Table of Contents

1. Applicability

- ☒ Distribution
- ☐ Gathering
- ☒ Processing
- ☒ Transmission/Jurisdictional Gathering

2. Scope

This procedure provides a safe and uniform method to remove air from gas piping of specific sizes and lengths using the "Inlet Control Method" illustrated in Attachment 1.

3. Core Information and Requirements

3.1. Safety

Do not vent gas under electric transmission lines except in case of extreme emergency (danger to life or property). This includes blowing down and purging meter runs, which may require piping the blowoff a safe distance downwind from the power lines or blowing down additional sections of pipeline to accomplish work. If you must vent below a power line, before venting notify the power line operator, who might be able to shift load and "kill" the power lines over the vent.

When the release point is relocated, properly secure the pipe to prevent movement. Follow the precautions outlined in **O&M Procedure 234**. Complete the Shutout Plan and review with all employees before beginning work.

When welding will be done in a bell hole, first purge, then check with a gas analyzer. Lower a welding torch or other open flame into the hole before any personnel enter the hole.

Wear appropriate personal protective equipment during purging to prevent injury (see **O&M Procedure 120**).

3.2. Types of Purges

Two primary types of purges are normally used in pipeline work: pre-welding purge and pre-pack purge. An alternate purge method is also given. This method may save gas and reduce purging risks.

3.2.1. Pre-Welding Purge

A pre-welding purge refers to preparing an area for a "hot" tie-in or for welding where natural gas is escaping from the tie-in area. This purge is normally very gentle, only enough to displace any air that may have entered while removing and reinstalling the replacement section. The intensity of the purge is directed from the bell hole, using enough gas to push the contaminated air/gas mixture past the work area. It should be strong enough to force gas out at the bottom and top of the weld area, but not strong enough to blow off any furnace tape used to prevent more air from entering once the purge is complete.

Normally 10 to 15 minutes of pre-welding purge are sufficient unless a large quantity of air entered the pipeline at the purge point blowoff or if it appears the air has not moved a safe distance from the bell hole. This purge is not intended to remove all air from the pipeline but rather to move any air or combustible mixture a safe distance away from the weld area.

When the purge is completed, allow venting at the bell hole to die down. When the bell hole is sufficiently vented, flash the hole from the top, ignite and control the gas at the weld before entering the bell hole for work.

Take a sample from the bottom portion of the pipe at the work site.

3.2.2. Pre-Pack Purge

The pre-pack purge is intended to remove any air or impurities from the pipeline after welding is completed and before putting the line back in service.

The pre-pack purge can be quite strong to speed up the operation and displace one atmosphere of gas in the complete section between the shut-in valves. Choose the low or high-pressure purge depending on noise limitations or hazards at the receiving or blow down end.

Install the bracket on the blowoff before beginning the pre-pack purge. The bracket and piping provide a sampling source to check the gas concentration from the high velocity stream.

Check samples of the purge gas periodically for concentration. The purge is considered completed two minutes after 100 percent natural gas concentration is indicated and a reasonable amount of time has elapsed since the purge began.

3.2.3. Alternate Purge Method

Instruments are available that measure the percentage of natural gas and/or oxygen level in air with continuous sampling. Instruments with two scales measure 0 to 100% of the lower explosive limit (LEL) and 0 to 25% oxygen. 100% LEL is approximately 4 to 5% natural gas. Other instruments with one scale measure 0 to 100% natural gas, which is a direct readout of natural gas in the air.

See Attachments 2, 3 and 4 for examples of sampling devices to be inserted into the gas flow from the blowoff on the downstream end of the purge section. This device delivers a representative gas sample to the purge instrument. Follow preparation and purging steps outlined in this procedure when using a purge instrument.

3.2.4. Example

We are using a purge instrument with two scales (0 to 100% LEL and 0 to 25% oxygen). The pipeline is 11 miles of 20-inch and a 6-inch blowoff.

3.2.5. Solution

- The Purge Table for 20-inch diameter pipe of 11 miles and a 6-inch blowoff using a slow purge indicates 39 minutes of purge time at 2l psig inlet control pressure.
- Attach the gas-sampling device on the 6-inch blowoff and set the purge instrument to the LEL scale. Open the control inlet valve and adjust to 2l psig.

- After reaching 100% LEL, adjust the purge instrument to the oxygen scale. When 0% oxygen is indicated, record the time and then purge for two more minutes.
- If oxygen is not indicated after two minutes, the purge is completed. Otherwise, keep purging two minutes from the time oxygen is indicated. This type of purge should take less than the 39 minutes determined in Step 1.
- When 0% oxygen is indicated for two consecutive minutes, stop the purge and determine the gas lost from the tables by interpolation. If the purge time was 23 minutes, then the gas lost is 71.04 MCF.

3.3. Preparing for Purging

- Determine the blowoff size, piping size and the length in miles of the section to be purged. Obtain the required purging time from the appropriate Purge Table.
- Connect an earth ground to blowoff at the discharge point.
- Have fire extinguishers immediately available.
- Install an accurate low pressure gauge readable to within one psig on the pipeline near the inlet pressure control point. Place the gauge so the person controlling the inlet pressure can constantly observe it. It may be necessary to connect the gauge through several feet of flexible tubing to eliminate vibration.
    - If the piping section is purged using a crossover or bypass and the pressure gauge connection is on the crossover or bypass, add 5 psig to the inlet pressure shown on the table.
    - Give the pressure gauge connection valve a good blow before connecting the gauge line to prevent valve grease from entering the gauge and altering gauge readings.
    - When purging through a crossover, fully open the valve on the pressured section and control the purge with the bypass valve nearest the section to be purged. If this procedure is reversed, high velocity gas passing through the crossover may cause extreme vibration.
    - Establish communication between the inlet control point and the blowoff point. Take adequate precautions at the blowoff point to protect the public and employees. Do not smoke or operate vehicles and equipment within 250 feet of the blowoff. (Triple this distance downwind of the blowoff.)
    - Open the blowoff valve at the downstream end of the section to be purged. Keep this valve in the full open position during the entire purge.

