

Presentation by



Manesar, Gurgaon - India

Agenda

1. Corporate + Manesar : Overview
2. Industry 4.0 -> Q 4.0
3. Case Study ZD/ZE @ Subros Manesar

14th Dec to 15th Dec, 2018

Presented By : C.S.Tiwari



Established in 1985, Subros is the Largest Auto. Air Conditioning & Thermal Products company in India.

A Joint Venture company between



Equity Distribution	Suri's (Indian Promoters)-40%, Denso-13%, Suzuki-13%, Public-34%
Business	Integrated Thermal Products manufacturer for auto and non auto products
Segments	Car, Bus, Truck, Refer, Railways and Home AC domain.
Plants	7 Locations (Pan India Presence)
Technical Centre	1 Location(Noida)
Tool Engineering Centre	1 Location (Noida)
Certifications	ISO 14001,IATF 16949, OHSAS 18001
Market Shares	40% (Passenger Car AC) 70% (Truck Aircon./Blower)
Consolid. Turnover (Net)	INR 1751 Cr (USD 257 Million) (2016-17) INR 1922 Cr (USD 282 Million) (2017-18)



Noida Plant



Pressure Die Casting



Pune Plant



Manesar Plant-1



Chennai Plant



Sanand Plant



Manesar Plant-2



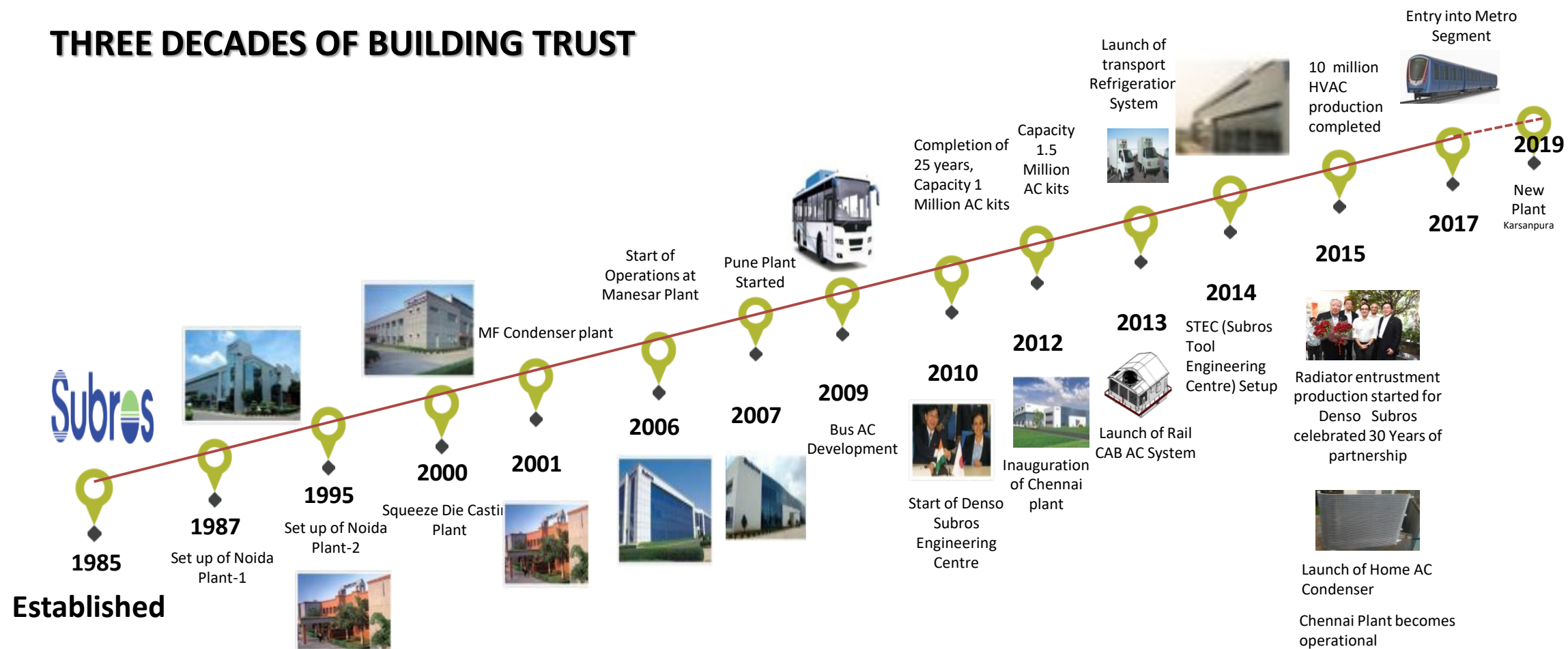
Technical Centre



Tool Engineering Centre



THREE DECADES OF BUILDING TRUST





Passenger Car Segment



DENSO



Mahindra



Commercial Vehicle Segment



DAIMLER



DENSO



Mahindra

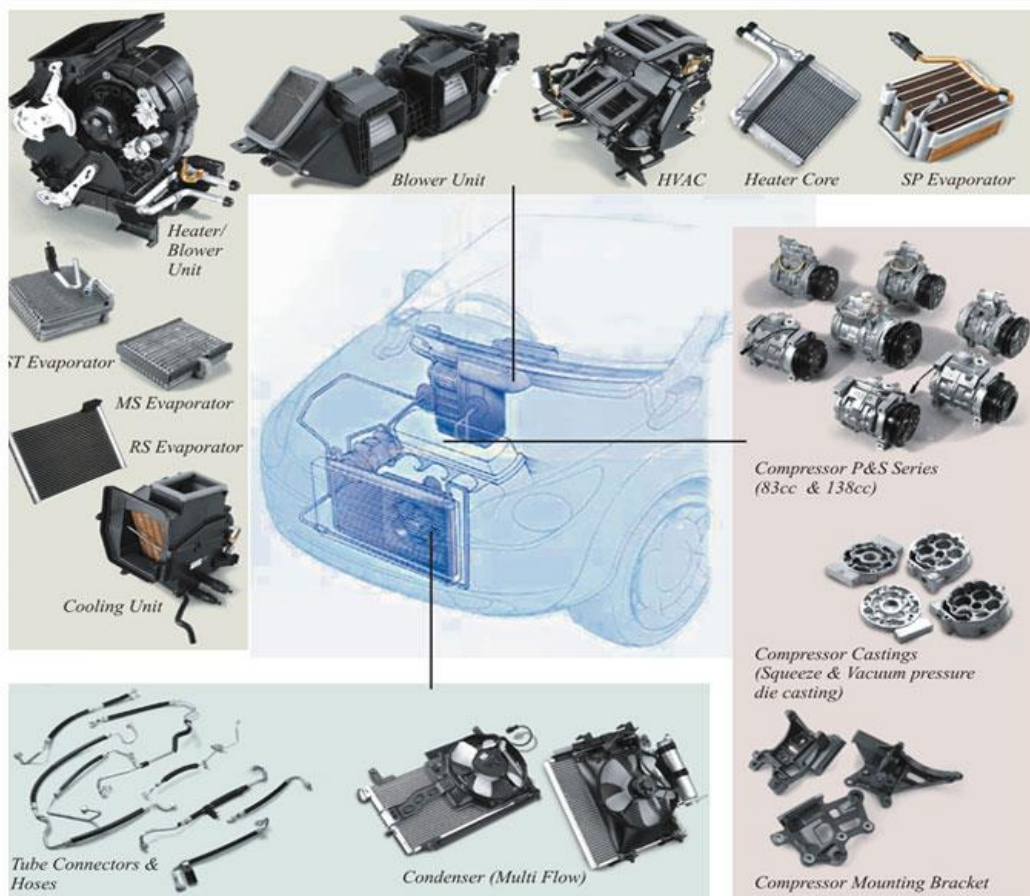


Railways



Home AC

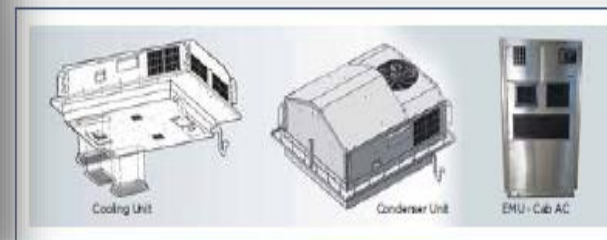




