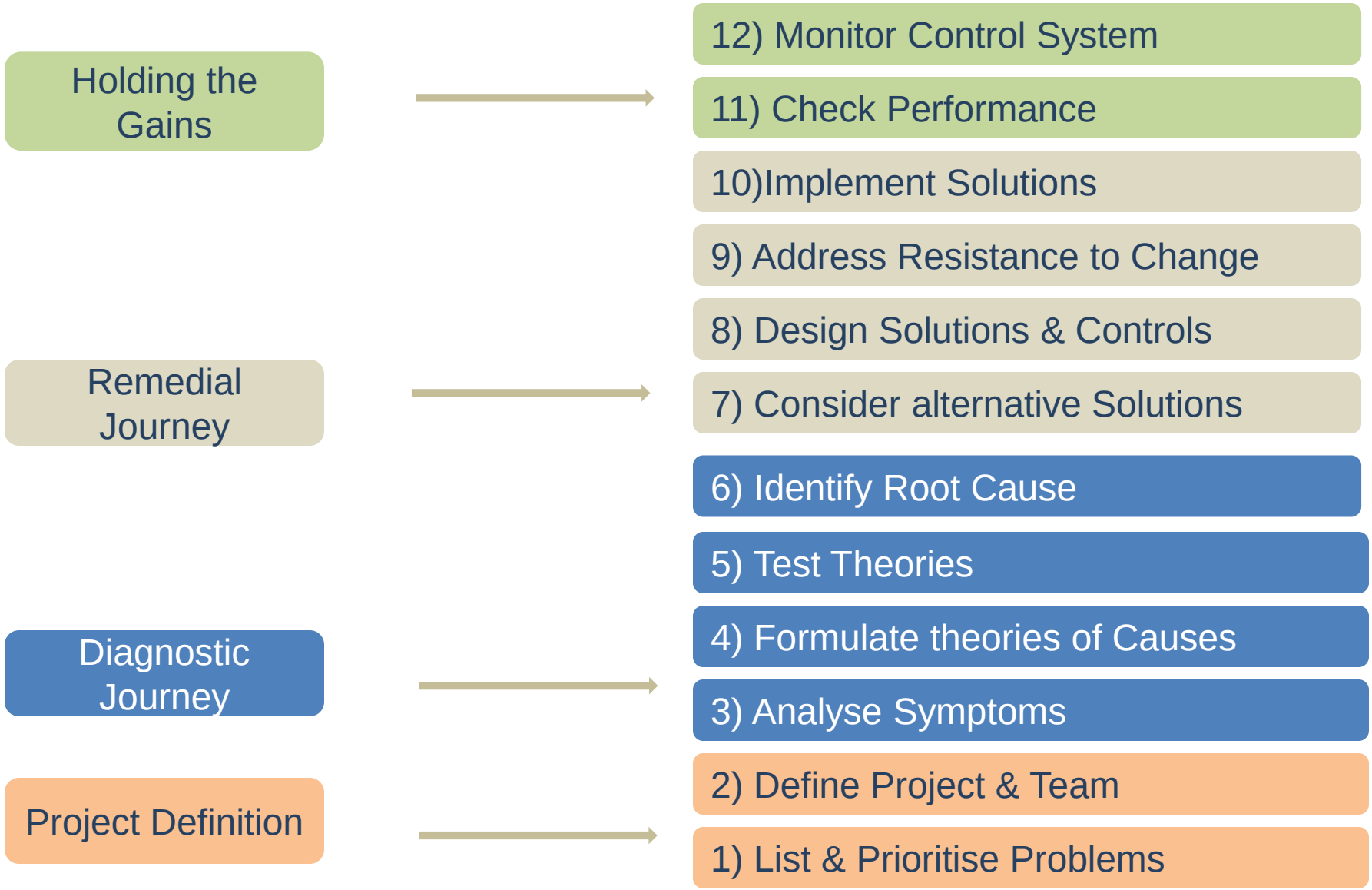
Business Excellence

Creating an Excellent Tomorrow, Today

One Time Cost Saving

Asset Optimization – A step towards competency development

12 Steps Methodology of Problem Solving



Project Identification

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Project Definition | Diagnostic Journey | Remedial Journey | Holding The Gains

Venue	P&E Office
Date	06-April-18
Team Mentor	Mr. Harinder Khurana
Team Members	Rohit Kumar Singh/ Samir Dafadar / Vipin Purohit / Ghanender K. Vashist / Venkatesh Akiri / Raushan K. Sahu

Check Sheet Analysis

S. No.	Description	Rohit Kr. Singh	Samir Dafadar	Vipin Purohit	Ghanender K. Vashist	Venkatesh Akiri	Raushan K. Sahu	Total Score
1	Smoking room improvement - filteration system for recirculatory air.	2	2	3	2	2	2	13
2	Asset optimization - revival of old asset in cost effective manner.	4	4	4	4	3	4	23
3	Complaint management system - reduction in nos. of complaints.	4		3			3	19
4	High lead time in repairing through OEM.	4	4					24
5	5 S zone - existing and new area improvement in 5 S zone.	3	3					18
6	Operational hinderance due to upcoming phase 3A work.	1	2	2				13

T1 HVAC System

- 06 Chillers
- 33 Pumps
- 10 Cooling towers
- 178 AHUs

Problem Statement

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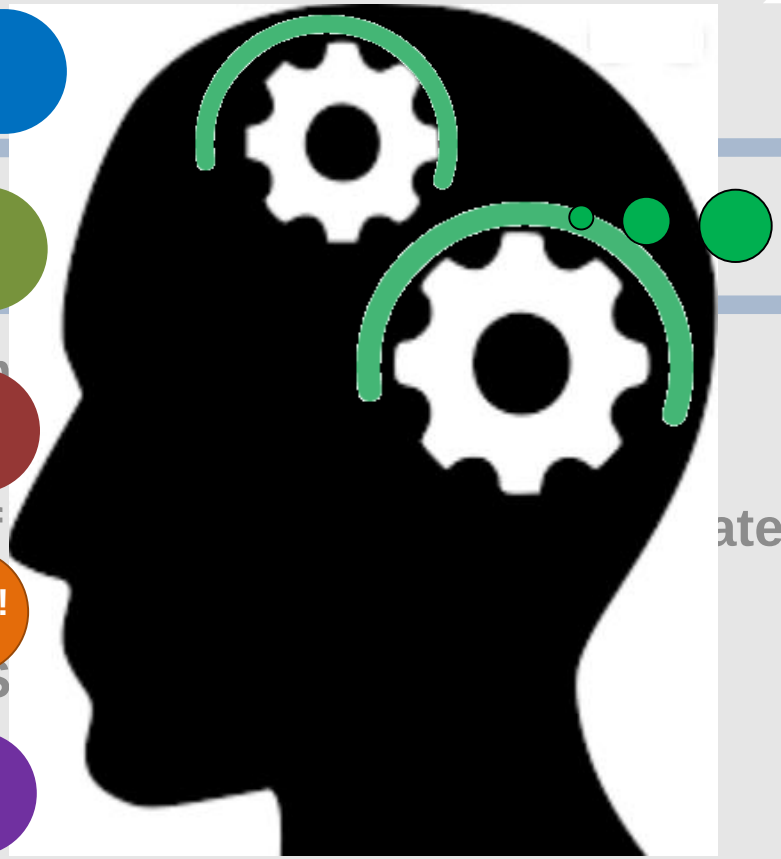
isting system having following issue

Constraints

- ❖ High Replacement Cost - OEM Monopoly!
- ❖ High Lead Time!
- ❖ OEM Dependency!
- ❖ Replacement Is The Only Solution!
- ❖ Over Stock of Spares !