3.4. Purging Procedure

Record the exact time that the purge is started. Bring the gas purge pressure up to the pressure determined by the Purge Tables and maintain it at that value for the period shown in the table (inlet pressure can normally be attained within 30 to 45 seconds).

The following procedure uses established times and pressures to ensure proper purging.

1. Begin the purging procedure with inlet and downstream block valves and blowdown valves closed.
2. Open the blowdown valve at the downstream end of section to be purged.
3. Slowly open the inlet valve and establish the recommended inlet pressure shown on Purge Tables. Begin purge timing when recommended pressure is reached.
    - When using gas to purge a pipeline of air, release the gas into one end of the line in a moderately rapid and continuous flow. If gas cannot be supplied in enough quantity to prevent a hazardous mixture of gas and air from forming, release a slug of inert gas into the line before the gas.
    - Purge gas pressure depends on the length and size of the line to be purged and the size of the blowdown valve used for venting. Refer to the Purge Tables at the end of this procedure to determine minimum purge pressure and time.
4. Shut the inlet valve.
5. When the required time has passed, notify personnel at the blowoff to close the blowoff valve.

6. Slowly open the inlet valve and allow pressure in line to build to operating pressure.
7. Open the downstream block valve after pressures are equalized across the valve setting.
8. Replace closures and remove pressure gauge(s).

Report the gas lost from purging following **O&M Procedure 1030** and/or **O&M Procedure 1830**.

3.5. Gas Lost Examples

The gas lost figures used in the attached tables are based on the assumptions:

- That the piping section to be purged contains air
- That a complete pipeline volume of air and a complete pipeline volume of gas will be lost

The gas lost figures are calculated based on using venturi-type plug blowoff valves. If full opening valves are installed on the blowoff, the stated purging time and pressure in the tables will result in a greater safety factor. Multiply the gas lost figure by a factor of 1.5 if the blowoff is a full opening valve. If the purged piping contains gas, multiply the gas lost shown in the tables by a factor of 2 (3 for full opening valves).

3.5.1. Example 1:

Assume one pipeline of 11.8 miles of 20-inch and 3.0 miles of 16-inch diameter pipe with a 4-inch blowoff valve is to be fast-purged.

3.5.2. Solution

- Refer to the Purge Table for a 20-inch diameter pipeline with a 4-inch blowoff valve, using a pipeline length of 12 miles. The purging time is 44 minutes, the inlet pressure is 41 psig and the gas lost is 131 Mcf.
- Refer to the Purge Table for 16-inch diameter pipeline with a 4-inch blowoff valve using a pipeline length of 3 miles. The purging time is 7 minutes, purging pressure is 39 psig and the gas lost is 21 Mcf.

Combining these values, we find:

	Purging Time (Minutes)	Gas Lost (Mcf)	Purging Pressure (Psig)
20" Line	44	131	41
16" Line	7	21	39
Purging Requirements	51	152	41

3.5.3. Example 2

Assume a 24-inch diameter pipeline with a 6-inch blowoff valve is to be purged. Further, assume that although the length of section to be purged is 1.8 miles, the inlet valve is 5.6 miles from the start of the section to be purged.

3.5.4. Solution

Refer to the Purge Table for a 24-inch diameter pipeline with a 6-inch blowoff valve. Under a 6-inch blowoff, with a length of 2 miles, 7 minutes purging time is required at 36 psig inlet control pressure. A quantity of gas equal to 32 Mcf will be lost to the atmosphere.

3.6. Purging in a High Population Density Area

In areas where the population density prohibits normal purging, inlet pressure and the length of the purge will vary according to the situation. Instruments used for this method should have 0 to 100% LEL and 0 to100% natural gas scales.

Regulate the inlet pressure for the purge to reduce excessive noise at the blowoff. Follow "Slow Purge" pressures as closely as possible.

Refer to the "Alternate Purge Method" (paragraph 3.2.3., above), which describes using purge instruments.

4. Training

Personnel should review this procedure as necessary before performing purging.

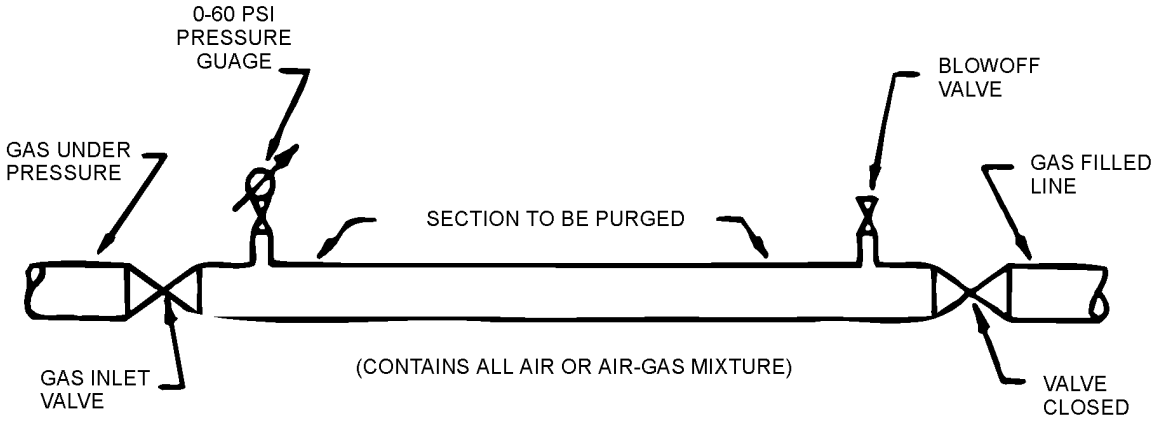
5. Documentation

Document gas lost using online Field Ticketing – Unmeasured Gas procedures (refer to **O&M Procedure 1030** and **O&M Procedure 1830**) and/or or **OM1000-05, Gas Lost Report**

