



Customer Background

Amazon Distribution Centers have been supplying and distributing packages for millions of people. Their advanced facilities and able workforce provide a strong, reliable service to all customers worldwide.

Problem Statement / Scope of Work

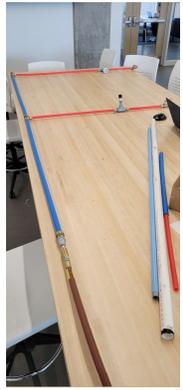
Amazon RME team has no way of monitoring their pneumatic systems for leaks. They are experiencing a high amount of downtime and have tasked us with creating a monitoring system. The system needs to communicate remotely, allow for real-time and historical data analysis, and be viewed anywhere in the country.

Testing

Gage	# of Readings	Max	Min	TIR
BluePSI3E47-P	730	38.5786	16.3071	22.2714

Date	Time	Value
2/22/2023	14:15:53	23.8214
2/22/2023	14:15:53	23.8214
2/22/2023	14:15:53	23.8214
2/22/2023	14:15:53	23.8214
2/22/2023	14:15:53	36.3011
2/22/2023	14:15:54	30.5217
2/22/2023	14:15:54	36.5211
2/22/2023	14:15:54	16.3071
2/22/2023	14:15:54	16.3071

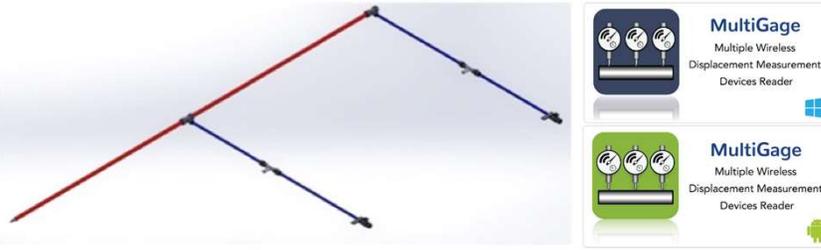
Clear Threshold Plot



Experimentation and Concepts



Final Design



Mechanical Design

Software

FMEA

PLANNING AND PREPARATION (STEP 1)		FUNCTION ANALYSIS (STEP 3)		FAILURE ANALYSIS (STEP 4)		RISK ANALYSIS (STEP 5)								
Company Name	Amazon	1. Next Higher Level Function and Requirement	2. Focus Element Function and Requirement	3. Next Lower Level Function and Requirement or Characteristic	1. Failure Effects (FE) to the next Higher Level Element and/or Vehicle End User	2. Failure Mode (FM) of the Focus Element	3. Failure Cause (FC) of the Next Lower Element or Characteristic	Current Prevention Control (PC) of FC	Current Detection Controls (DC) of FC or FM	DANFA #	Fltr Code			
Engineering Location	West Lafayette, IN, US				Severity (S)									
Customer Name	Joseph Mueller (Amazon)													
Model Year(s)/Platform(s)	2022-2023													
PVC Piping	Couplings	Threads	Provides a path for compressed air to travel to assets	Connects individual pipes and assets together to create a pressurized system	Fastens sensors and other couplings together	Piping does not withstand or control air from the compressor	3	Couplings do not fit or provide a snug fit between pipes	Threads mismatch or do not create seal	Research into pipe specifications and capabilities	4	Hand testing the strength of the assembly by pulling apart	6	L
Air Compressor	Couplings	Seals	Generates pressurized air needed for testing and operations	Connects compressor outlets to pipes and other assets	Reduces unwanted pressure losses within the system	Compressor does not reach desired pressures	4	Couplings do not fit or provide a snug fit between pipes	Gaps between components are not sealed properly	Function analysis and specification research into specific model of compressor	5	Use of compressor continued, but with different pressure readings	5	L
Sensor	Mechanical fasteners	Screws/bolts	Detects, measures, and records the pressure of the system at a point	Connects sensors to the system at determined locations	Fastens sensors to the system to prevent durability issues	Sensor is not compatible with piping	3	Fasteners do not hold assets in place after continued use	Fasteners do not withstand pressures or stresses in system	Further research into functionality and compatibility of asset	8	Fasteners hand tested by pulling apart with relative force	5	M

Requirements

Req #	Design Requirements	Validation	Design Target
1	Design, build & purchase sensor	Monitor pressure is within ± 1 PSI	Sensor detects pressure
2	Quantity of sensors	50-150 sensors	Sensors places in areas that exhibit faults & leaks
3	Digital Wi-Fi interface	Strong, uninterrupted, connectivity established	Information sent (high pressure, good pressure, low pressure)
4	Preventive/Proactive Maintenance	<75 hours of downtime/month	Turnaround time decreased
5	Analytics / Research Development	Data Transfer to Excel	Data collected from system
6	Set ranges for warnings	Warning alert (<60 PSI or >30PSI) Cation alert (<70 PSI or > 20 PSI)	Alerts sent to teams