Mission

Need was to develop competency to repair defective parts to avail cost effective solution.

Team Constitution & Responsibilities

Team Leader Name: Rohit K. Singh (Overall Project Implementation)

Team Members Name:

DIAL

1. **Samir Dafadar** (Supervising complete process)
2. **Vipin Purohit** (Planning, resource mobilization, coordination between In-house team for smooth process)
3. **Ghanender K. Vashist** (Responsible for compressor overhauling work)
4. **Venkatesh Akiri** (Consumables arrangement)
5. **Raushan K. Sahu** (Collecting Data of Day to Day activity)
6. **Archana Kala** (Issuing of PO for consumables)

BRADY

7. **Dalvir Singh** (Responsible for lifting, shifting equipment, tools and tackle arrangement)
8. **Vikram Singh Negi** (Responsible for Vacuuming & Gas charging work)

Team Mentor Name: Harinder Khurana

Project Title

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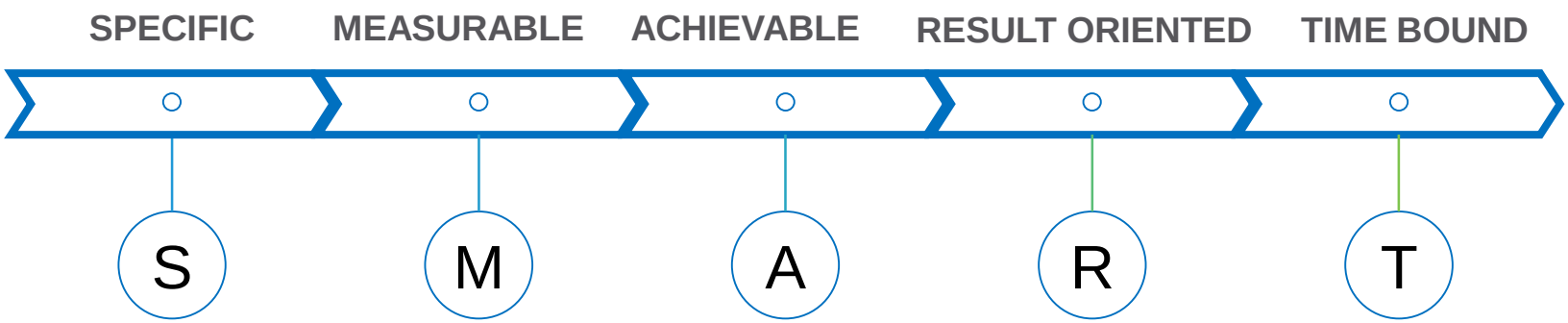
"Asset Revival of Chillers at T-1 through In-house Repairing by Dec-2018"



Initial Plan – Project Expectation

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Key Indicators	Pre-Implementations	Target
Repair / Replacement Cost	High (Rotor assembly 30.5Lack)	50% reduction
Machine Serviceability	Low (<90%)	High (>98%)
Spare Availability	OEM Dependency (Imported Item)	Local Availability

01 **Development of engineered solution which is easily available & repairable at low cost.**

02 **More focus on performance quality so as to have better performance & life.**

Activity Plan

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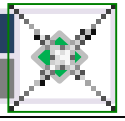
Project Definition  Diagnostic Journey Remedial Journey Holding The Gains

S #	ACTIVITY	RESP	MONTH: Apr18 to Dec'18									REMARKS
			M 1	M2	M3	M4	M5	M6	M7	M8	M9	
1	Identify probable solution	PLAN										
		ACTUAL										
2	Identification of best possible solution	PLAN										
		ACTUAL										
3	Deployment of resources	PLAN										
		ACTUAL										
4	Implementation of solution	PLAN										
		ACTUAL										
5	Check the system	PLAN										
		ACTUAL										
6	Learning	PLAN										
		ACTUAL										

Plan

DIAGNOSTIC JOURNEY

Problem Diagnostic - Brainstorming

Team Members Present:

- Mr. Rohit K. Singh, P&E
- Mr. Samir Dafadar, P&E
- Mr. Ghanender K. Vashist, P&E
- Mr. Venkatesh Akiri, P&E
- Mr. Raushan K. Sahu, P&E
- Mr. Dalvir Singh, Brady
- Vipin Purohit, P&E