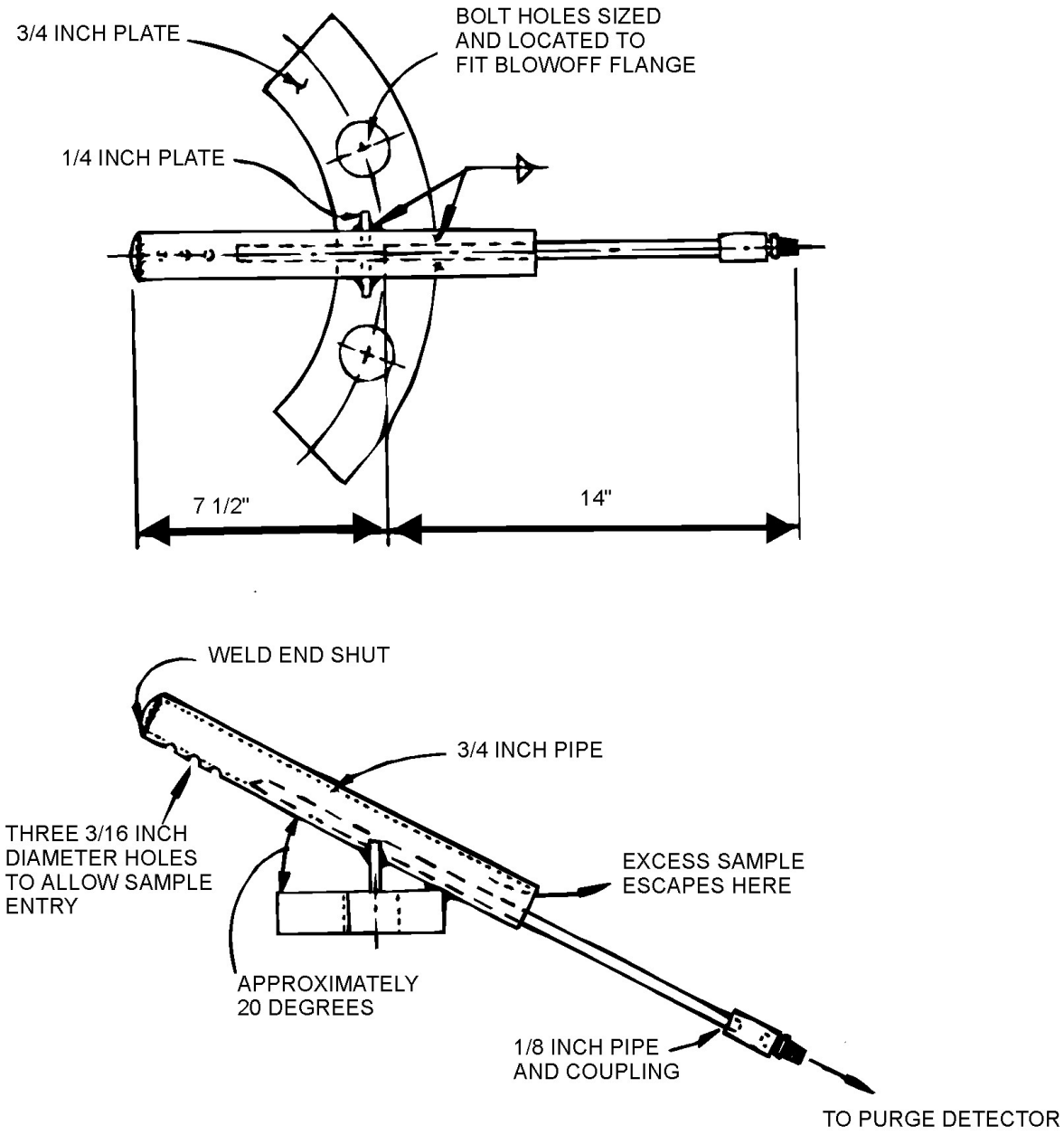
6. References

- 49 CFR192.605(b)
- **O&M Procedure 120**
- **O&M Procedure 223**
- **O&M Procedure 234**
- **O&M Procedure 236**
- **O&M Procedure 1030**
- **O&M Procedure 1830**
- **OM1000-05, Gas Lost Report**