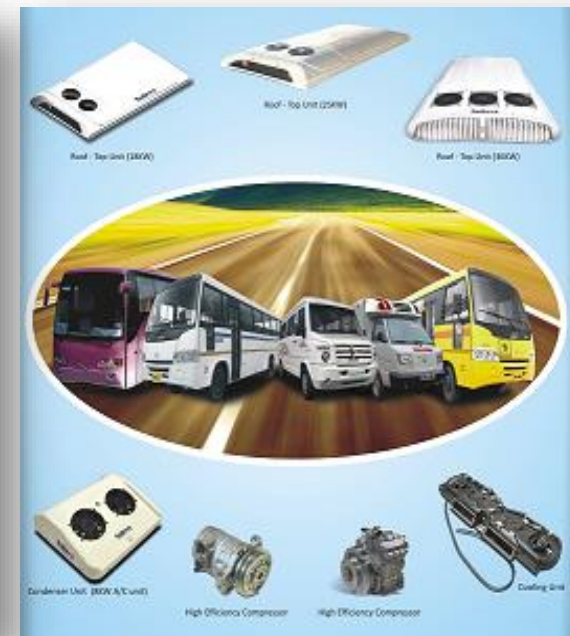
Passenger Car Thermal Products



Refrigeration Truck Thermal Products



Railways Thermal Products



Bus Thermal Products



Home AC Heat Exchanger

Location wise Product Profile

Engineering & Development Centres :

- ❖ Denso Subros Engineering Services Centre (Design JV) - Noida
- ❖ Central Technical Centre – Noida
- ❖ Product Engineering Centre – Chennai
- ❖ STEC- Tool Engineering and Manufacturing-Noida

Plant wise Product Profile :

- ❖ Noida – Compressors, Heat Exchangers, Pressure Die Casting , Press Shop, Injection Molding (Small Parts)
- ❖ Manesar – Car ACs, ECM products,
- ❖ Gujarat- Car AC products
- ❖ Pune – Car / CV Ac products
- ❖ Chennai – Car / CV Ac , Rail AC, ECM , Off Road ECM, Bus ACs, Truck Refrigeration Systems, Home AC Condensers



Total Land area -all plants-187,408 sq mtr
Total Building area-all plants 109,910 sq mtr



Manesar Plant



Established in	2006
Manufacturing Facility	HVAC Assembly Injection molding Condenser Hose and Pipe Compressor Assembly Radiator Assembly
No of Employees	1162 Nos
Plant Sales (2017-18)	INR 1451 Cr
Capacity	1.5 Million units for all Parts
Land Area (Sq Mtr)	39940
Building Area (Sq. Mtr)	37000 (approx)
Quality Certification	ISO 14001, IATF 16949, OHSAS 18001
Customer Recognition (MSIL)	Consecutive 9 Times Gold Trophy for Overall Excellence