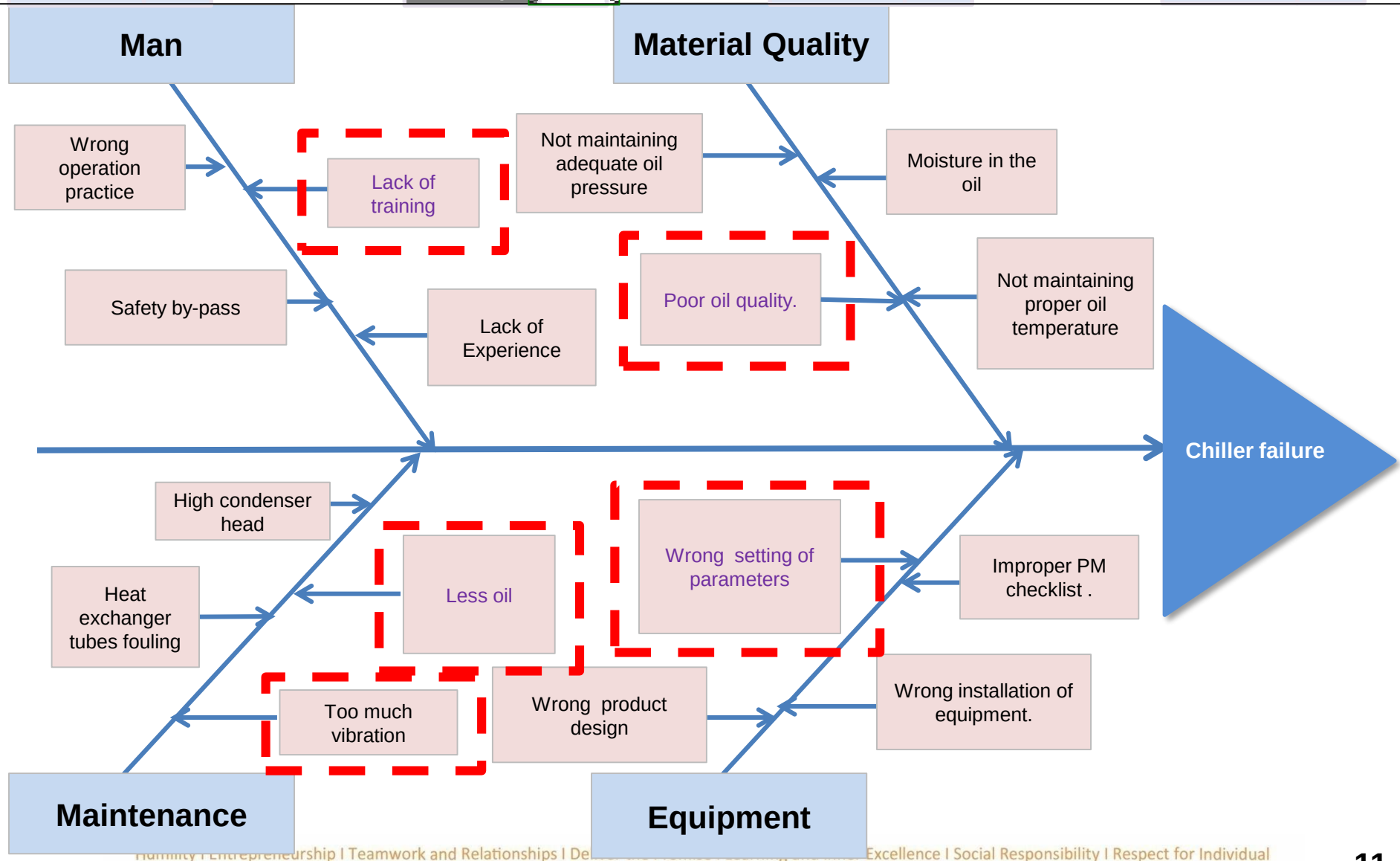
Venue: Room No. – 3 NUB

Date : 16-April-18

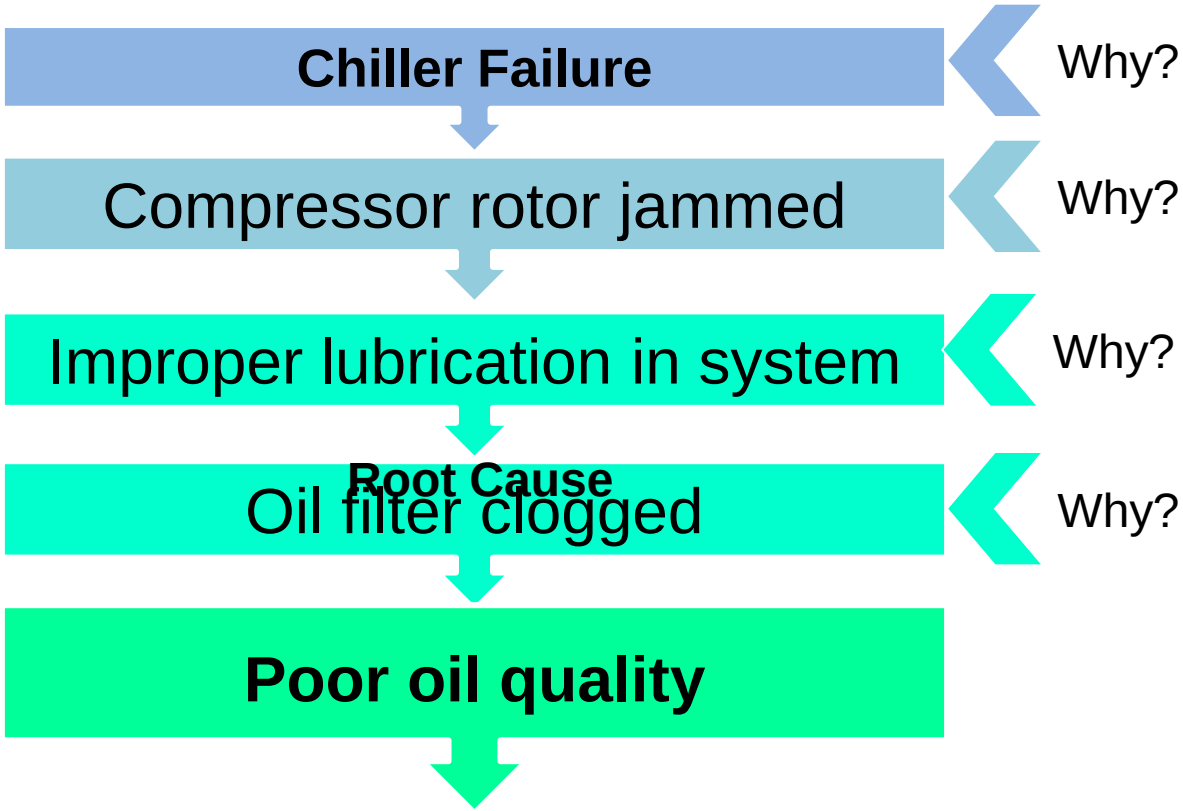
Topic: Identification of causes using fish bone diagram:-

- Quantity and quality of oil in compressor.
- Oil pump functioning.
- Lack of Training in operating Chiller.
- Oil pressure and thrust bearing clearance.

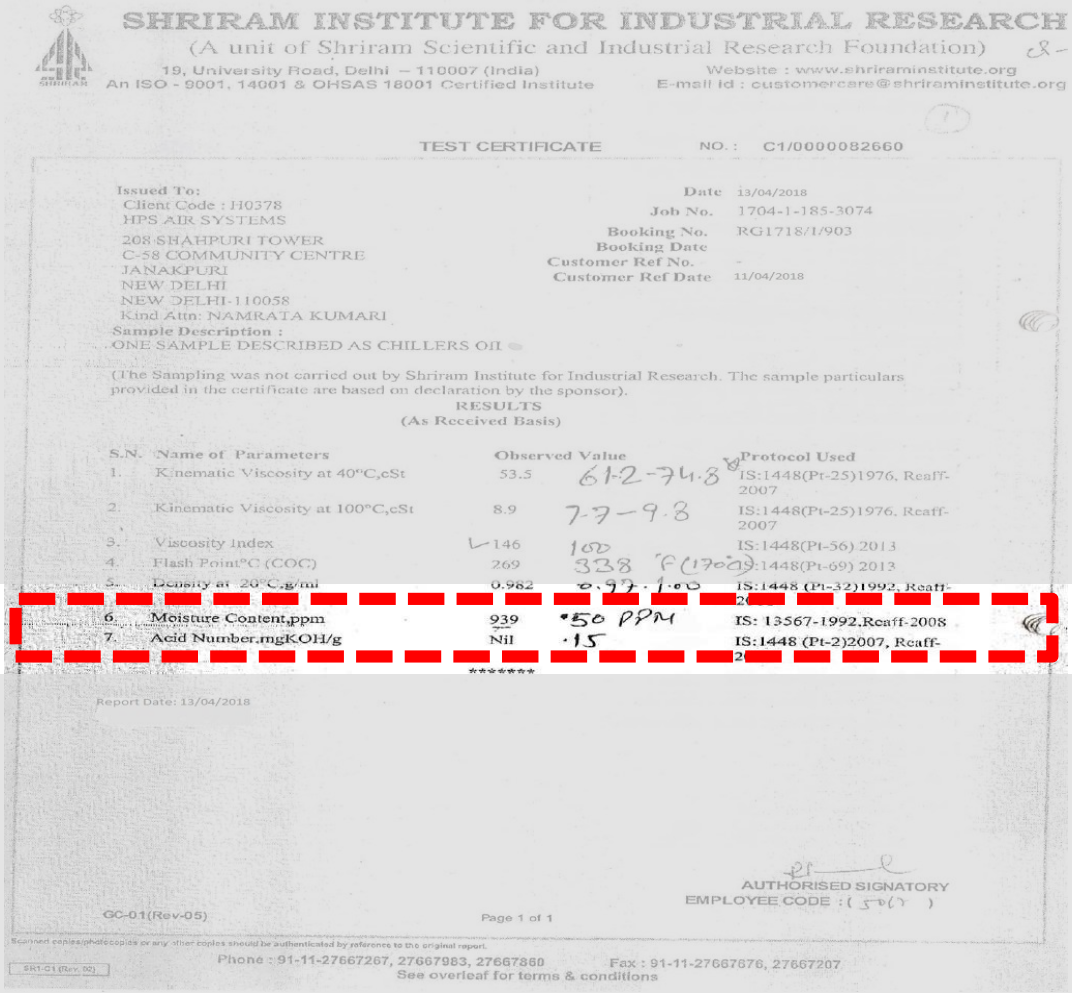
Cause and Effect Analysis



Why–Why Analysis



Oil Test Report



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E-mail id : customercare@shriraminstitute.org