Attachment 1 - Inlet Control Method

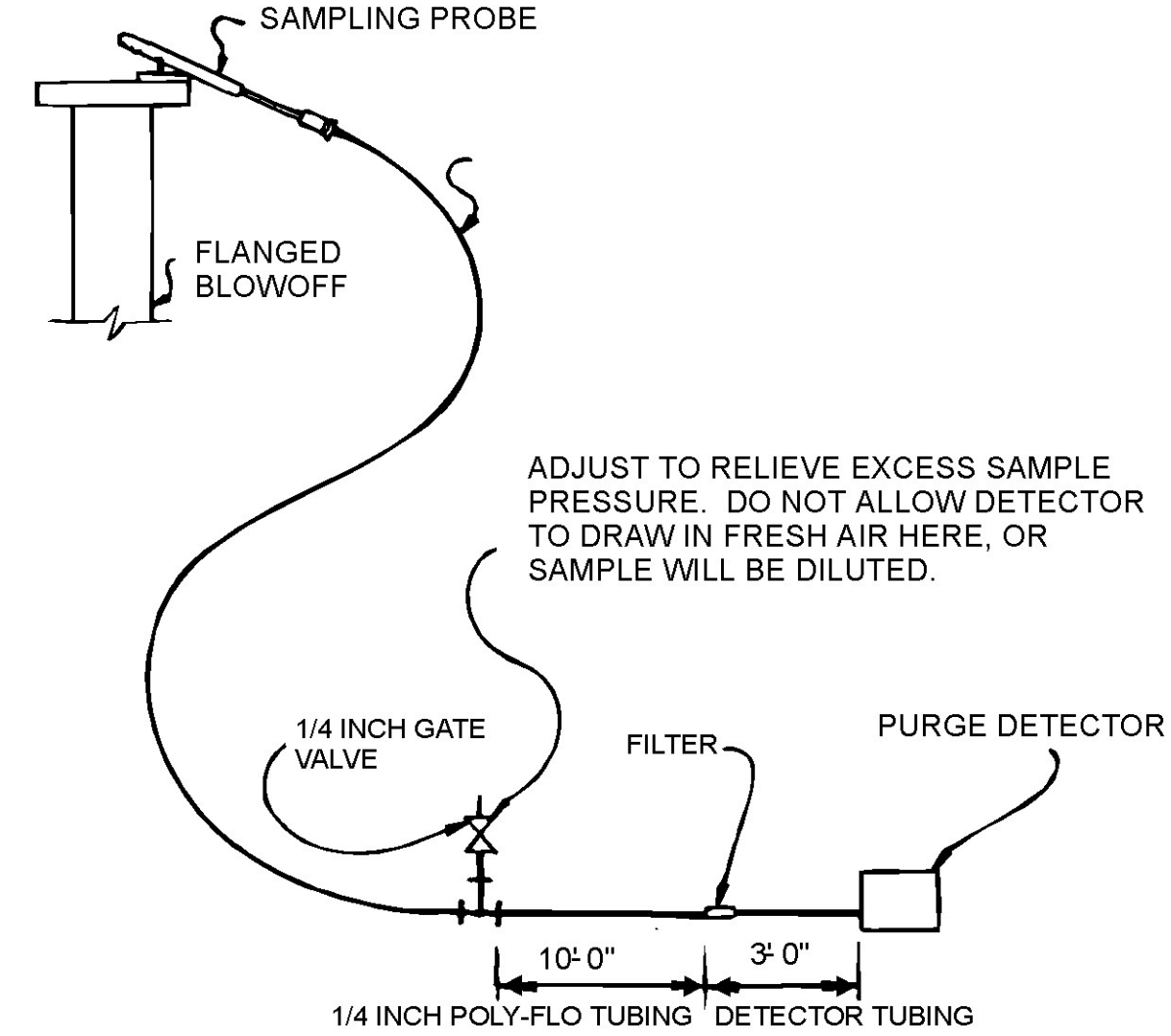


Attachment 2 – Purge Detector Sampling Probe



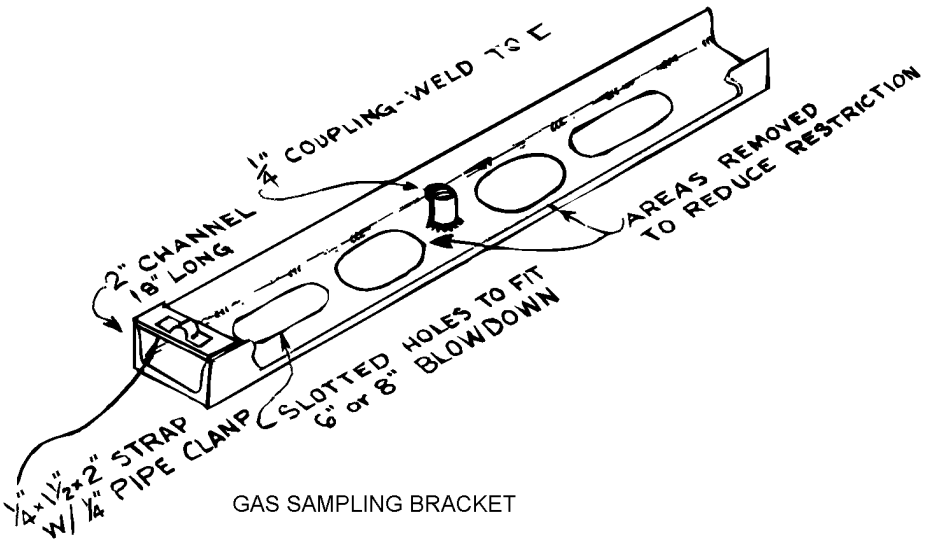
PURGE DETECTOR SAMPLING PROBE

Attachment 3 – Arrangement of Purge Detector Apparatus

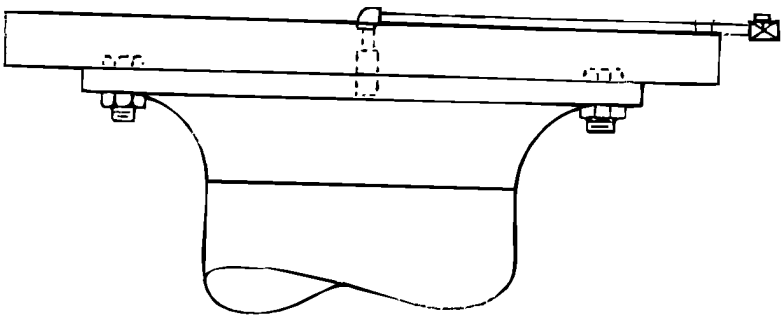


ARRANGEMENT OF PURGE DETECTOR APPARATUS

Attachment 4 - Bracket Mounted On Blow-Off



GAS SAMPLING BRACKET



Purge Tables

2-Inch Pipeline							
Purged Pipeline Length, Miles	Inlet Pressure, psia	Steady-State Flow Rate, MMScf/d	1-Displacement Purge Time, Min.	Pure Gas Volume Vented, Scf	Mixture Gas Vented, Scf	Total Gas Vented, Scf	Total (2-Displacement) Purge Time, Min.
0.5	20	0.651275	0.75	339	1	341	1.5
1	20	0.469708	1.88	613	2	615	3.8
2	20	0.393534	4.99	1,364	3	1,367	10.0
3	20	0.369017	8.97	2,299	4	2,302	17.9
4	20	0.351979	13.67	3,341	4	3,346	27.3
5	24	0.343493	17.56	4,189	5	4,193	35.1
6	26	0.339562	22.23	5,242	5	5,247	44.5
7	28	0.332272	27.08	6,249	6	6,254	54.2
8	30	0.327506	32.11	7,303	6	7,309	64.2
9	35	0.324479	35.97	8,105	7	8,112	71.9
10	40	0.327735	39.94	9,090	7	9,097	79.9
11	43	0.321843	44.80	10,013	7	10,020	89.6
12	46	0.317099	49.79	10,964	8	10,972	99.6
13	50	0.317662	54.46	12,014	8	12,022	108.9
14	54	0.314392	59.21	12,927	8	12,935	118.4
15	58	0.315824	64.04	14,045	9	14,054	128.1
16	62	0.317497	68.97	15,207	9	15,216	137.9
17	66	0.319364	73.93	16,396	9	16,405	147.9
18	70	0.321390	78.97	17,625	9	17,635	157.9
19	74	0.323544	84.01	18,876	10	18,885	168.0
20	78	0.325853	89.19	20,183	10	20,193	178.4

