

# Manufacture of Producer Gas

Shreya Singh

Sant Longowal Institute of Engineering and Technology

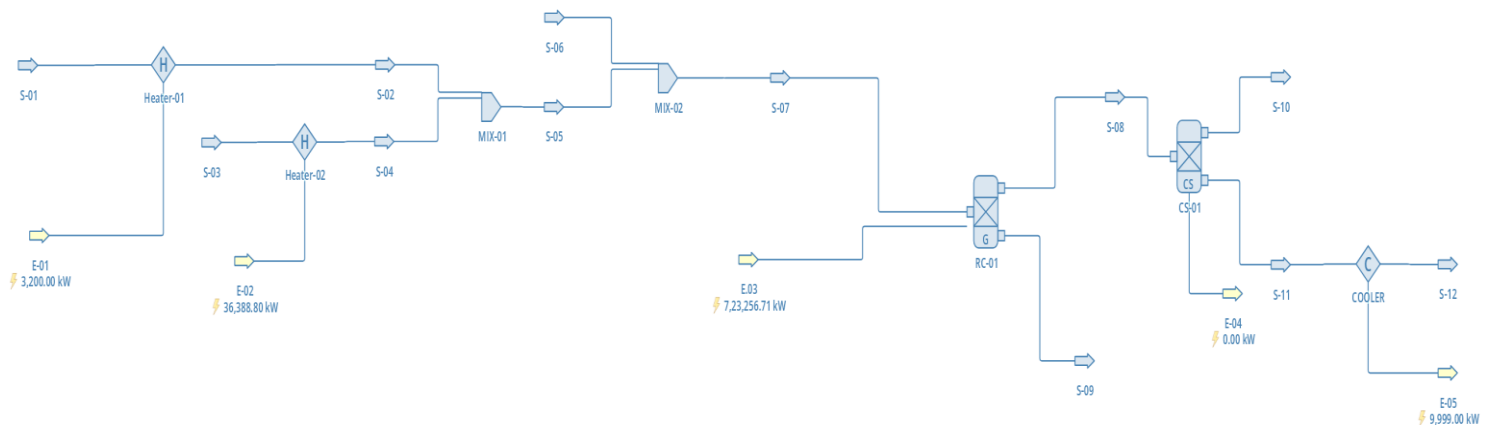
## Background & Description:

Producer Gas containing carbon monoxide, hydrogen, nitrogen and carbon dioxide as the main constituents is produced as a result of reactions between oxygen, carbon dioxide, water and coal. Heated water from S-02 is mixed with heated air and bituminous coal (S-06) and reactions are carried out in the Gibbs Reactor resulting in the formation of carbon monoxide. The bottom product S-09 is removed as ash while the top required product is passed through a compound separator where the required percentage of the constituents of producer gas is formed and is cooled down to the required temperature.

The reactions taking place are:

1.  $O_2 + 2C \rightarrow 2CO$
2.  $CO_2 + C \rightarrow 2CO$
3.  $O_2 + C \rightarrow CO_2$
4.  $HOH + C \rightarrow CO + H_2$