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C-58 COMMUNITY CENTRE
JANAKPURI
NEW DELHI
NEW DELHI-110058
Kind Attn: NAMRATA KUMARI
Sample Description :
ONE SAMPLE DESCRIBED AS CHILLERS OIL

Date 13/04/2018
Job No. 1704-1-185-3074
Booking No. RG1718/1/903
Booking Date
Customer Ref No. -
Customer Ref Date 11/04/2018

(The Sampling was not carried out by Shriram Institute for Industrial Research. The sample particulars provided in the certificate are based on declaration by the sponsor).

RESULTS
(As Received Basis)

S.N.	Name of Parameters	Observed Value		Protocol Used
1.	Kinematic Viscosity at 40°C,cSt	53.5	61-2-74.8	IS:1448(Pt-25)1976, Reaff-2007
2.	Kinematic Viscosity at 100°C,cSt	8.9	7-7-9.8	IS:1448(Pt-25)1976, Reaff-2007
3.	Viscosity Index	146	102	IS:1448(Pt-56) 2013
4.	Flash Point°C (COC)	269	338	IS:1448(Pt-69) 2013
5.	Density at 20°C,g/ml	0.982	0.93-1.03	IS:1448 (Pt-32)1992, Reaff-2
6.	Moisture Content,ppm	939	50 PPM	IS: 13567-1992,Reaff-2008
7.	Acid Number,mgKOH/g	Nil	.15	IS:1448 (Pt-2)2007, Reaff-2

****

Report Date: 13/04/2018

AUTHORISED SIGNATORY
EMPLOYEE CODE : (5061)

GC-01(Rev-05)

Page 1 of 1

Scanned copies/photocopies or any other copies should be authenticated by reference to the original report.

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REMEDIAL JOURNEY

Probable Solutions – Heat Map Analysis

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Solution Available	Rohit Kr. Singh	Samir Dafadar	Vipin Purohit	Ghanender K. Vashist	Venkatesh Akiri	Raushan K. Sahu
OEM Solution :- Buy spare from OEM	✗	✗	✗	✗	✗	✗
Replacement of Existing System :- Assembly, Part or Full System	✗	✗	✓	✗	✓	✓
Repair of Faulty Part :- In-house engineering	✓	✓	✓	✓	✓	✓