3-Inch Pipeline							
Purged Pipeline Length, Miles	Inlet Pressure, psia	Steady-State Flow Rate, MMScf/d	1-Displacement Purge Time, Min.	Pure Gas Volume Vented, Scf	Mixture Gas Vented, Scf	Total Gas Vented, Scf	Total (2-Displacement) Purge Time, Min.
0.5	20	0.651275	0.49	222	3	225	1.0
1	20	0.469708	1.32	431	5	435	2.6
2	25	0.393534	3.32	907	7	914	6.6
3	30	0.369017	5.62	1,440	9	1,449	11.2
4	34	0.351979	8.21	2,007	10	2,017	16.4
5	38	0.343493	10.98	2,619	11	2,631	22.0
6	42	0.339562	13.54	3,193	12	3,205	27.1
7	45	0.332272	17.06	3,937	14	3,950	34.1
8	48	0.327506	20.35	4,628	15	4,643	40.7
9	51	0.324479	23.78	5,358	15	5,374	47.6
10	55	0.327735	27.10	6,168	16	6,184	54.2
11	57	0.321843	30.91	6,908	17	6,926	61.8
12	59	0.317099	34.81	7,665	18	7,684	69.6
13	62	0.317662	38.64	8,524	19	8,543	77.3
14	64	0.314392	42.68	9,318	20	9,338	85.4
15	67	0.315824	46.67	10,236	20	10,256	93.3
16	70	0.317497	50.70	11,179	21	11,200	101.4
17	73	0.319364	54.74	12,140	22	12,162	109.5
18	76	0.321390	58.93	13,152	23	13,175	117.9
19	79	0.323544	63.11	14,180	23	14,203	126.2
20	82	0.325853	67.24	15,216	23	15,239	134.5

4-Inch Nominal Pipe Diameter		
	1-Inch Blowoff Valve	2-Inch Blowoff Valve

Pipeline Length (Miles)	Gas Lost (Mcf)	Slow Purge		Fast Purge		Slow Purge		Fast Purge	
		Time (Minutes)	Pressure (Psig)	Time (Minutes)	Pressure (Psig)	Time (Minutes)	Pressure (Psig)	Time (Minutes)	Pressure 39(Psig)
1	0.52	6	19	4	36	3	20	1	39
2	1.05	12	20	8	37	5	25	2	52
3	1.57	19	21	12	38	7	30	3	64
4	2.09	25	21	17	39	9	34	4	73
5	2.61	31	22	21	40	11	38	5	82
6	3.13	37	23	25	41	14	42	6	90
7	3.65	44	23	29	42	16	45	7	98
8	4.18	50	24	33	43	18	48	8	105
9	4.70	56	25	37	44	20	51	9	112
10	5.22	63	25	42	45	23	55	10	118
11	5.74	69	26	46	45	25	57	11	124
12	6.26	75	26	50	46	27	59	12	129
13	6.79	82	27	54	47	30	62	13	135
14	7.31	88	27	59	48	32	64	14	140
15	7.83	95	28	63	49	34	67	15	145
16	8.35	101	29	67	50	37	69	16	150
17	8.87	108	29	71	51	39	71	17	155
18	9.40	115	30	76	51	41	73	18	160
19	9.92	121	31	80	52	44	75	19	165
20	10.44	128	31	85	53	46	77	20	170

6-Inch Nominal Pipe Diameter					
		2-Inch Blowoff Valve			
Pipeline Length (Miles)	Gas Lost (Mcf)	Slow Purge		Fast Purge	
		Time (Minutes)	Pressure (Psig)	Time (Minutes)	Pressure (Psig)
1	1.17	3	22	2	43
2	2.34	4	25	3	47
3	3.52	7	28	5	50
4	4.69	9	30	6	54
5	5.86	11	32	8	57
6	7.03	14	35	9	61
7	8.20	16	37	11	64
8	9.38	19	39	12	67
9	10.55	21	41	14	70
10	11.72	23	43	15	72
11	12.89	25	44	17	75
12	14.06	27	46	18	78
13	15.24	30	48	20	80
14	16.41	32	50	21	83
15	17.58	34	51	23	85
16	18.75	37	53	24	87
17	19.92	39	54	26	90
18	21.10	41	56	27	92
19	22.27	43	57	29	94
20	23.44	45	59	30	96

8-Inch Nominal Pipe Diameter									
		2-Inch Blowoff Valve				3-Inch Blowoff Valve			
Pipeline Length (Mi)	Gas Lost (Mcf)	Slow Purge		Fast Purge		Slow Purge		Fast Purge	
		Time (Min)	Pressure (Psig)	Time (Min)	Pressure (Psig)	Time (Min)	Pressure (Psig)	Time (Min)	Pressure (Psig)

1	1.96	4	20	3	39	2	24	2	44
2	3.92	8	21	5	40	4	27	3	49
3	5.87	12	21	8	41	5	30	4	53
4	7.83	15	22	10	42	6	33	5	57
5	9.79	19	23	13	43	8	35	7	61
6	11.75	23	24	15	44	10	38	8	65
7	13.71	26	24	18	45	12	40	9	68
8	15.66	30	25	20	46	14	43	10	72
9	17.62	34	25	23	47	15	45	12	75
10	19.58	38	26	25	48	17	47	13	78
11	21.54	42	27	28	49	18	49	14	81
12	23.50	45	27	30	50	20	51	16	84
13	25.45	49	28	33	50	22	53	17	87
14	27.41	53	28	35	51	24	55	19	89
15	29.37	57	29	38	52	25	56	20	92
16	31.33	61	29	41	52	27	58	21	95
17	33.29	65	30	43	53	29	60	22	97
18	35.24	69	31	46	54	31	62	24	100
19	37.20	73	31	48	55	32	63	25	102
20	39.16	77	32	51	56	34	65	26	105