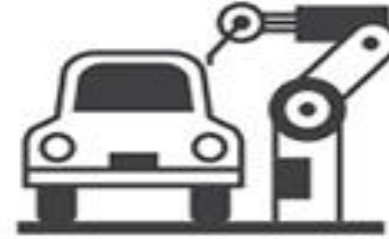


FUTURE FACTORY

Turning ideas into reality



Internet of things



18th Century

Industry 1.0

Mechanical production.
Equipment powered by
steam and water

19th Century

Industry 2.0

Mass production assembly
lines requiring labor and
electrical energy

20th Century

Industry 3.0

Automated production
using electronics and IT

Today

Industry 4.0

Intelligent production
incorporated with IoT, cloud
technology and big data

Industry Q 4.0

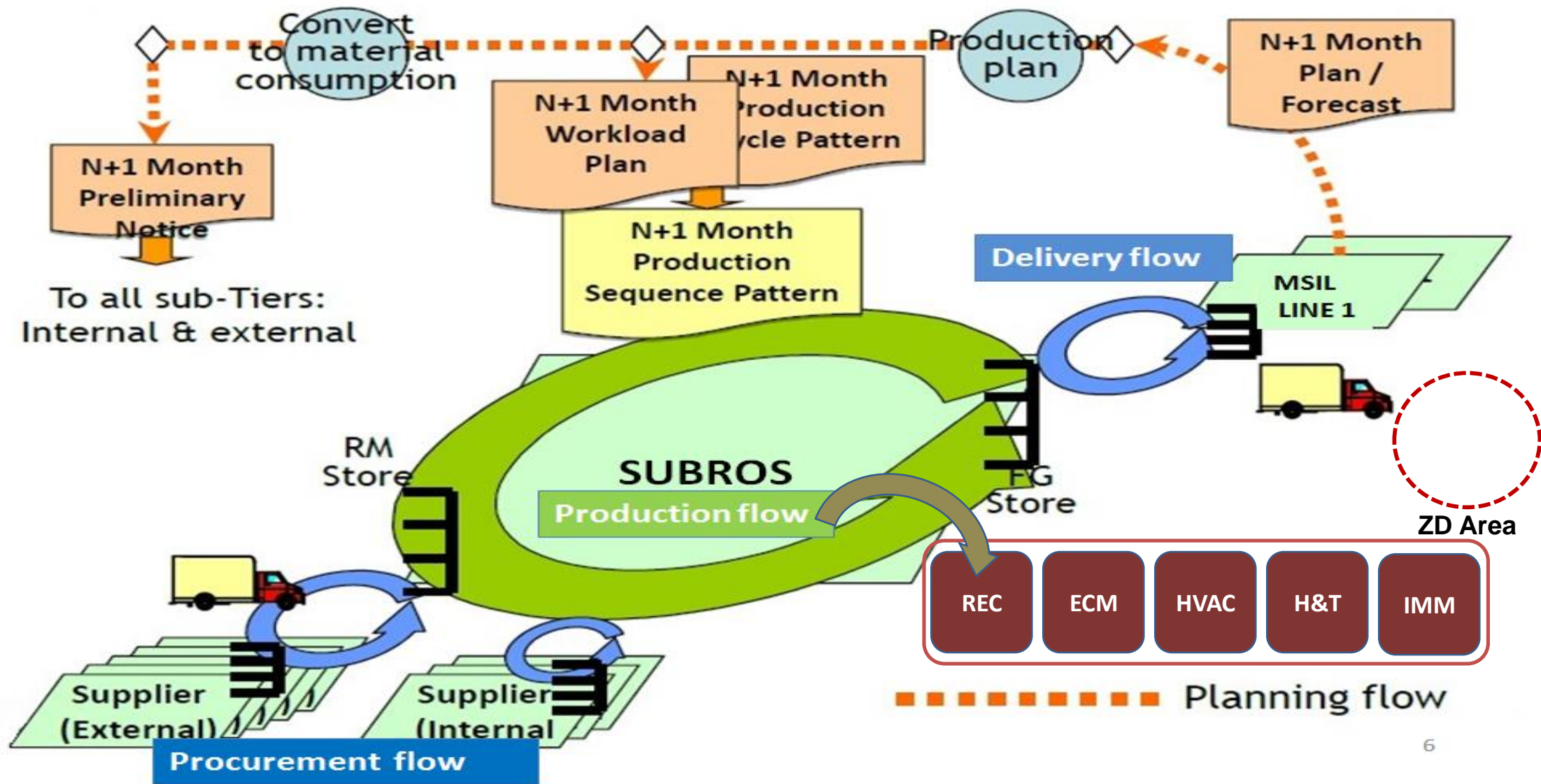


S. N.	QS	Traditional	Industrial Q 4.0
01	Management System	<ul style="list-style-type: none"> Manual dependency w.r.t. Process 	<ul style="list-style-type: none"> Process automation through networking
02	Analytic	<ul style="list-style-type: none"> Input based analysis 	<ul style="list-style-type: none"> Big data analytics having Visualization, Prescriptive, Predictive, Diagnostic & Descriptive
03	Data	<ul style="list-style-type: none"> Traditional Data manual control 	<ul style="list-style-type: none"> Big data in broader view through server
04	Connectivity	<ul style="list-style-type: none"> Traditional data having Quality Plan, Work instructions, Non Conformance, Execution Analysis, results & Processes 	<ul style="list-style-type: none"> Edge Devices having Connected Products, Testing, Supply Chain, Operations & Workers
05	Scalability	<ul style="list-style-type: none"> Limited to Premises only 	<ul style="list-style-type: none"> Big data connectivity via cloud (Available one click
06	Collaboration	<ul style="list-style-type: none"> Secure Portal (limited to inhouse) Digital Messaging (SMS system) 	<ul style="list-style-type: none"> Social Media (connected globally) Block Chain (Interlinking of data Availability)
07	Competency	<ul style="list-style-type: none"> Individual dependancy 	<ul style="list-style-type: none"> Online Competency / expertise availability
08	Leadership	<ul style="list-style-type: none"> Mental, Cross functional & Executive ownership 	<ul style="list-style-type: none"> Connected for Quality KPI, ownership & its alignment
09	Compliance	<ul style="list-style-type: none"> Traditional Custom compliance (manual) 	<ul style="list-style-type: none"> Highly Automated & Connected
10	Application Development	<ul style="list-style-type: none"> Web Client 	<ul style="list-style-type: none"> Real Time Monitoring via Internet/Wi-fi

Project : Zero Defect Zero Effect (ZED)