Resistance

Most Probable

Solution Evaluation

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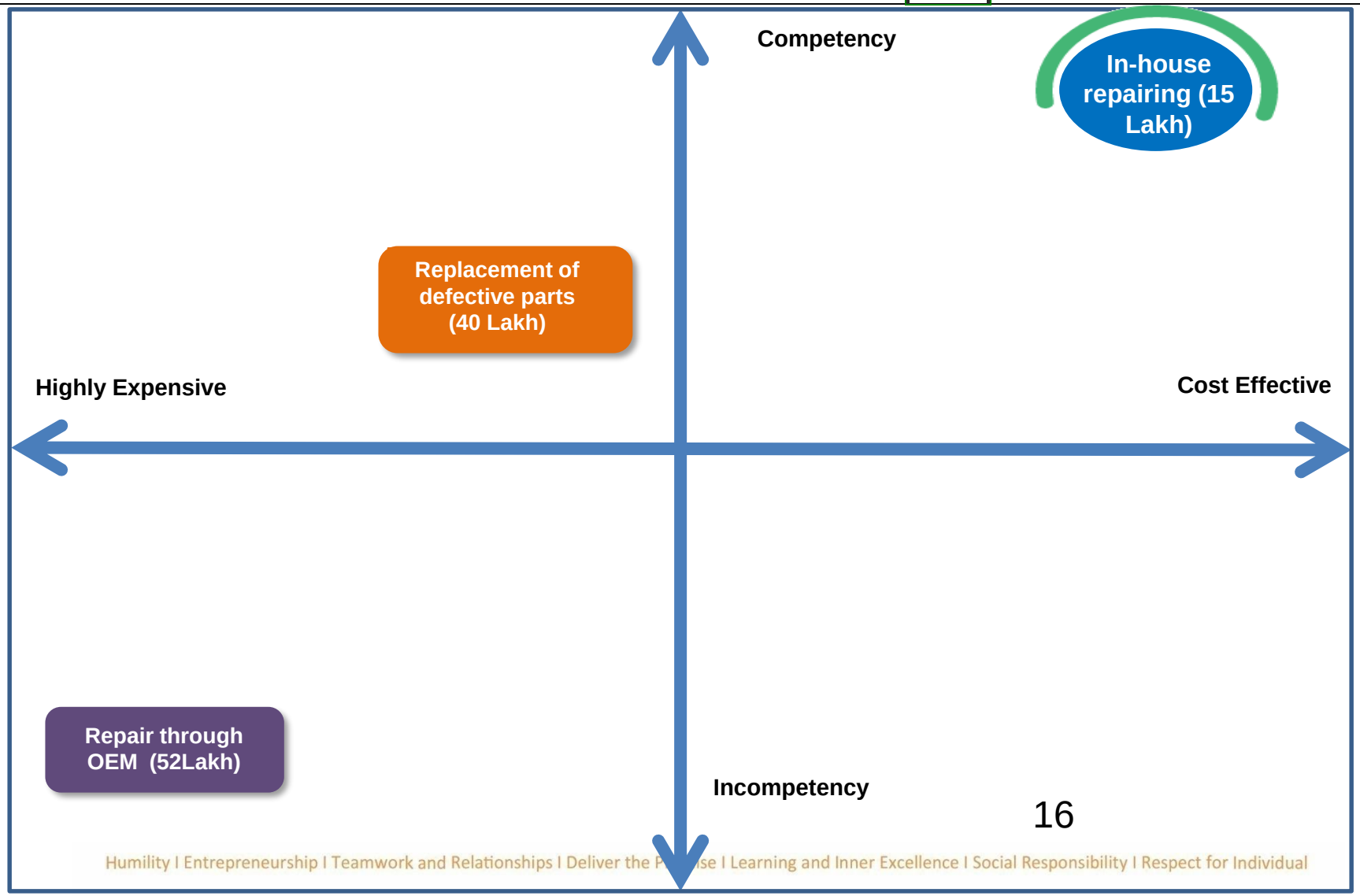
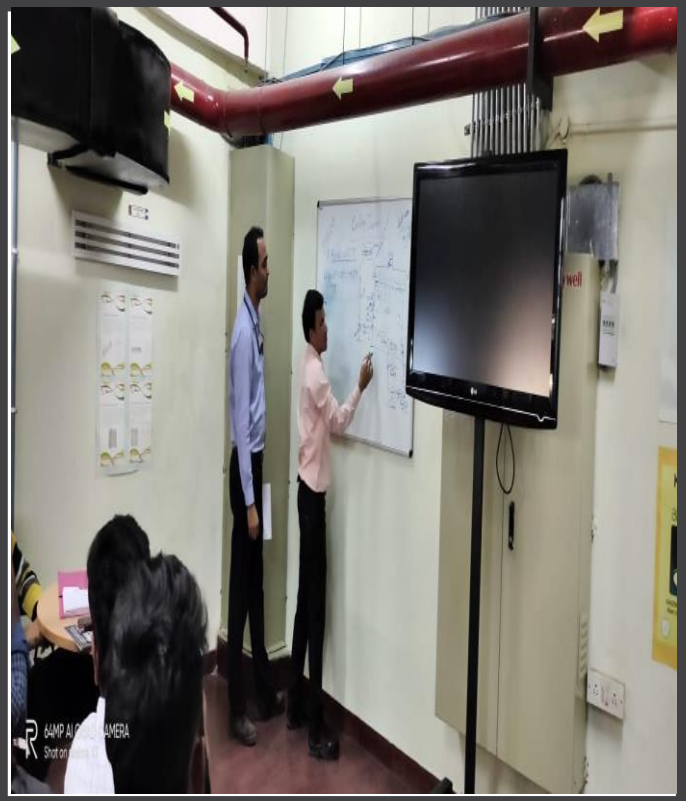
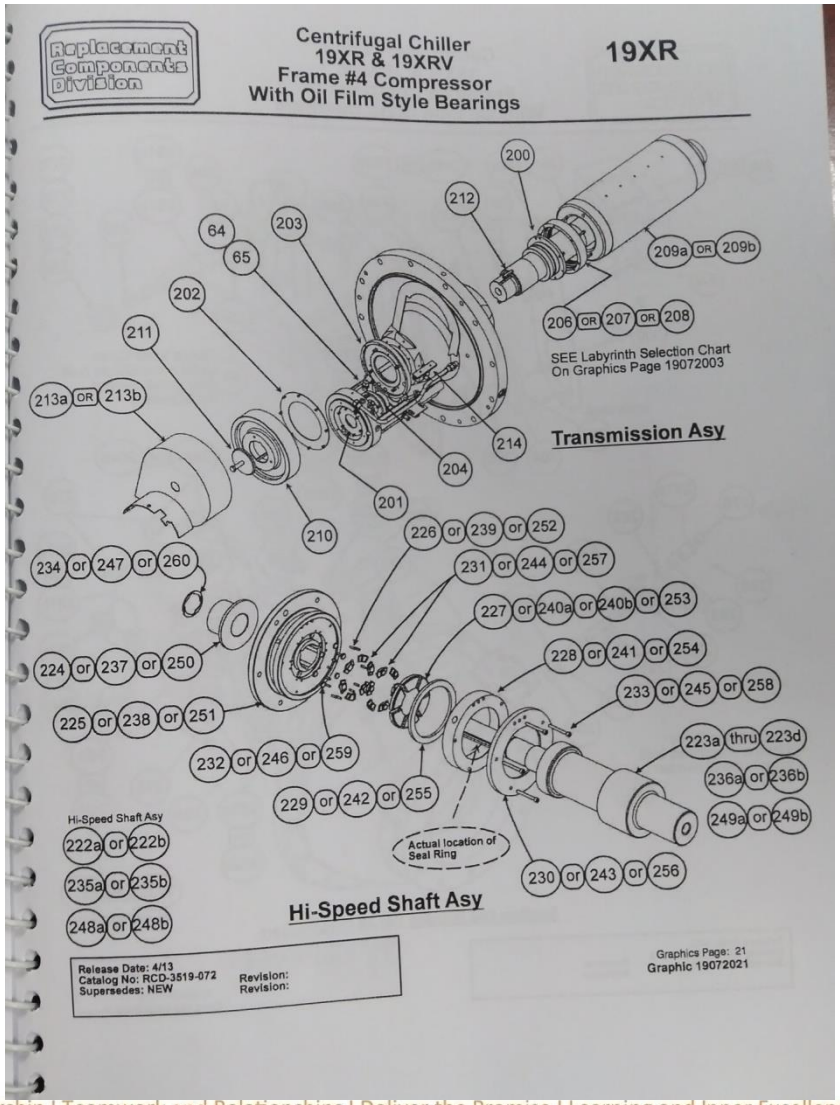


16

Training Session Before Starting Execution



ROTOR ASSEMBLY SYNOPSIS



19XR,XRV COMPRESSOR FRAME 2 THROUGH FRAME 5 FITS AND CLEARANCES (in.)

ITEM	COMPRESSOR	FRAME 2	FRAME 3	FRAME 4		FRAME 5	
	Code	201-299, 2ZZ	321-389, 3ZZ	421-487, 4B1-4W7		501-599	
	DESCRIPTION	Oil Film Bearings	Rolling Element Bearings	Oil Film Bearings	Rolling Element Bearings	Oil Film Bearings	Rolling Element Bearings
A	Low Speed Journal-Gear End	.0050/.0040	.0050/.0040	.0055/.0043	.0055/.0043	.0069/.0059	.0069/.0059
B	Low Speed Journal-Motor End	.0050/.0040	.0050/.0040	.0053/.0043	.0053/.0043	.0065/.0055	.0065/.0055
C1	Low Speed Labyrinth to Thrust Disk	.0115/.0055	N/A	.010/.005	N/A	N/A	N/A
C2	Labyrinth to Low Speed Shaft	N/A	.010/.005	.0095/.0055	.0095/.0055	.013/.009	.013/.009
D	Low Speed Shaft Thrust Float	.020/.008	.020/.008	.023/.008	.023/.008	.020/.008	.020/.008
E	Impeller Eye to Shroud	*	*	*	*	*	*
F1	Impeller Bore to Shaft-Rear	–.0020/–.0005	–.0025/–.0010	–.0014/–.0029	–.0014/–.0029	–.0019/–.0005	–.0019/–.0005
F2	Impeller Bore to Shaft-Front	N/A	N/A	–.0005/–.0025	–.0005/–.0025	–.0014/.0000	N/A
G	Impeller Discharge to Shroud	*	*	*	*	*	*
H	Impeller Spacer to Shaft	.0025/.0010	.0025/.0010	.0025/.0010	.0025/.0010	.0024/.0010	.0024/.0010
I	Slinger to Shaft	.0013/.0005	.0012/.0004	.0012/.0004	.0012/.0004	.0012/.0004	.0012/.0004
J	Labyrinth to Slinger	.013/.009	.010/.006	.010/.006	.010/.006	.010/.006	.010/.006
K	Labyrinth to Impeller	.012/.008	.012/.008	.012/.008	.012/.008	.012/.008	.012/.008
L	High Speed Journal-Impeller End	.0047/.0037	N/A	.0040/.0028	N/A	.0048/.0038	N/A
M	Thrust Assembly Seal Ring Axial Clearance	.006/.002	N/A	.006/.002	N/A	.006/.002	N/A
N	Thrust Assembly Seal Ring to Shaft	.0045/.0015	N/A	.0045/.0015	N/A	.0045/.0015	N/A
O	High Speed Shaft Thrust Float	.014/.008	0 Float	.014/.008	Float	.014/.008	0 Float
P	High Speed Journal-Gear End	.0050/.0040	N/A	.0048/.0038	N/A	.0062/.0052	N/A

*Depends on impeller size, contact your Carrier Service Representative for more information.