10-Inch Nominal Pipe Diameter													
Pipeline Length (Mi)	Gas Lost (Mcf)	2-Inch Blowoff Valve				3-Inch Blowoff Valve				4-Inch Blowoff Valve			
		Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
		Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	3.10	6	20	4	39	3	21	2	41	2	23	1	44
2	6.20	12	20	8	39	5	22	4	42	3	26	2	48
3	9.30	18	20	12	39	8	23	6	44	5	28	3	51
4	12.40	24	20	16	40	10	24	8	45	6	31	4	55
5	15.50	30	20	20	40	13	25	10	47	8	33	5	58
6	18.60	36	21	24	40	16	26	12	48	9	35	6	60
7	21.70	42	21	28	40	18	27	14	49	11	37	7	64
8	24.80	48	21	32	41	21	28	16	51	12	39	8	67
9	27.90	54	21	36	41	23	29	18	52	14	41	9	70
10	31.00	60	21	40	41	26	30	20	53	16	43	10	73
11	34.10	66	22	44	42	29	31	22	54	17	45	11	75
12	37.20	72	22	48	42	32	32	24	56	19	47	12	78
13	40.30	78	22	52	42	35	33	26	57	20	48	13	81
14	43.40	84	22	56	42	37	34	28	58	22	50	15	83
15	46.50	90	22	60	43	39	35	30	59	24	52	16	85
16	49.60	96	23	64	43	42	36	32	60	25	53	17	88
17	52.70	102	23	68	43	45	37	35	61	27	55	18	90
18	55.80	108	23	72	44	48	38	37	62	28	56	19	92
19	59.80	114	23	77	44	50	39	39	63	30	58	20	95
20	62.00	121	23	81	44	53	40	41	64	32	59	21	97

12-Inch Nominal Pipe Diameter													
Pipeline Length (Mi)	Gas Lost (Mcf)	2-Inch Blowoff Valve				3-Inch Blowoff Valve				4-Inch Blowoff Valve			
		Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
		Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	4.39	9	20	6	40	4	21	3	40	3	21	2	38
2	8.78	17	20	11	40	7	22	6	41	5	22	3	40

3	13.16	25	20	17	40	11	22	9	42	7	23	5	42
4	17.55	33	20	22	41	15	23	12	43	9	25	6	44
5	21.94	42	20	28	41	18	24	15	44	11	26	8	46
6	26.33	50	20	33	41	22	24	18	45	13	27	9	48
7	30.72	58	20	39	42	26	25	21	46	15	28	11	50
8	35.10	67	20	44	42	30	25	24	47	17	30	12	52
9	39.49	75	20	50	42	33	26	27	48	20	31	14	54
10	43.88	84	20	56	43	37	26	30	49	22	32	15	56
11	48.27	92	20	62	43	41	27	33	50	24	33	16	57
12	52.66	101	20	67	43	44	28	36	51	26	34	18	59
13	57.04	110	21	73	44	48	28	39	52	29	35	19	61
14	61.43	118	21	79	44	52	29	42	53	31	37	21	62
15	65.82	127	21	85	44	56	29	45	54	33	38	22	64
16	70.21	136	21	91	45	59	30	48	55	35	39	24	65
17	74.60	145	21	96	45	63	30	51	56	38	40	25	66
18	78.98	153	21	102	45	67	31	54	57	40	41	27	68
19	83.37	162	21	108	46	71	31	57	58	42	42	28	69
20	87.76	171	21	114	46	75	32	60	59	45	43	30	71

14-Inch Nominal Pipe Diameter													
Pipeline	Gas	3-Inch Blowoff Valve				4-Inch Blowoff Valve				6-Inch Blowoff Valve			
Length	Lost	Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
(Mi)	(Mcf)	Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	5.31	5	21	4	40	3	21	2	40	2	20	2	38
2	10.62	9	21	7	40	5	22	4	41	4	22	3	40
3	15.94	13	21	10	40	8	22	6	42	6	23	4	42
4	21.25	18	22	14	41	11	23	7	43	7	25	5	44
5	26.56	22	22	17	41	13	24	9	44	9	26	6	46
6	31.87	27	22	21	41	16	24	11	45	11	27	7	48
7	37.18	31	22	24	42	18	25	13	46	12	28	8	50
8	42.50	36	22	27	42	21	25	14	47	14	30	9	52
9	47.81	40	23	31	42	24	26	16	48	16	31	11	54
10	53.12	44	23	34	43	26	26	18	49	18	32	12	56
11	58.43	49	23	38	43	29	27	20	50	19	33	13	57
12	63.74	53	23	41	43	32	28	21	51	21	34	14	59
13	69.06	58	23	45	44	35	28	23	52	23	35	15	61
14	74.37	62	24	48	44	37	29	25	53	25	37	17	62
15	79.68	67	24	52	44	40	29	27	54	26	38	18	64
16	84.99	72	24	56	45	43	30	29	55	28	39	19	65
17	90.30	76	24	59	45	46	30	31	56	30	40	20	66
18	95.62	81	24	63	45	49	31	32	57	32	41	21	68
19	100.93	85	25	66	46	51	31	34	58	33	42	22	69
20	106.24	90	25	70	46	54	32	36	59	35	43	24	71