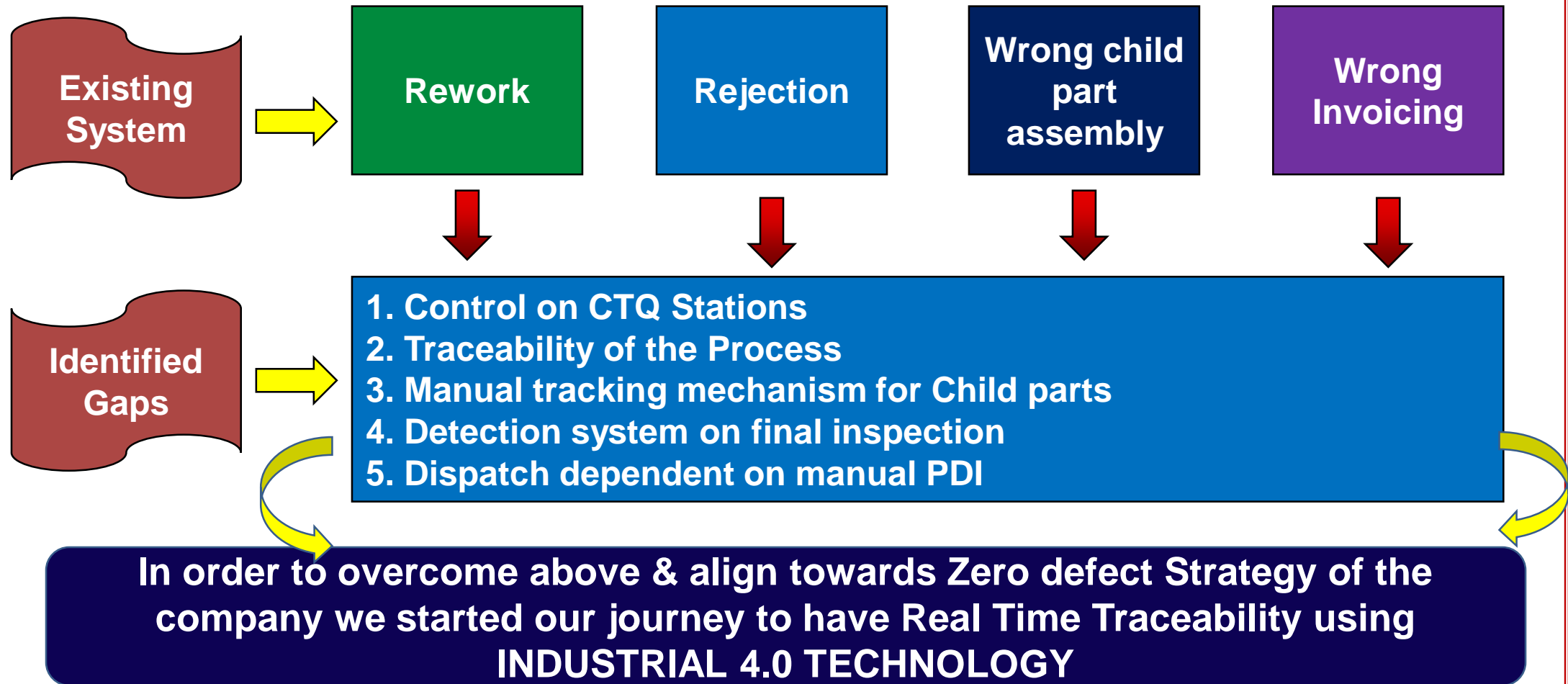
Area : HVAC

Duration : April~June, 2017





HVAC Assembly





Servo Motor



Heater Case



Foot Duct



Blower Motor



Evap Core



Cam & Lever



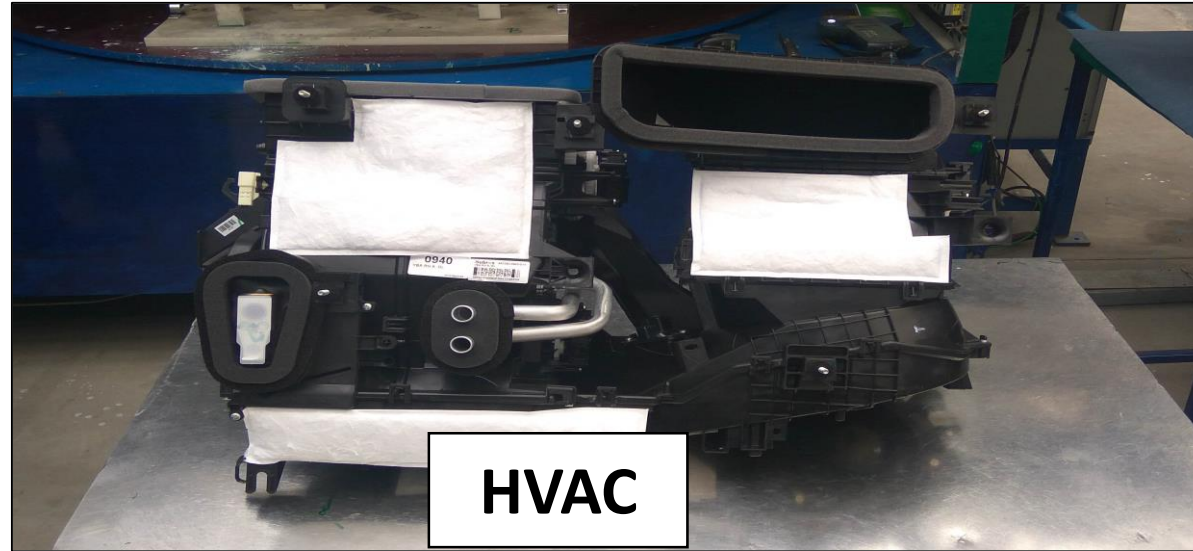
FR case



Resistor



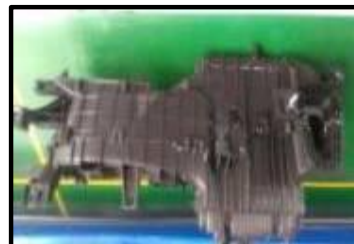
TXV



HVAC



Thermistor



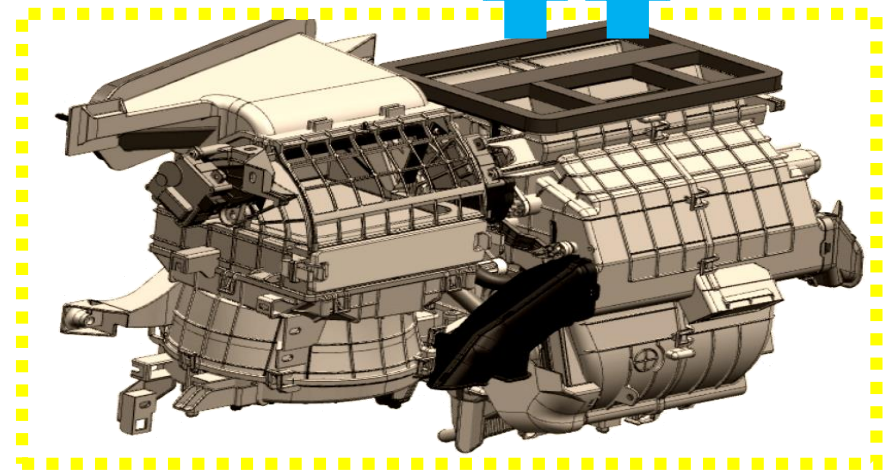
Blower case



Heater case

Product Name – HVAC (YRA-Baleno)

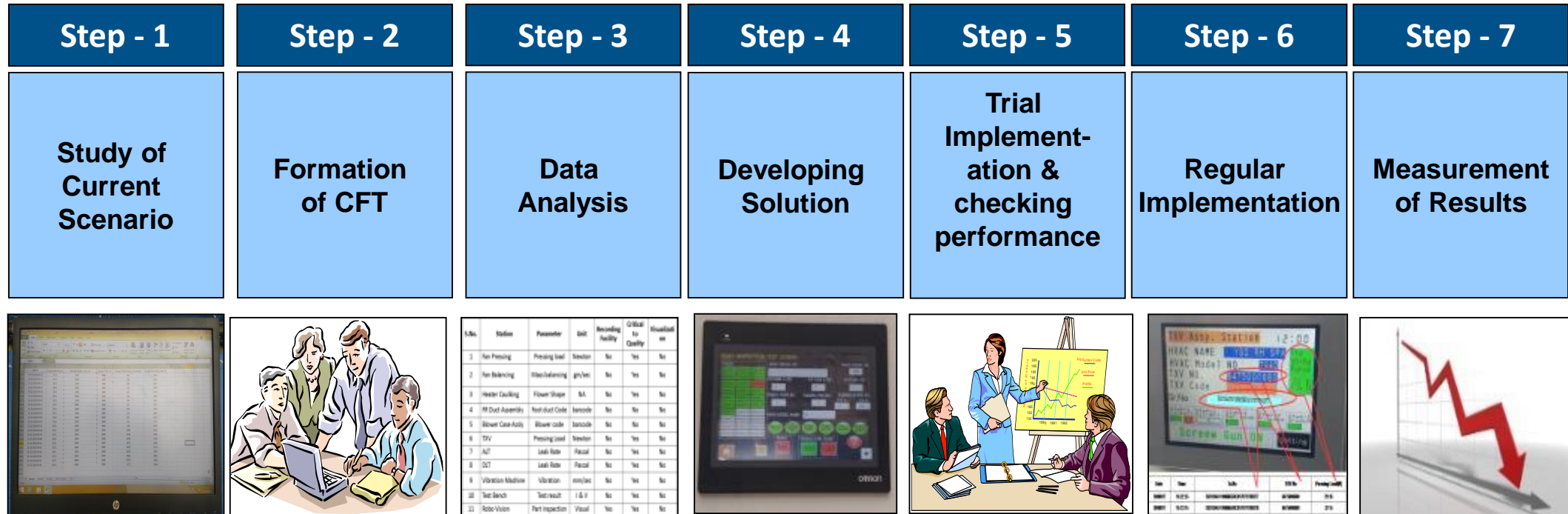
HVAC stands for Heating Ventilation and Air Conditioning.



Main use of product

- Maintaining desired condition as per individual by, Cooling, Heating, Dehumidifying, Ventilating the cabin air.
- Also it provides Windshield Anti-fogging which ensures proper windshield visibility, hence safety of passengers.