NOTES:
1. All clearances for cylindrical surfaces are diametrical.
2. Dimensions shown are with rotors in the thrust position.
3. Frame 2 rolling element style high speed shaft and bearing must be removed from the high speed shaft and bearing assembly before the high speed shaft and bearing assembly can be separated from the transmission.
4. If any components within a rolling element high speed shaft and bearing assembly are damaged it is recommended that the entire high speed shaft and bearing assembly be replaced.

Implementation Stage

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Remedial Journey

Re-engineered

- Dismantling of compressor rotor.
- Thrust bearing clearance and alignment.

Implementation Stage

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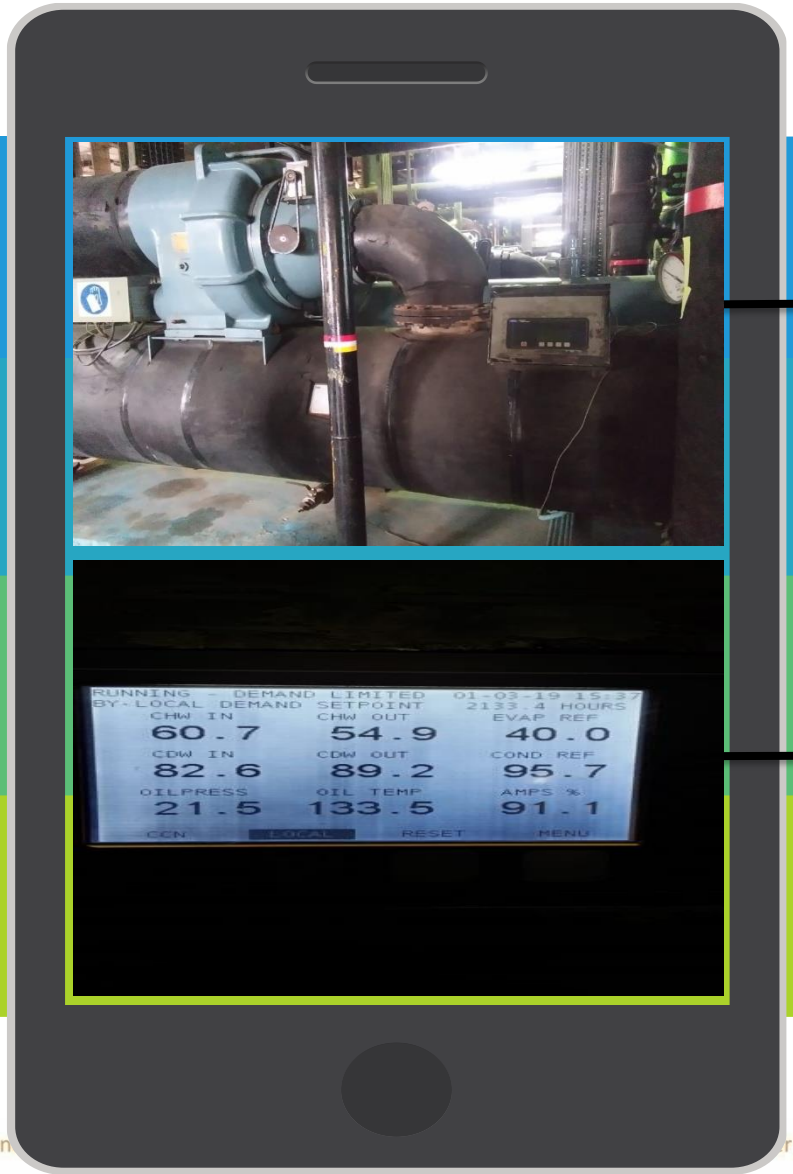
Remedial Journey

Re-engineered

- Pressure Testing & Vacuuming.
- Refrigerant Charging.

Glimpse of Defective Vs. Functional Chiller



Defective Vs. Working chiller post rectification

HOLDING THE GAINS

Plan Vs Actual

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S #	ACTIVITY	RESP	MONTH: Apr18 to Dec'18									REMARKS
			M 1	M2	M3	M4	M5	M6	M7	M8	M9	
1	Identify probable solution	PLAN										
		ACTUAL										
2	Identification of best possible solution	PLAN										
		ACTUAL										
3	Deployment of resources	PLAN										
		ACTUAL										
4	Implementation of solution	PLAN										
		ACTUAL										
5	Check the system	PLAN										
		ACTUAL										
6	Learning	PLAN										
		ACTUAL										