16-Inch Nominal Pipe Diameter													
Pipeline	Gas	3-Inch Blowoff Valve				4-Inch Blowoff Valve				6-Inch Blowoff Valve			
Length	Lost	Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
(Mi)	(Mcf)	Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	6.98	6	21	5	40	4	19	3	36	3	20	2	38
2	13.96	12	21	9	40	7	20	5	37	5	22	3	41
3	20.93	18	21	14	41	10	21	7	39	7	24	5	44
4	27.91	24	22	19	41	14	22	10	40	9	26	6	47

5	34.86	29	22	23	42	17	22	12	41	11	27	8	49
6	41.85	35	22	27	42	21	24	14	42	14	29	9	52
7	48.83	41	23	32	43	24	24	16	43	16	31	11	54
8	55.80	46	23	36	43	28	25	19	44	18	32	12	57
9	62.78	52	23	41	44	31	25	21	45	20	33	14	59
10	69.75	58	24	45	44	35	26	23	46	23	35	15	61
11	76.73	64	24	50	45	38	27	26	47	25	37	17	63
12	83.70	70	24	54	45	42	27	28	48	27	38	18	65
13	90.68	76	25	59	45	45	28	30	49	30	40	20	67
14	97.68	82	25	64	46	49	28	32	50	32	41	21	69
15	104.63	88	25	68	46	52	29	35	51	34	42	23	71
16	111.60	94	25	73	47	56	30	37	52	37	44	25	73
17	118.58	100	26	78	47	59	30	39	53	39	45	27	75
18	125.55	106	26	83	48	63	31	42	54	42	46	29	77
19	132.52	113	26	87	48	66	31	44	55	44	47	31	79
20	139.50	119	27	92	48	70	32	47	56	46	48	32	81

18-Inch Nominal Pipe Diameter													
Pipeline Length	Gas Lost	4-Inch Blowoff Valve				6-Inch Blowoff Valve				8-Inch Blowoff Valve			
		Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
(Mi)	(Mcf)	Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	8.82	4	21	3	40	3	19	2	36	2	19	2	36
2	17.64	9	21	6	40	6	19	4	37	4	20	3	38
3	26.45	13	21	9	40	9	20	6	37	6	21	4	39
4	35.27	17	21	12	40	12	20	8	38	7	22	5	41
5	44.09	22	21	15	41	14	20	10	38	9	23	6	42
6	52.91	26	21	18	41	17	21	12	39	10	24	7	44
7	61.73	31	22	21	41	20	21	14	40	12	25	8	45
8	70.54	35	22	24	41	23	22	15	40	14	26	9	47
9	79.36	40	22	27	42	26	22	17	41	16	27	11	48
10	88.18	44	22	30	42	29	23	19	41	18	28	12	49
11	97.10	48	22	33	42	31	23	21	42	19	29	13	51
12	105.82	53	22	36	42	34	24	23	42	21	30	14	52
13	114.63	57	23	39	43	37	24	25	43	23	31	15	53
14	123.45	62	23	41	43	40	24	27	43	25	32	17	55
15	132.27	66	23	44	43	43	25	29	44	26	33	18	56
16	141.09	71	23	47	43	46	25	31	45	28	34	19	57
17	149.91	75	23	50	43	49	25	33	45	30	35	20	58
18	158.72	80	23	53	44	52	26	35	46	32	36	21	59
19	167.54	84	24	57	44	55	26	37	46	33	37	23	60
20	176.36	89	24	60	44	58	26	39	47	35	38	24	61

20-Inch Nominal Pipe Diameter													
Pipeline Length	Gas Lost	4-Inch Blowoff Valve				6-Inch Blowoff Valve				8-Inch Blowoff Valve			
		Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
(Mi)	(Mcf)	Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	10.95	6	20	4	40	4	19	3	36	3	18	2	35
2	21.90	11	21	7	40	7	19	5	36	5	19	3	36
3	32.85	16	21	11	40	11	19	7	36	7	19	4	37
4	43.80	22	21	15	40	14	19	10	37	9	20	6	38
5	54.76	27	21	18	40	18	20	12	37	11	21	7	39
6	65.71	32	21	22	40	21	20	15	37	13	21	9	40

7	76.66	38	21	25	40	25	20	17	38	15	22	10	41
8	87.61	43	21	29	41	28	20	19	38	17	22	12	42
9	98.56	49	21	33	41	32	21	21	39	19	23	13	43
10	109.51	54	21	36	41	36	21	24	39	22	24	15	44
11	120.46	60	21	40	41	39	21	26	39	24	24	16	45
12	131.41	65	22	44	41	43	21	29	40	26	25	18	46
13	142.36	71	22	48	41	46	22	31	40	29	25	20	47
14	153.31	76	22	51	41	50	22	34	40	31	26	21	48
15	164.27	82	22	55	42	54	22	36	40	33	26	22	49
16	175.22	88	22	59	42	58	22	39	41	35	27	23	50
17	186.17	93	22	63	42	61	22	41	41	37	27	25	51
18	197.12	99	22	67	42	65	23	44	41	40	28	26	52
19	208.07	104	22	70	42	70	23	46	42	42	28	28	53
20	219.02	110	22	74	42	73	23	49	42	44	29	29	54

24-Inch Nominal Pipe Diameter													
Pipeline Length	Gas Lost	6-Inch Blowoff Valve				8-Inch Blowoff Valve				10-Inch Blowoff Valve			
		Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
(Mi)	(Mcf)	Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	15.90	6	18	4	36	4	18	3	35	2	18	2	35
2	31.81	11	19	7	36	7	18	5	35	4	18	3	36
3	47.71	16	19	10	36	10	18	7	36	6	19	4	37
4	63.61	21	19	14	36	13	18	9	36	8	20	6	38
5	79.52	26	19	17	36	16	19	11	36	10	20	7	38
6	95.42	31	19	21	36	19	19	13	37	12	21	9	39
7	111.32	36	19	24	36	22	19	15	37	14	21	10	40
8	127.22	42	19	28	36	25	19	17	37	16	22	11	41
9	143.13	47	19	31	37	29	20	19	38	18	22	12	41
10	159.03	52	19	35	37	32	20	21	38	20	23	14	42
11	174.93	57	19	38	37	35	20	23	38	22	23	15	43
12	190.84	62	19	42	37	38	20	26	39	24	24	16	44
13	206.74	68	20	45	37	42	21	28	39	27	24	18	44
14	222.64	73	20	49	37	45	21	30	39	29	25	19	45
15	238.55	78	20	52	37	48	21	32	40	31	25	21	46
16	254.45	84	20	56	37	51	21	35	40	33	26	22	46
17	270.35	89	20	59	38	54	21	37	40	36	26	24	47
18	286.35	95	20	63	38	58	22	39	41	38	26	25	48
19	302.16	100	20	67	38	61	22	41	41	40	27	27	48
20	318.06	105	20	70	38	64	22	43	41	42	27	28	49