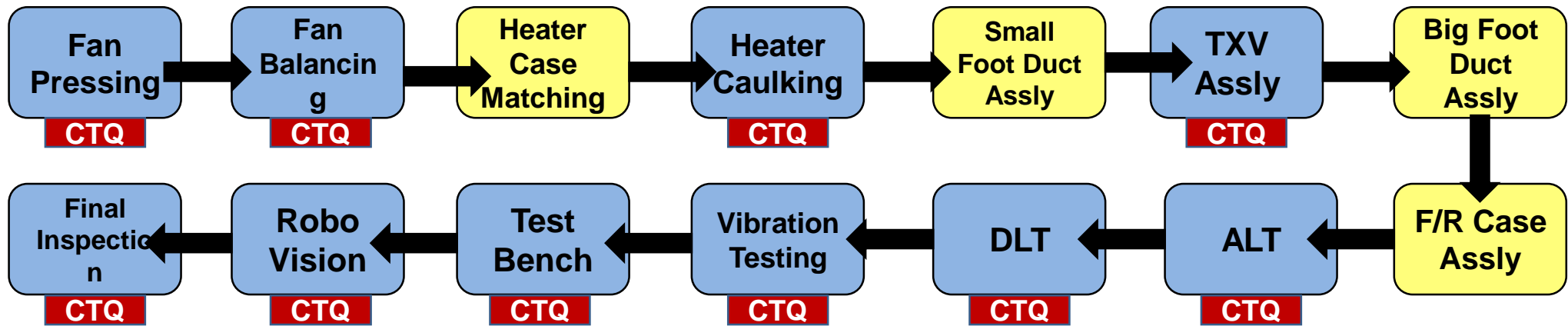




Focus Area was Q 4.0 Starting from Step 3 ~ 7



Process Flow



Gaps in current Scenario

Manual Stamping System on Stations

No access control to Critical to Quality (CTQ) stations

No real time visualization system for line output

No child part traceability & no real time visualization system for line output

No test record storage facility available for analysis

No automated traceability system for invoice generation



To implement Zero Defect & Zero Effect System in HVAC line

(Based on analysis & our AOP target)

Project Start Date : 01.04.2017

Project End Date : 25.06.2017

Project Definition

As per **ZERO DEFECT & ZERO EFFECT** Policy company becomes committed to produce the product with **Zero defect** & its manufacturing should have **Zero adverse enviromental & ecological effects**.

- . **Zero Defect** *(Focus on Customer)*
 - . Zero nonconformance/ non-compliance
 - . Zero Waste
- . **Zero Effect** *(Focus on Society)*
 - . Zero Air Pollution/ Liquid Discharge (ZLD)/ Solid Waste
 - . Zero wastage of natural resources

CFT Formation : CSTiwari, Vineet Vimal, Appu Kumar, Subhash, Pradumann



S.No	Station	Parameter	Unit	Critical to Quality	Biometric Requirement	Traceability Requirement	Data Recording	Visualization Requirement	Interlinking Required
1	Fan Pressing	Pressing load	Newton	Yes	Yes	Yes	Yes	Yes	Yes
2	Fan Balancing	Mass balancing	gm/sec	Yes	Yes	Yes	Yes	Yes	Yes
3	Heater Case matching	-----	-----	Not Req'd	Not Req'd	Yes	Yes	Not Req'd	Yes
4	Heater Caulking	Flower Shape	NA	Yes	Yes	Yes	Yes	Yes	Yes
5	Small foot duct Assembly	Foot duct Code	barcode	Not Req'd	Not Req'd	Yes	Not Req'd	Not Req'd	Yes
6	TXV	Pressing Load	Newton	Yes	Yes	Yes	Yes	Yes	Yes
7	Big foot duct Assly	Foot duct Code	barcode	Not Req'd	Not Req'd	Yes	Not Req'd	Not Req'd	Yes
8	F/R Case Assly	Casing Code	barcode	Not Req'd	Not Req'd	Yes	Yes	Not Req'd	Yes
9	ALT	Leak Rate	Pascal	Yes	Yes	Yes	Yes	Yes	Yes
10	DLT	Leak Rate	Pascal	Yes	Yes	Yes	Yes	Yes	Yes
11	Vibration Machine	Vibration	mm/sec	Yes	Yes	Yes	Yes	Yes	Yes
12	Test Bench	Test result	I & V	Yes	Yes	Yes	Yes	Yes	Yes
13	Robo Vision	Part inspection	Visual	Yes	Yes	Yes	Yes	Yes	Yes
14	Final inspection	All check points	-----	Yes	Yes	Yes	Yes	Yes	Yes



Phase - 1

Interlinking of Stations
Traceability of Child Parts
Traceability of Final Product



Phase - 2

Biometric Access for Critical to Quality Stations (CTQ)
ANDON up-gradation for display for real time production



Phase - 3

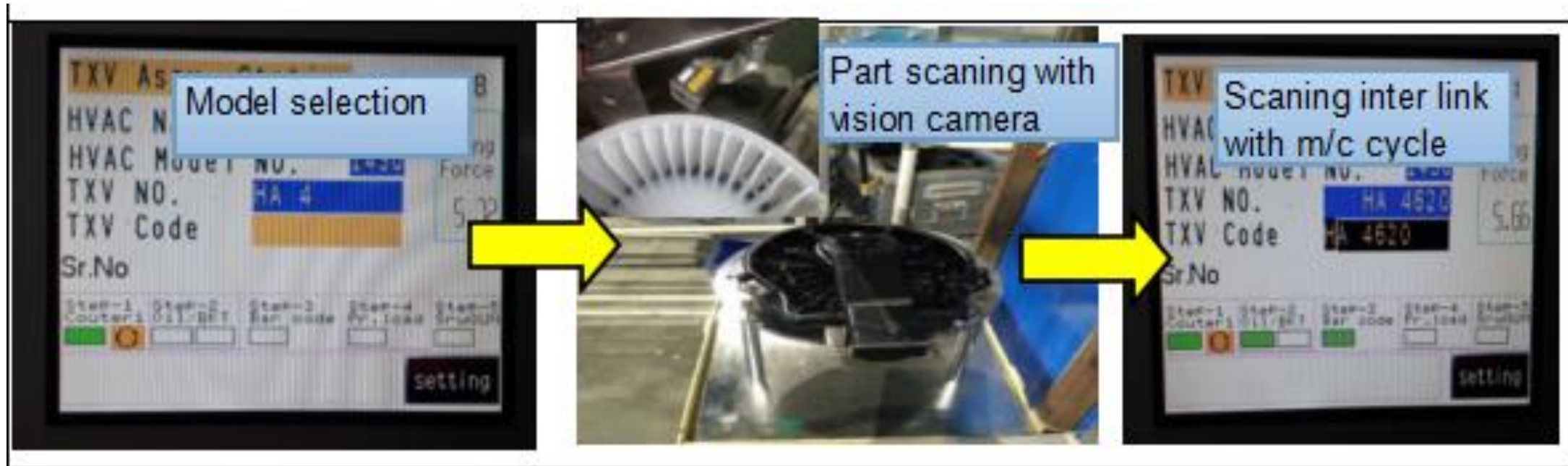
Mobile based App display of data
Invoice generation on basis of final test results



S.N.	Phase	Activity	Plan / Actual	Activity Schedule											
				April'17				May'17				June'17			
				Wk-1	Wk-2	Wk-3	Wk-4	Wk-5	Wk-6	Wk-7	Wk-8	Wk-9	Wk-10	Wk-11	Wk-12
1	Phase - 1	Interlinking the sequence of operation of one station with proceeding station	P												
			A												
2		Data availability in digital form for product& process	P												
			A												
3		Installation of centralize CPU for data collection	P												
			A												
4		LAN connectivity of all the machines with centralize CPU	P												
			A												
5		Barcode fixing on Heater Case & Blower Case	P												
			A												
6		Barcode scanner installation	P												
			A												
7		Traceability of child Parts	P												
			A												
8		Traceability of complete HVAC	P												
			A												
9	Phase - 2	Biometric installation on Critical to Quality stations	P												
			A												
10		Upgradation of ANDON from convention display to LED TV based system	P												
			A												
11	Phase - 3	Accesss of real time production report through Mobile App	P												
			A												
12		Final invoice generation only for the OK product from all stations	P												
			A												