## Flowsheet:



**Results:**

Object	S-12	S-11	S-10	S-09	S-08	S-07	S-06	S-05	S-04	S-03	S-02	S-01	
Temperature	1263.61	1687.09	1687.09	3915	1887.09	370.947	298.15	456.46	758.731	298.15	373.1	298.15	K
Pressure	101325	101325	101325	101325	101325	101325	101325	101325	101325	101325	101325	101325	Pa
Mass Flow	16.8999	16.8999	62.9113	18.5646	79.8113	116	30	86	76	76	10	10	kg/s
Molar Flow	653.075	653.075	2316.79	1545.76	2969.87	5468.7	2289.85	3178.85	2623.76	2623.76	555.084	555.084	mol/s
Volumetric Flow	67.7125	90.4056	326.715	0.0126133	411.121	99.4428	7.88424	119.06	163.345	64.1879	0.0104295	0.0100369	m <sup>3</sup> /s
Molar Enthalpy (Mixture)	31401.1	46711.8	50564.4	-1.43206E+06	49717.2	-575162	-1.38024E+06	4775.1	13868.9	0	-38209.5	-43974.4	kJ/kmol
Molar Entropy (Mixture)	79.8631	90.3026	85.8582	-317.744	89.3319	-1536.02	-4624.69	21.278	32.3632	4.41272	-101.622	-147.491	kJ/(kmol.K)
Molar Fraction (Vapor)	1	1	1	0	1	0.597324	0.146507	1	1	1	1	1	0
Molar Flow (Mixture) / Carbon monoxide	180.498	180.498	45.1246	1.63932E-05	225.623	0	0	0	0	0	0	0	mol/s
Mass Flow (Mixture) / Carbon monoxide	5.05578	5.05578	1.26395	4.64778E-07	6.31973	0	0	0	0	0	0	0	kg/s
Molar Flow (Mixture) / Carbon dioxide	45.1089	45.1089	135.327	1.327E-05	180.436	1.09402	0	1.09402	1.09402	1.09402	0	0	mol/s
Mass Flow (Mixture) / Carbon dioxide	1.98522	1.98522	5.95567	5.84004E-07	7.94089	0.0481472	0	0.0481472	0.0481472	0.0481472	0	0	kg/s
Molar Flow (Mixture) / Argon	0	0	24.5046	2.99103E-06	24.5046	24.5039	0	24.5039	24.5039	24.5039	0	0	mol/s
Mass Flow (Mixture) / Argon	0	0	0.678909	1.19486E-07	0.678909	0.978882	0	0.978882	0.978882	0.978882	0	0	kg/s
Molar Flow (Mixture) / Oxygen	0	0	554.172	5.79792E-05	554.172	705.76	156.232	549.528	549.528	549.528	0	0	mol/s
Mass Flow (Mixture) / Oxygen	0	0	17.7328	1.85926E-06	17.7328	22.5835	4.99925	17.5842	17.5842	17.5842	0	0	kg/s
Molar Flow (Mixture) / Water	0	0	356.775	2.62386E-05	356.775	555.084	0	555.084	0	0	555.084	555.084	mol/s
Mass Flow (Mixture) / Water	0	0	6.4274	4.72696E-07	6.4274	10	0	10	0	0	10	10	kg/s
Molar Flow (Mixture) / Methane	0	0	81.1991	5.70537E-06	81.1991	0.00490603	0	0.00490603	0.00490603	0.00490603	0	0	mol/s
Mass Flow (Mixture) / Methane	0	0	1.30263	9.15282E-08	1.30263	7.87048E-05	0	7.87048E-05	7.87048E-05	7.87048E-05	0	0	kg/s
Molar Flow (Mixture) / Krypton	0	0	0.00299092	6.51915E-10	0.00299092	0.00299084	0	0.00299084	0.00299084	0.00299084	0	0	mol/s
Mass Flow (Mixture) / Krypton	0	0	0.000250633	5.46202E-11	0.000250633	0.000250627	0	0.000250627	0.000250627	0.000250627	0	0	kg/s
Molar Flow (Mixture) / Neon	0	0	0.0476973	6.23947E-08	0.0476973	0.0476961	0	0.0476961	0.0476961	0.0476961	0	0	mol/s
Mass Flow (Mixture) / Neon	0	0	0.000962517	1.23811E-09	0.000962517	0.000962492	0	0.000962492	0.000962492	0.000962492	0	0	kg/s
Molar Flow (Mixture) / Carbon	0	0	3.14248E-32	1545.76	3.14248E-32	1968.06	1968.06	0	0	0	0	0	mol/s
Mass Flow (Mixture) / Carbon	0	0	3.77412E-34	18.5646	3.77412E-34	23.6364	23.6364	0	0	0	0	0	kg/s
Molar Flow (Mixture) / Nitrogen	346.079	346.079	1038.24	0.000101808	1384.32	2088.21	39.6411	2048.57	2048.57	2048.57	0	0	mol/s
Mass Flow (Mixture) / Nitrogen	9.69486	9.69486	29.0846	2.85199E-06	38.7794	58.4979	1.11048	57.3874	57.3874	57.3874	0	0	kg/s
Molar Flow (Mixture) / Helium-4	0	0	0.0137477	4.90239E-08	0.0137477	0.0137474	0	0.0137474	0.0137474	0.0137474	0	0	mol/s
Mass Flow (Mixture) / Helium-4	0	0	5.50236E-05	1.96233E-10	5.50236E-05	5.50233E-05	0	5.50233E-05	5.50233E-05	5.50233E-05	0	0	kg/s
Molar Flow (Mixture) / Hydrogen	81.388	81.388	81.388	0.000280031	162.776	125.919	125.919	0	0	0	0	0	mol/s
Mass Flow (Mixture) / Hydrogen	0.164068	0.164068	0.164068	5.64508E-07	0.328137	0.253837	0.253837	0	0	0	0	0	kg/s
Phases	V	V	V	L+V	V	V+L	V+L	V	V	V	L	L	
Energy Flow	-17194	-7195.02	-33416.9	-1.10581E+06	-40612	-1.86958E+06	-1.73009E+06	-119479	35957.9	-430.873	-153437	-158837	KW

**References: -**

1. Dryden's Outlines of Chemical Technology
2. [https://en.wikipedia.org/wiki/Producer\\_gas](https://en.wikipedia.org/wiki/Producer_gas)