727	709	718	893	819	856
9:44:45	1123	43217	726	708	717	882	826	854
9:45:00	1133	43239	724	711	717	868	823	846
9:45:15	1127	43196	722	710	716	884	827	855
9:45:30	1127	43209	721	710	716	869	827	848
9:45:45	1132	43178	721	710	715	864	827	846
9:46:00	1128	43215	719	711	715	869	824	847
9:46:15	1122	43118	718	712	715	881	822	851
9:46:30	1101	43240	718	712	715	878	826	852
9:46:45	1047	43252	717	711	714	857	831	844
9:47:00	1059	43250	716	712	714	877	791	834
9:47:15	1087	43141	716	712	714	891	778	834
9:47:30	1098	43255	718	712	715	889	805	847
9:47:45	1120	43252	718	711	715	892	798	845
9:48:00	1125	43190	718	714	716	858	754	806
9:48:15	1132	43234	718	715	717	859	793	826
9:48:30	1119	43197	717	716	717	861	778	819

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### *Fire Test Data - continued*

9:48:45	1108	43213	716	717	716	856	801	829
9:49:00	1107	43191	713	716	714	862	804	833
9:49:15	1090	43095	711	719	715	654	624	639
9:49:30	1050	43194	701	711	706	456	447	451
9:49:45	1052	43151	683	697	690	349	354	351
9:50:00	1055	43096	664	681	673	272	183	228
9:50:15	921	43103	635	658	647	59	69	64
9:50:30	823	42092	596	617	606	36	65	50
9:50:45	1081	42088	542	575	559	29	56	43
9:51:00	1125	42104	486	536	511	27	52	39
9:51:15	1148	42096	442	497	470	25	49	37
9:51:30	1107	42095	404	453	428	27	49	38
9:51:45	1146	42059	366	384	375	28	46	37
9:52:00	1095	42191	327	283	305	31	44	38
9:52:15	1119	42135	287	190	238	32	45	38
9:52:30	1109	42122	245	134	190	27	42	34
9:52:45	1081	42079	204	106	155	22	41	31
9:53:00	1122	42123	164	91	128	22	41	32
9:53:15	1141	42130	130	78	104	21	37	29
9:53:30	1153	42177	107	71	89	20	36	28
9:53:45	1160	42165	91	63	77	18	32	25
9:54:00	1136	42148	80	59	69	32	31	31
9:54:15	1073	42192	73	54	64	24	30	27
9:54:30	1058	42176	66	53	59	18	27	23
9:54:45	1020	42154	56	50	53	17	26	21
9:55:00	1013	42079	47	47	47	16	25	20
9:55:15	999	42225	43	45	44	14	25	20
9:55:30	970	42077	41	47	44	14	24	19
9:55:45	1048	42034	39	45	42	13	22	18
9:56:00	1067	42106	38	43	41	14	21	18
9:56:15	1083	42180	37	45	41	14	22	18
9:56:30	1089	42189	37	41	39	14	22	18
9:56:45	1082	42043	37	39	38	14	20	17
9:57:00	1038	42104	36	37	37	14	18	16
9:57:15	993	42208	36	37	36	13	21	17
9:57:30	1030	42075	36	36	36	13	18	16
9:57:45	1001	42033	35	38	36	14	20	17
9:58:00	1095	42015	34	37	36	14	21	17
9:58:15	1063	42102	34	37	36	14	18	16
9:58:30	1039	42034	33	34	34	14	18	16
9:58:45	1008	42036	33	34	34	14	19	16
9:59:00	1005	42145	33	36	34	13	19	16

# Yarmouth Research and Technology, LLC

## Leakage Summary for Burn and Cool Down Periods

All pressure transducers and thermocouples are in calibration per YRT's QA program.

Seat leakages were collected manually. External leakage was collected electronically.