Plan Actual Delay

Performance–Post Implementation

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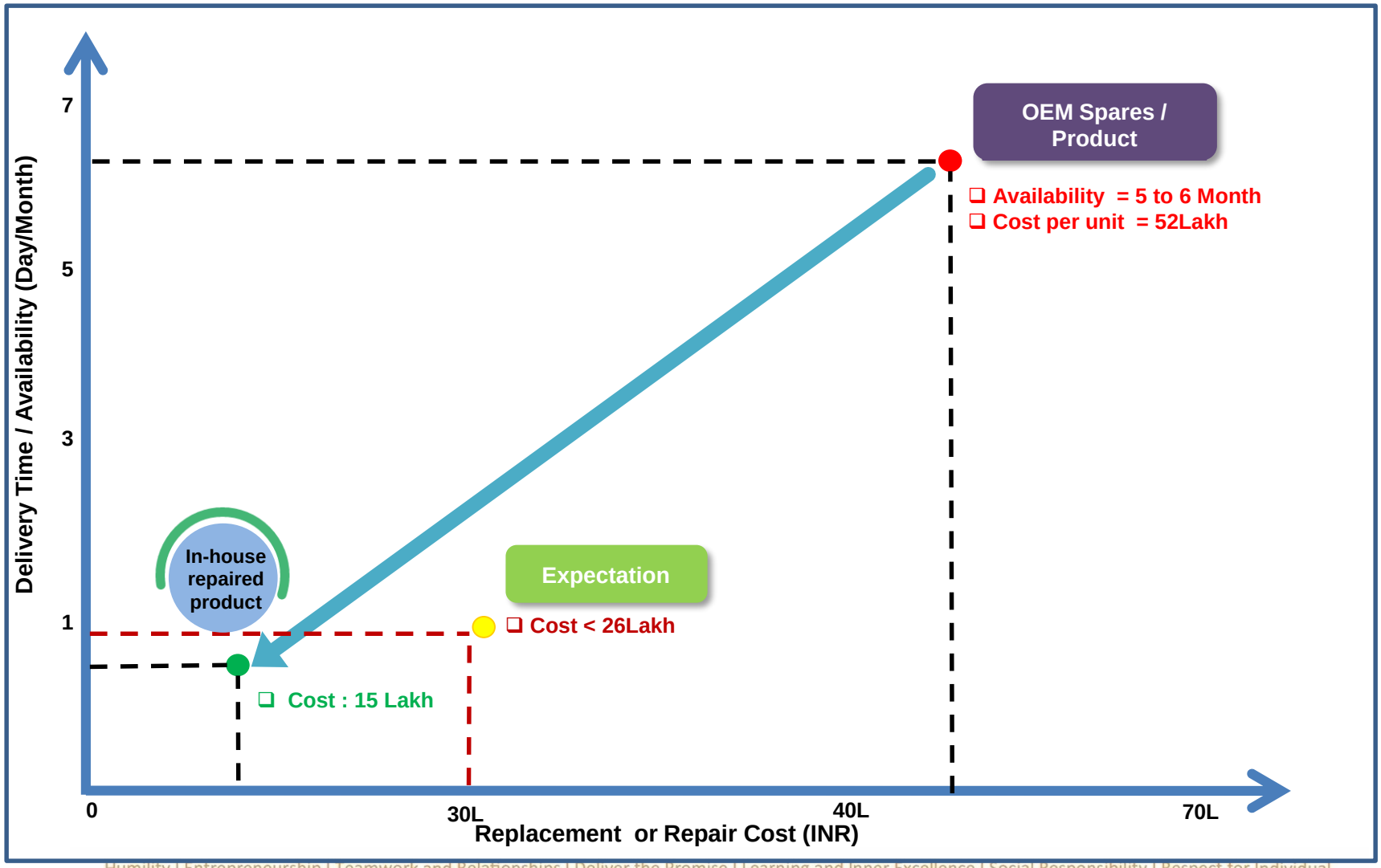
S.No	Parameter	Minimum limit	Maximum limit	Remarks
1	SUCTION PRESSURE	30 PSIG	45 PSIG	
2	Discharge pressure	85 PSIG	130 PSIG	
3	SST (SATURATED SUCTION TEMPERATURE)	CORRESPONDING TEMPERATURE AS PER SUCTION PRESSURE		
4	SCT (SATURATED CONDENSER TEMPERATURE)	CORRESPONDING TEMPERATURE AS PER DISCHARGE PRESSURE		
5	WATER IN & WATER OUT TEMPERATURE DIFFERENCE	MIN. 6- 13° F		
6	LIMITS OF OIL PRESSURE	DIFFERENCE B/W DISCHARGE PRESSURE & OIL PRESSURE ALWAYS LESS THAN 90 PSIG		
7	OIL HEATER	IF OIL TEMP < 45° C THEN HEATER WILL ON.	IF OIL HEATER > 55° C THEN HEATER WILL OFF.	
		OAT - OUTER AREA TEMP.	LWT - LEAVING WATER TEMP.	
8	EXPANSION VALVE LIMITS	0	70	
9	CONCEPT OF SUBCOOLING	Range of subcooling = 10 DEG F +_3 DEG F		
	IF SUBCOOLING VALUE EQUAL TO 7 DEG F ADD REFRIIGRANT & IF VALUE IS 13 REMOVE REFRIGRANT.			
	SUBCOOLING = T(SCT IN DEG F) - {LIQUID LINE TEMP (IN DEG F) + 1}	SUBCOOLING MUST BE EQUALS TO 10 DEG FAHRENHEITE (F)		
	WE CAN CALCULATE T(SCT) AS PER DISCHARGE PRESSURE.			
	LIQUID LINE TEMP TAKEN FROM OUTLET OF CONDENSER & BEFORE DRYER.			
10	CONCEPT OF SUPERHEAT	Range of subcooling = 7.5 DEG C +_ 5 DEG C		
	IF SUPERHEAT VALUE EQUAL TO 12.5 DEG C THEN ADD REFRIIGRANT & IF VALUE IS 2.5 DEG C THEN REMOVE REFRIGRANT.			
	SUPER HEAT = {VAPOUR (SUCTION) LINE TEMP IN DEG C - 1} - T (SST IN DEG C)	SUPER HEAT MUST EQUALS TO 7.5 DEG CENTIGRADE (C)		
	WE CAN CALCULATE T(SST) AS PER SUCTION PRESSURE.			
	VAPOUR LINE TEMP TAKEN FROM OUTLET OF EVAPORATOR & BEFORE COMPRESSOR.			
11	CONCEPT OF GAS CHARGING	IN AIR COOLED PER TR 1.25 KG	IN WATER COOLED PER TR 0.9 KG	

Solution Outcome



Holding Gains

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Key Indicators	Pre-Implementations	Target	Post-Implementations
Repair / Replacement Cost	High	50% reduction	>72% (Repair cost < INR15 Lakh)
Machine serviceability	<90%	>98%	**>99%**
Spare Availability	OEM Dependency (Imported)	Local Availability	In house repairing

01 **Chiller has been repaired. Savings of Rs. 37.5 Lakh is audited.**

02 **Maximizing the Asset Utilization by Reuse & Repair process, Improved Lead Time with saving of Man hours.**

