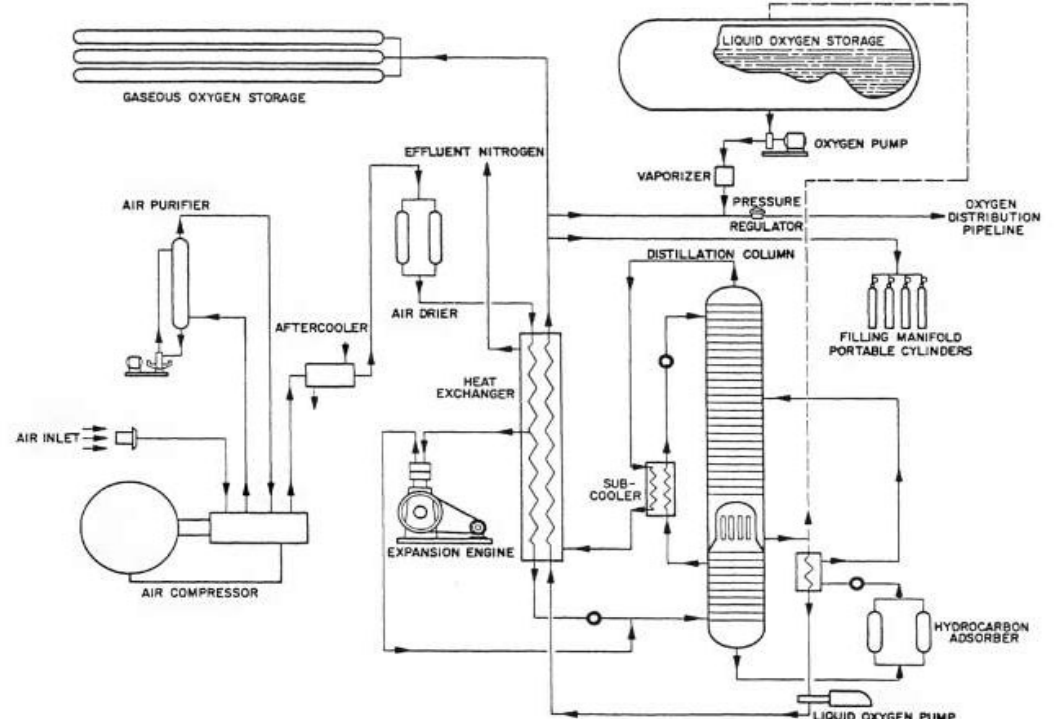


					MARS SPACE CONSTRUCTION. LLC Montgomery, TX 77356 All we have to do is SCIENCE the HELL out of this					
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								Doc. I.D. DES-Starship-013 Page 1 of 5 REV. A		
REV Description Eng Date Appr Date					Job No. XXXXXXXX By: GJR Date 6/11/2021					
REVISION HISTORY										
Title: Starship - MSC Rocket Propellant Plant Module										
Design Variables need to be defined: 1. Extract 1 ton of ice per day to produce drinkable water and air for the base. 2. Locate module sufficient distance away from other modules for safety concerns. 3. Locate Propellant Plant sufficient distance away from other modules for safety concerns yet close to Starship 4. Locate landing locations.										
<u>Design to Scale:</u> 1. Process package to generate propellant in 2 months for re-fill Starship for return trip to Earth. 2. FULL cargo package design for processing & storage for re-fill multiple Starships for return trip to Earth.										
PROPELLANT PROCESSING MODULE MSC-D-XXXX-P04-112 LIQUID OXYGEN PLANT MODULE MSC-D-XXXX-P04-014 Atmospheric Constituent Separation Major constituents of dry air, by volume (by Wikipedia)										
The diagram illustrates the process of generating propellant on Mars. It starts with the Martian Atmosphere, which is filtered for dust and then processed by an Atmospheric constituent separation unit. This unit separates Carbon Dioxide (CO2) from Nitrogen (N2) gas. The CO2 is then fed into a Sabatier Reactor, which produces Hydrogen (H2) and Water Vapor. The H2 is then fed into a Reverse water-gas shift reactor, which produces CO and H2. The CO is then fed into a Carbon Monoxide (CO) Storage unit. The H2 is then fed into a Gas Separator, which produces Methane Gas (CH4) and Water Vapor. The Water Vapor is then fed into an Electrolysis unit, which produces Oxygen (O2) and Hydrogen (H2). The O2 is then fed into a Radiator. The H2 is then fed into a Dry Gas Products unit. The Dry Gas Products are then fed into a CH4 & O2 Gas Liquefaction unit, which produces LO2 and LCH4. The LO2 and LCH4 are then stored in Liquid propellant storage & thermal management units.										
NOTES: 1) XX										

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REVISION HISTORY														
REVISION HISTORY					Title: Starship Module - MSC Rocket Propellant Plant									
Abundance of Elements in Earth's Crust CH₄ Synthesis Sabatier process														
NOTES: 1) XX														

Request for Quotation	X
REV.	X
DATE	X
BY	X
APPR.	X
NO.	X
FRM	X

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REVISION HISTORY					Job No. XXXXXXXX By: GJR Date: 6/11/2021		
REVISION HISTORY					Title: Starship Module - MSC Rocket Propellant Plant		
AIR SEPARATION					Air separation is one of the largest, as well as earliest, industrial applications of cryogenics. In this process, cryogenic temperatures are used to separate air into its constituent gases: nitrogen (78.08%), oxygen (20.95%), argon (0.93%) and carbon dioxide (0.3%). Trace gases such as krypton, neon, xenon and helium total far less than 1%. Water vapor can also be a significant fraction of air but it is removed along with carbon dioxide at the start of the separation process.		
					Figure 1: Schematic of a liquid oxygen plant. Image: Mechanical Engineers' Handbook, Vol. 4, M. Kutz (Ed). Copyright © 2015 Air Liquide. Reproduced with permission of John Wiley & Sons, Inc.		
NOTES:					1) XX		