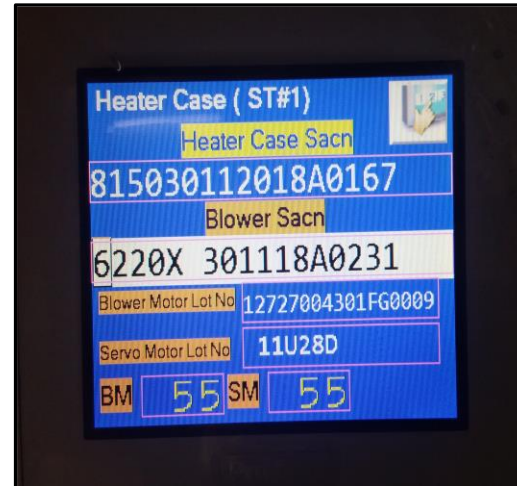
Interlinking of station with previous operation



Interlinked the operation of current station with the OK result of previous operation as shown for Blower motor assembly




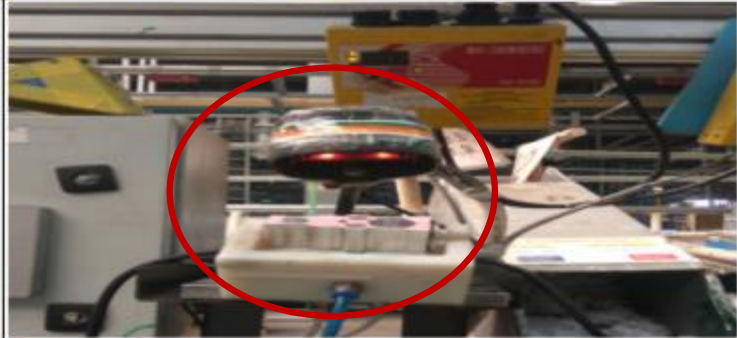

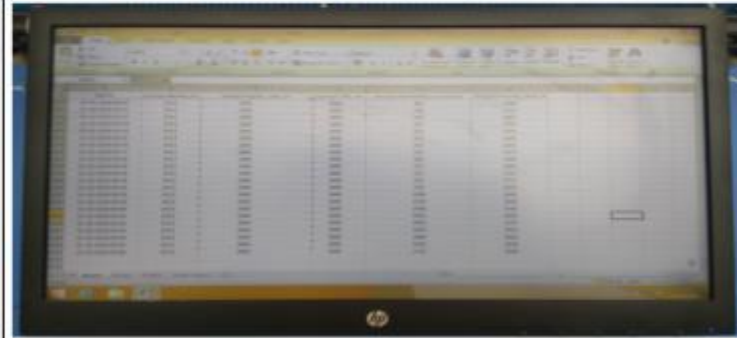


Data Collection from all Stations



Identification of component through barcode & saving of test results in centralize CPU against barcode identification



S. No.	Activity	Pictures	Pictures
1	Barcode Installed on components		
2	Installation of Scanner on Line		
3	CPU Installed on the line		



Child Part Traceability



**Blower
Motor**



**Lot
Number**



**Servo
Motor**



**Lot
Number**



TXV



**Lot
Number**



**Heater
Case**



**Serial
Number**



**Blower
Case**



**Serial
Number**



Thermistor



**Lot
Number**



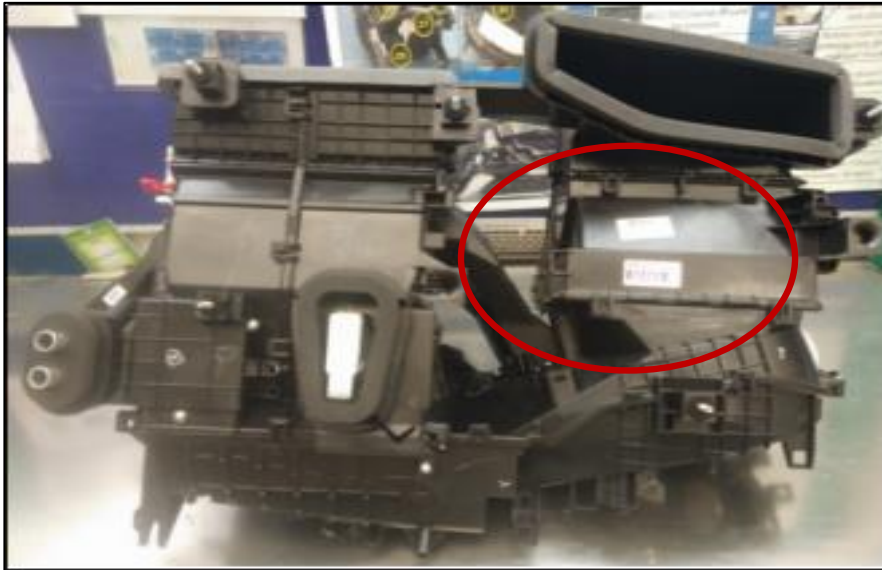
Resistor



**Lot
Number**

**Electrical/ Plastic Child part traceability while assembly i.e.
recording of LOT number, serial number etc**




Barcode on final product



Barcode Installed on Final Product for conformation of all operations & Invoice generation



1. Auto Popup system for Gauge and Fixture validation traceability which highlights the due date for Validation in advance

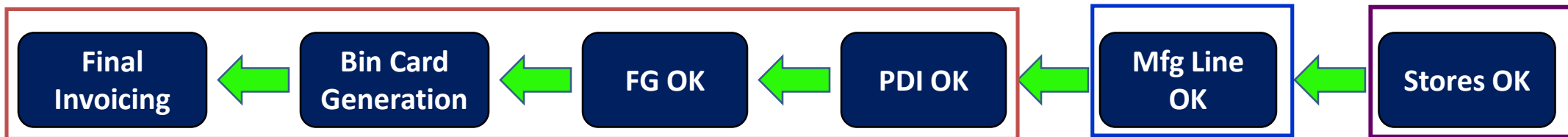
Judgement		Criteria	Status
Red		< 7 days	Immediate Action
Yellow		7~15 days	To be completed
Green		> 15 days	OK