03 **Breaking the Barrier of OEM Dependency & Team Confidence Building.**

Benefits

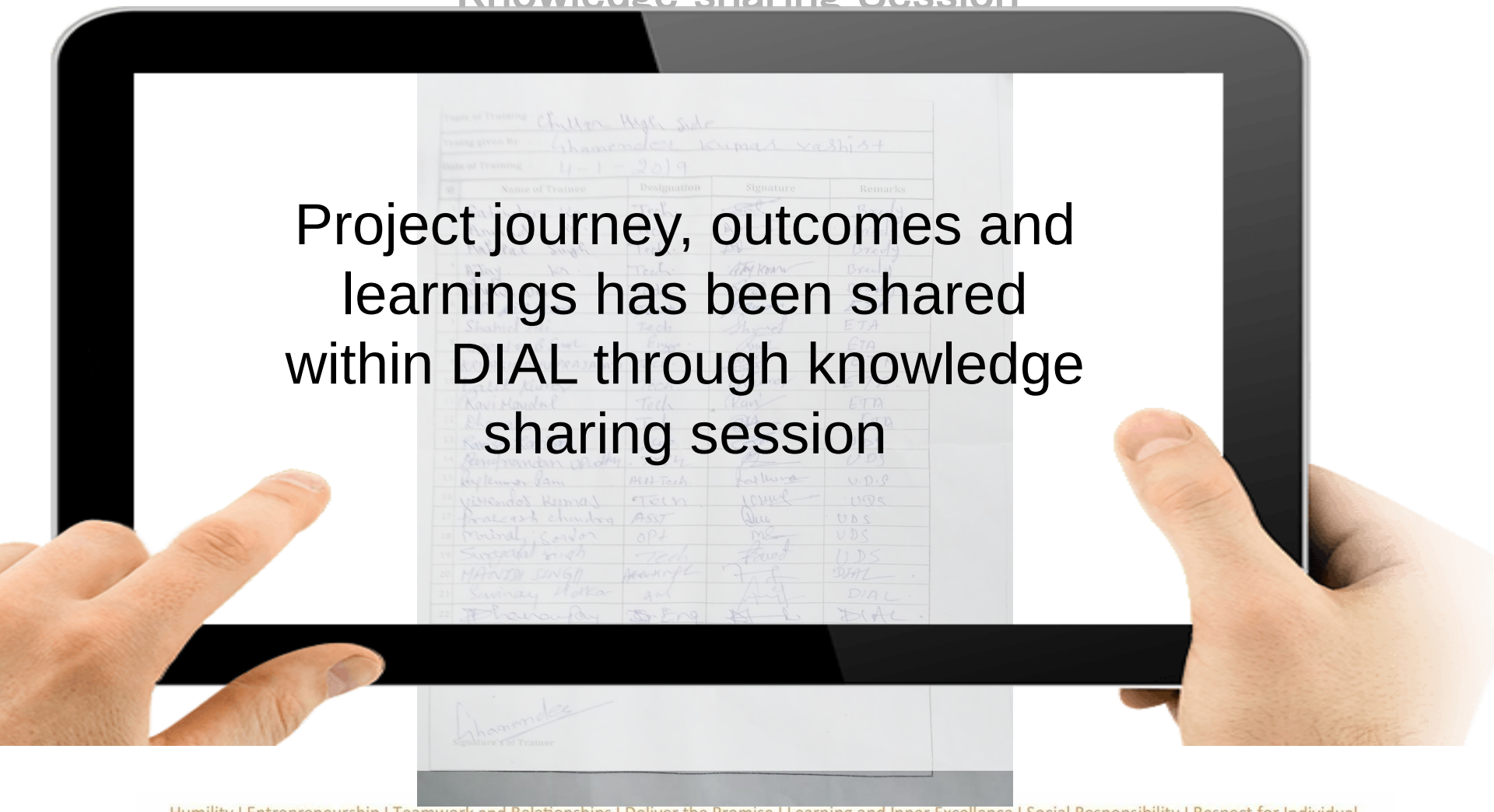
One Time Saving: **37.32 Lakh**

Tangible Benefits

Intangible Benefits

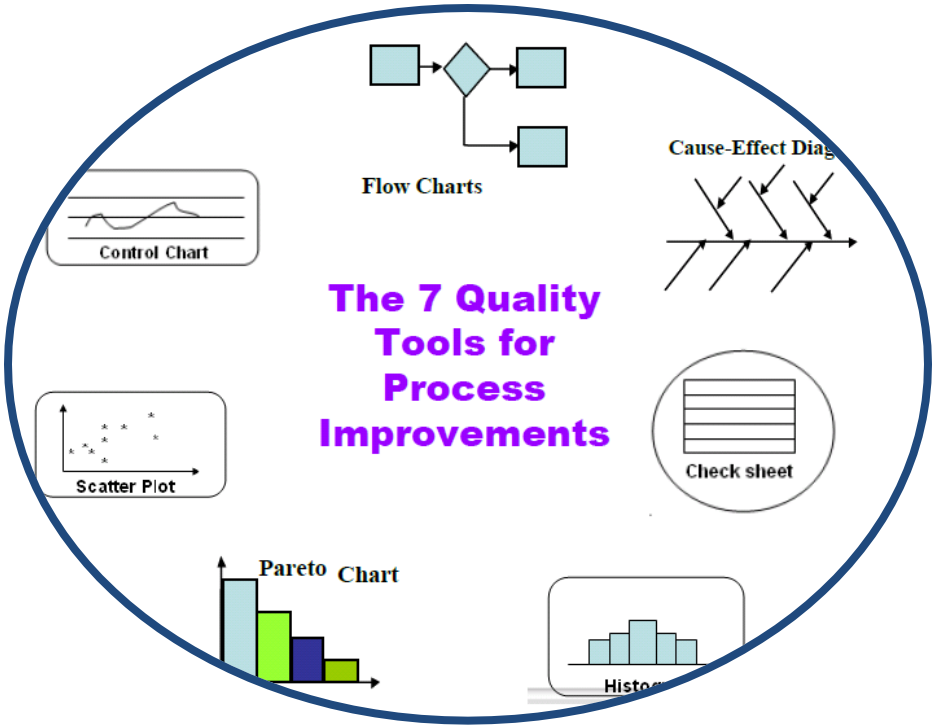
Team Work **Responsiveness** **Reduce Dependency on OEM**

Knowledge sharing Session



QC Tools Applied

- Check sheet
- Cause –Effect Diagram
- Why – Why Analysis
- Brainstorming
- Heat Map Analysis



BLIP Audit Report

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Project Definition | Diagnostic Journey | Remedial Journey | Holding The Gains

From: Saurabh Miglani
Sent: Saturday, July 06, 2019 2:33 PM
To: Rohit Kumar Singh; Deepak Raina; Naveenkumar Saini; Samir Dafadar; Vipin Purohit; Madhu Munnam; Manish Singh; Ghanender Kumar Vashist; Savinay Hotkar; Dhananjay Rao Nagulla; Santoshkumar Murapaka; Zirgham Ahmad Khan; Manoj Kumar Valipishetty; Viren Badyal; Raushan Kumar Sahu; Venkatesh Akiri; Tapas Kumar Mishra; Raushan Kumar Sahu
Cc: Roy Sebastian; Harinder Khurana; Subir Hazra; Krishna Munagala; Ruchika Ahluwalia; aavmandassociates@gmail.com; Rajani Dimri
Subject: BLIP Audit Mail | 2018-19 | P&E | Mechanical

Dear Team
Thank you for the submission of the initiatives taken, kindly note the audit observations as below:

No.	Initiative Name	Claimed Value (Rs. Lakh)	Status	Audited Value (Rs. Lakh)	Audit Comments, if any
1)	Reduction in Energy Consumption at Terminal 3	357.00	*Approved*	*367.54*	Continuing the trend, the Per Pax Energy Consumption has been brought down from 1.45 to 1.28. The same ratio was 1.63 for 2016-17. In fact there has been a saving in the absolute terms as well. However, the BLIP amount has been approved basis the per pax method. Team is expected to sustain this trend.
2)	Water conservation at Terminal Building 3	140.00	*Approved*	*243.44*	With the initiatives taken the water to pax consumption has ratio has been brought down from 5.25 to 4.79 for potable water & 17.84 to 14.9 for flush water thereby reducing the overall consumption ratio. The BLIP amount is approved basis this methodology and expect this trend to be sustained
3)	Improvement in water recovery at Terminal Buildings	771.00	Not Approved	-	BLIP saving has been claimed on account of Improvement in water recovery at terminal buildings. As a practice DIAL recovers only the cost involved with no element of profit
4)	Maximization of assets life by doing in-house repair works at Terminal 3	25.04	*Approved*	*25.04*	Frequent failure of FCU thermostat happened due to internal circuitry failure or external damages. Team was able to repair in-house and prolong the utility of existing assets. On the other hand, the option was to procure a new thermostat from the OEM, and this is the basis of our calculation.
5)	Reduction of Rectification Cost of Chillers at T1	47.33	**Approved**	**37.40**	Team had utilized its competency for chiller maintenance works at T1 and utilized the unused / dead assets from T2 which were deployed since the AAI era and thereby reducing the dependency on the OEM for fresh procurement and thereby becomes our basis for the approved amount.

Appendix

Estimate of OEM


Adobe Acrobat Document


Adobe Acrobat Document

Rotor Balancing Report


Adobe Acrobat Document

Thank You