Total Through Seat Leakage Collected Over 30 Minute Duration:	0	mls
Average Leak Rate Over 30 Minute Duration:	0	ml/min
Allowable Leak Rate:	2400	ml/min
Total Through Seat Leakage Collected Over 10 Minute Cool Down:	0	mls
Total Water Volume Lost Over 40 Minute Burn and Cool Down:	1001	mls
Water Collected in System Relief Valve:	1025	mls
Calculated External Leakage During 40 Minute Duration:	-24	mls
Average Leak Rate Over 40 Minute Duration:	0	ml/min
Allowable Leak Rate:	600	ml/min
<b>Were the Valve Leakages Below the Allowables?</b>	<b>Yes</b>	



## Yarmouth Research and Technology, LLC

### Summary of Test Parameters During Burn and Cool Down Periods

Amount of Time Pressure Dropped Below 50%:	0.0	minutes
Maximum Allowable Low Pressure Time:	2.0	minutes
Maximum Pressure During Burn/Cool Down:	1160	psig
Average Pressure During Burn/Cool Down:	1090	psig
Minimum Pressure During Burn/Cool Down:	823	psig
Amount of Time of Avg. Cal Block > 650 deg.C:	20.3	minutes
Minimum Allowable Time at Temperature:	15.0	minutes
Maximum Avg Cal Block Temperature:	718	deg. C
Average Cal Block Temperature:	515	deg. C
Lowest Avg Cal. Block Temperature:	30.3	deg. C
Maximum Body Flame Temperature During Burn:	854	deg. C
Average Body Flame Temperature During Burn:	815	deg. C
Maximum Bonnet Flame Temperature During Burn:	996	deg. C
Average Bonnet Flame Temperature During Burn:	903	deg. C
Average of Both Flame Temperatures During Burn:	859	deg. C

**Notes**

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<b>Were Test Conditions Within Compliance?</b>	<b>Yes</b>
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# Yarmouth Research and Technology, LLC

## Post-Burn Seat Test Information

Customer: Cornerstone Valve

Date: 12/14/2016

Product Code: 6 inch Class 600 Soft Seated Cryogenic Floating Ball Valve

Project Number: 216451

### Test Data

Time	Pressure (psig)	Cal Block Temp - C
10:09:48	30	31
10:10:03	29	30
10:10:18	29	30
10:10:33	29	30
10:10:48	29	30
10:11:03	28	31
10:11:18	29	30
10:11:33	29	31
10:11:48	28	30
10:12:03	29	31
10:12:18	29	31
10:12:33	31	30
10:12:48	30	31
10:13:03	31	31
10:13:18	31	31
10:13:33	31	31
10:13:48	31	32
10:14:03	30	31
10:14:18	29	30
10:14:33	30	31
10:14:48	31	31

*Leakages were collected manually.*

Total Seat Leakage Collected Over 5 Minute Duration:	0	mls
Average Leak Rate Over 5 Minute Duration:	0	ml/min
Allowable Leak Rate:	240	ml/min

Was the Valve Leakage Below the Allowable?	Yes
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# Yarmouth Research and Technology, LLC

## Operational Test Information

Customer: Cornerstone Valve

Date: 12/14/2016

Product Code: 6 inch Class 600 Soft Seated Cryogenic Floating Ball Valve

Project Number: 216451

Time	Pressure (psig)	Cal Block Temp - C
10:19:54	1137	29
10:20:09	1152	29
10:20:24	1143	30
10:20:39	1108	30
10:20:54	1120	30
10:21:09	1137	29
10:21:24	1125	30
10:21:39	1109	29
10:21:54	1091	30
10:22:09	1099	30
10:22:24	1113	29
10:22:39	1132	29
10:22:54	1141	30
10:23:09	1142	30
10:23:24	1092	29
10:23:39	1108	29
10:23:54	1110	29
10:24:09	1120	29
10:24:24	1126	29
10:24:39	1143	29
10:24:54	1142	29

*Leakages were collected manually.*

Total External Leakage Collected Over 5 Minute Duration:	0	mls
Average Leak Rate Over 5 Minute Duration:	0	ml/min
Allowable Leak Rate:	150	ml/min

Was the Valve Leakage Below the Allowable?	Yes
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