2. Measurement of both Product & Process related data

3. Quality defect first time NG data available for Red Bin Activity

4. Study of Cp & Cpk online as data readily available at centralized storage system

5. Final invoice generation only if product ok at all the stages of manufacturing process

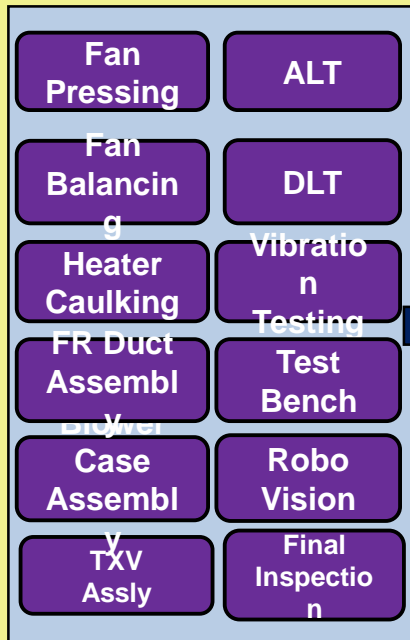


6. Automated ware house management System (FIFO & Inventory Control)

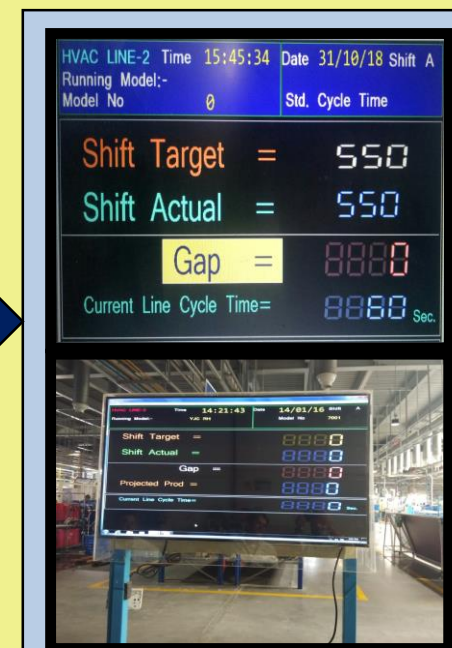
Andon Upgradation for Line Production data display



**Old Conventional
ANDON**



**Upgraded LED
ANDON**



Upgradation from Conventional ANDON to LED based ANDON system for display of real time production data



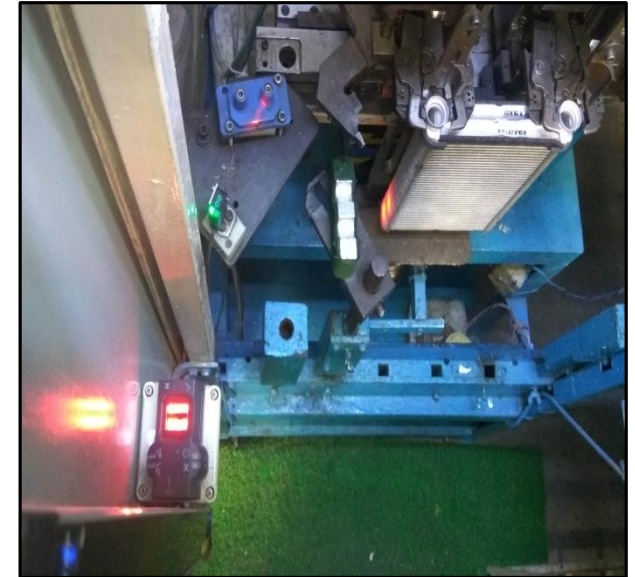
Biometric Access



WS#1



WS#2



WS#3

Biometric access to all Critical to Quality Stations (CTQ)



Display of Data

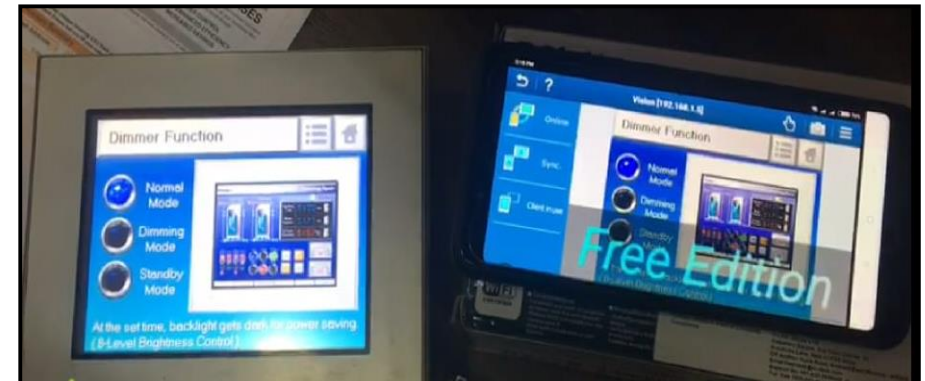


ANDON

MOBILE
(Further Tuning WIP)



HMI &
MOBILE



Display of ANDON data on mobile phone via App

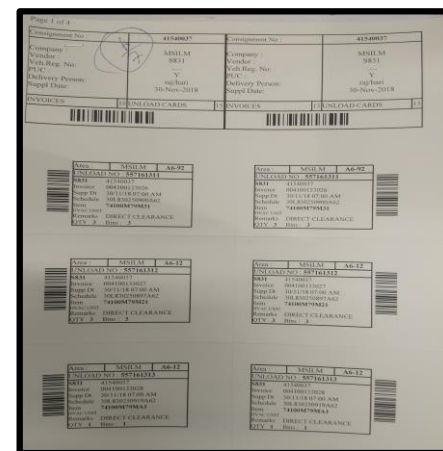
Invoice generation after conformation of Traceability



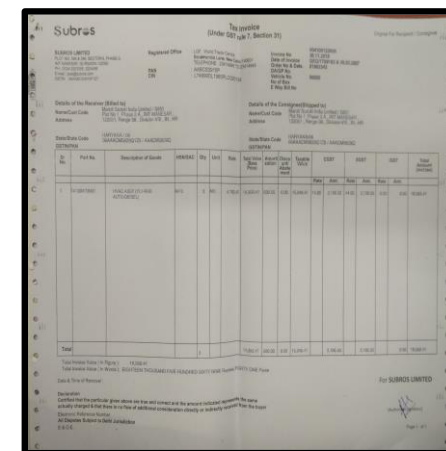
SCANNER



PRODUCT



SCANNED DATA



FINAL INVOICE

Invoice generation only after traceability of product found OK at all manufacturing stages



S.N.	Phase	Activity	Plan / Actual	Activity Schedule											
				April'17				May'17				June'17			
				Wk-1	Wk-2	Wk-3	Wk-4	Wk-5	Wk-6	Wk-7	Wk-8	Wk-9	Wk-10	Wk-11	Wk-12
1	Phase - 1	Interlinking the sequence of operation of one station with proceeding station	P												
			A												
2		Data availability in digital form for product& process	P												
			A												
3		Installation of centralize CPU for data collection	P												
			A												
4		LAN connectivity of all the machines with centralize CPU	P												
			A												
5	Phase - 1	Barcode fixing on Heater Case & Blower Case	P												
			A												
6		Barcode scanner installation	P												
			A												
7		Traceability of child Parts	P												
			A												
8		Traceability of complete HVAC	P												
			A												
9	Phase - 2	Biometric installation on Critical to Quality stations	P												
			A												
10	Phase - 2	Upgradation of ANDON from convention display to LED TV based system	P												
			A												
11	Phase - 3	Accesss of real time production report through Mobile App	P												
			A												
12	Phase - 3	Final invoice generation only for the OK product from all stations	P												
			A												