26-Inch Nominal Pipe Diameter													
Pipeline Length	Gas Lost	6-Inch Blowoff Valve				8-Inch Blowoff Valve				10-Inch Blowoff Valve			
		Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
(Mi)	(Mcf)	Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	18.73	6	18	4	36	4	18	3	35	3	18	2	35
2	37.46	12	19	8	36	7	18	5	35	6	18	4	36
3	56.18	18	19	12	36	11	18	7	35	8	19	5	36
4	74.91	24	19	16	36	15	18	10	35	10	19	7	37
5	93.64	30	19	20	36	18	18	12	36	13	19	9	37
6	112.37	36	19	25	36	22	18	15	36	15	20	10	38
7	131.10	43	19	29	36	26	19	17	36	17	20	12	38
8	149.82	49	19	33	36	29	19	20	36	19	20	13	39

9	168.55	56	19	37	36	33	19	22	37	22	21	15	39
10	187.28	62	19	42	36	37	19	25	37	24	21	17	40
11	206.01	69	19	46	36	40	19	27	37	27	21	18	40
12	224.74	75	19	51	37	44	19	30	37	29	22	20	41
13	243.50	82	19	55	37	48	20	32	38	32	22	22	41
14	262.20	88	19	60	37	52	20	35	38	34	22	23	42
15	280.92	96	19	64	37	55	20	37	38	37	23	25	42
16	229.65	102	19	68	37	59	20	40	38	39	23	26	43
17	318.38	109	19	72	37	63	20	42	39	42	23	28	43
18	337.10	116	20	76	37	67	20	45	39	44	24	29	44
19	355.83	123	20	80	37	71	20	48	39	47	24	31	44
20	374.56	129	20	84	37	75	21	50	39	49	24	33	45

30-Inch Nominal Pipe Diameter													
Pipeline Length	Gas Lost	8-Inch Blowoff Valve				10-Inch Blowoff Valve				12-Inch Blowoff Valve			
		Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
(Mi)	(Mcf)	Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	24.96	5	18	4	34	4	18	2	35	2	19	2	35
2	49.92	10	18	7	34	7	18	4	35	4	19	3	36
3	74.88	15	18	10	34	10	18	6	36	6	20	5	36
4	99.84	20	18	13	34	13	18	8	36	8	20	6	37
5	124.80	24	18	16	34	16	18	11	36	10	20	7	37
6	149.75	29	18	19	34	19	19	13	36	12	21	8	38
7	174.71	34	18	23	34	22	19	15	36	14	21	10	39
8	199.67	39	18	26	34	26	19	17	37	16	21	11	39
9	224.36	44	18	29	34	29	19	19	37	18	22	12	40
10	249.59	49	18	32	34	32	19	21	37	20	22	14	40
11	274.55	54	18	35	35	35	19	23	37	22	23	15	41
12	299.51	59	18	39	35	38	20	26	37	24	23	17	41
13	324.47	64	18	42	35	41	20	28	38	26	23	18	42
14	349.43	69	18	45	35	44	20	30	38	28	24	19	42
15	374.39	74	19	48	35	47	20	32	38	31	24	21	43
16	399.34	79	19	51	35	50	20	34	38	33	24	22	43
17	424.30	84	19	54	35	53	20	37	38	35	25	24	44
18	449.27	89	19	58	35	57	20	39	39	37	25	25	44
19	474.22	94	19	62	35	61	21	41	39	39	25	26	45
20	499.18	100	19	66	36	65	21	43	39	41	26	28	45

36-Inch Nominal Pipe Diameter													
Pipeline Length	Gas Lost	10-Inch Blowoff Valve				12-Inch Blowoff Valve				14-Inch Blowoff Valve			
		Slow Purge		Fast Purge		Slow Purge		Fast Purge		Slow Purge		Fast Purge	
(Mi)	(Mcf)	Min	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig	Min.	Psig
1	36.17	5	17	4	35	3	19	2	35	3	18	2	35
2	72.34	10	18	7	35	6	19	4	35	5	18	4	35
3	108.50	14	18	10	35	9	19	6	35	7	18	5	35
4	144.67	19	18	13	35	12	19	8	35	10	18	7	36
5	180.84	23	18	16	35	15	19	10	36	12	19	8	36
6	217.01	28	18	19	35	18	19	12	36	15	19	10	36
7	253.18	32	18	22	35	21	19	14	36	17	19	12	37
8	289.34	37	18	25	35	24	20	16	36	20	19	14	37
9	325.51	42	18	28	35	27	20	18	36	22	19	15	37
10	361.68	46	18	31	35	30	20	20	37	25	20	17	38

11	397.85	51	18	34	35	33	20	22	37	27	20	18	38
12	434.02	56	18	38	36	36	20	24	37	30	20	20	38
13	470.18	61	18	41	36	39	20	26	37	32	20	22	39
14	506.35	65	18	44	36	42	21	28	37	35	20	23	39
15	542.52	70	18	47	36	45	21	30	38	37	21	25	39
16	578.69	75	18	50	36	48	21	32	38	40	21	27	39
17	614.86	80	19	54	36	51	21	34	38	42	21	29	40
18	651.02	85	19	57	36	54	21	36	38	45	21	30	40
19	687.19	90	19	60	36	57	21	38	38	47	21	32	40
20	723.36	95	19	63	36	60	21	40	38	50	22	34	40