S.No.	Station	Parameter	Unit	Critical to Quality	Biometric Requirement	Traceability Requirement	Data Recording	Visualization Requirement	Interlinking Required
1	Fan Pressing	Pressing load	Newton	Yes	Yes	Yes	Yes	Yes	Yes
2	Fan Balancing	Mass balancing	gm/sec	Yes	Yes	Yes	Yes	Yes	Yes
3	Heater Case matching	-----	-----	Not Reqd	Not Reqd	Yes	Yes	Not Reqd	Yes
4	Heater Caulking	Flower Shape	NA	Yes	Yes	Yes	Yes	Yes	Yes
5	Small foot duct Assembly	Foot duct Code	barcode	Not Reqd	Not Reqd	Yes	Not Reqd	Not Reqd	Yes
6	TXV	Pressing Load	Newton	Yes	Yes	Yes	Yes	Yes	Yes
7	Big foot duct Assly	Foot duct Code	barcode	Not Reqd	Not Reqd	Yes	Not Reqd	Not Reqd	Yes
8	F/R Case Assly	Casing Code	barcode	Not Reqd	Not Reqd	Yes	Yes	Not Reqd	Yes
9	ALT	Leak Rate	Pascal	Yes	Yes	Yes	Yes	Yes	Yes
10	DLT	Leak Rate	Pascal	Yes	Yes	Yes	Yes	Yes	Yes
11	Vibration Machine	Vibration	mm/sec	Yes	Yes	Yes	Yes	Yes	Yes
12	Test Bench	Test result	I & V	Yes	Yes	Yes	Yes	Yes	Yes
13	Robo Vision	Part inspection	Visual	Yes	Yes	Yes	Yes	Yes	Yes
14	Final inspection	All check points	-----	Yes	Yes	Yes	Yes	Yes	Yes

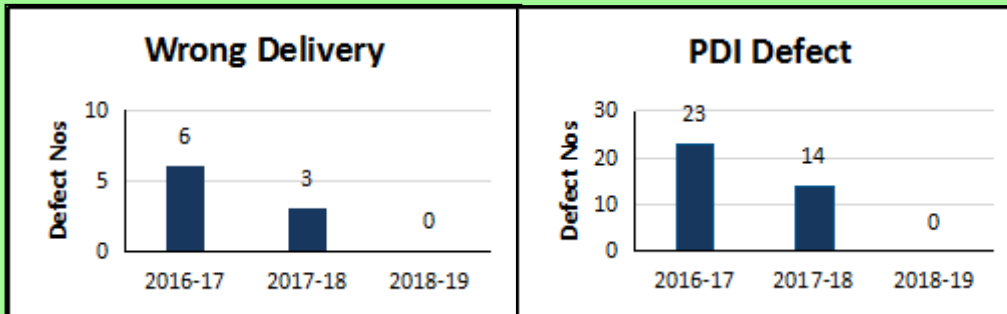
S.No.	Quality Check	Unit	Station
1	Screw Gun Torque	Nm	All Station
2	Evaporator Core Weight	Grams	Blower Case Assembly
3	Fan Pressing shaft height	mm	Fan Pressing
4	Thermistor Resistance	Ohm	TXv Assembly
5	Defrost Leak Value	M/Sec	Vibration Test Bench
6	Blower Motor Noise Test	dB	Noise Testing
7	Lever Force Testing	Newton	Lever force Testing Station

Implemented traceability system is also compatible to store & evaluate additional Quality Parameters on real time basis



Traceability

Tangible Benefits:



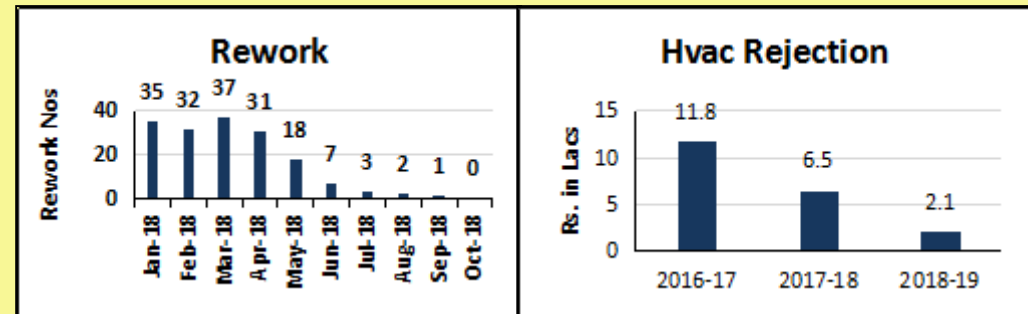
Zero wrong delivery & Zero PDI defect

In-tangible Benefits :

1. Traceability of warranty Failures, if any
2. Test data verification on line
3. Process/ Machine reliability monitoring
4. Monitoring of life span of child parts
5. Elimination of Operator Dependency

Biometric Access

Tangible Benefits:



Elimination of Rework & reduced line rejection

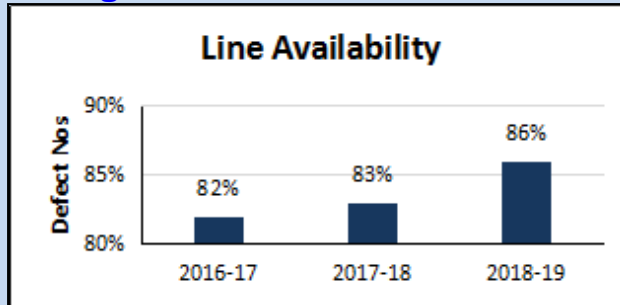
In-tangible Benefits :

1. Only Authorized Operator Allowed
2. Access of CTQ Stations data only to skilled operators
3. Online Root Cause Available
4. Station Operator Accountability



Andon System

Tangible Benefits:



Increased availability of Line by 3%

Intangible Benefits:

1. Proactive Actions Started
2. Visual Control on Plan Vs Actual
3. Action Plan Readiness for next Shift

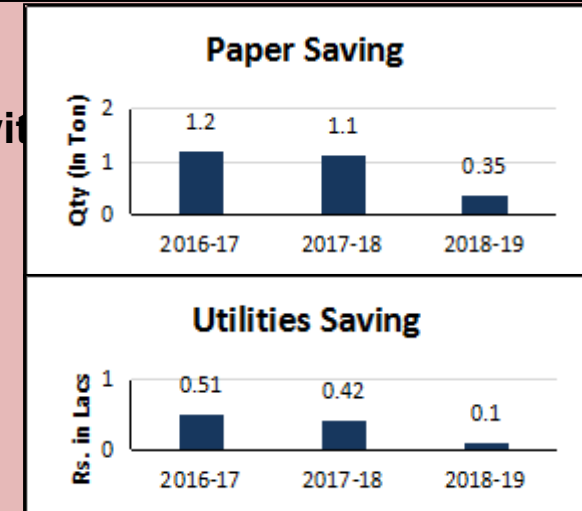
Zero Effect

Tangible Benefits:

1. Paper less data collection
2. Saving in Utilities cost associated with rework & rejection
3. **Plant Utilization upto 90%**

Intangible Benefits:

1. Increased Control on MUDA
2. Eco friendly solution
3. Efficient Utilization of Resources



Additional Benefits

1. **Solutions developed by Inhouse Team** – Better Control
2. Learning Alignment for Industrial 4.0 Technology
3. **Increased Customer Confidence and Delight**
4. Team building & Skill enhancement
6. **Advanced control on Process and Product**



Horizontal Deployment to all Sections starting from Receiving Till Dispatch

Early Stage Control and Change Management : NPD & Launch Phase

Auto Recording of Dimensional & Inspection parameters : QA Precision Instruments

Supplier Quality and Supplier Management

Remote Plants Coordination

Customer Demand Management

Real Time Monitoring of BD of Tools & Equipments and Production / Quality Data

Automated Guided Vehicle (AGV) for product transfer from line to stores & Vice-Versa

Thank You