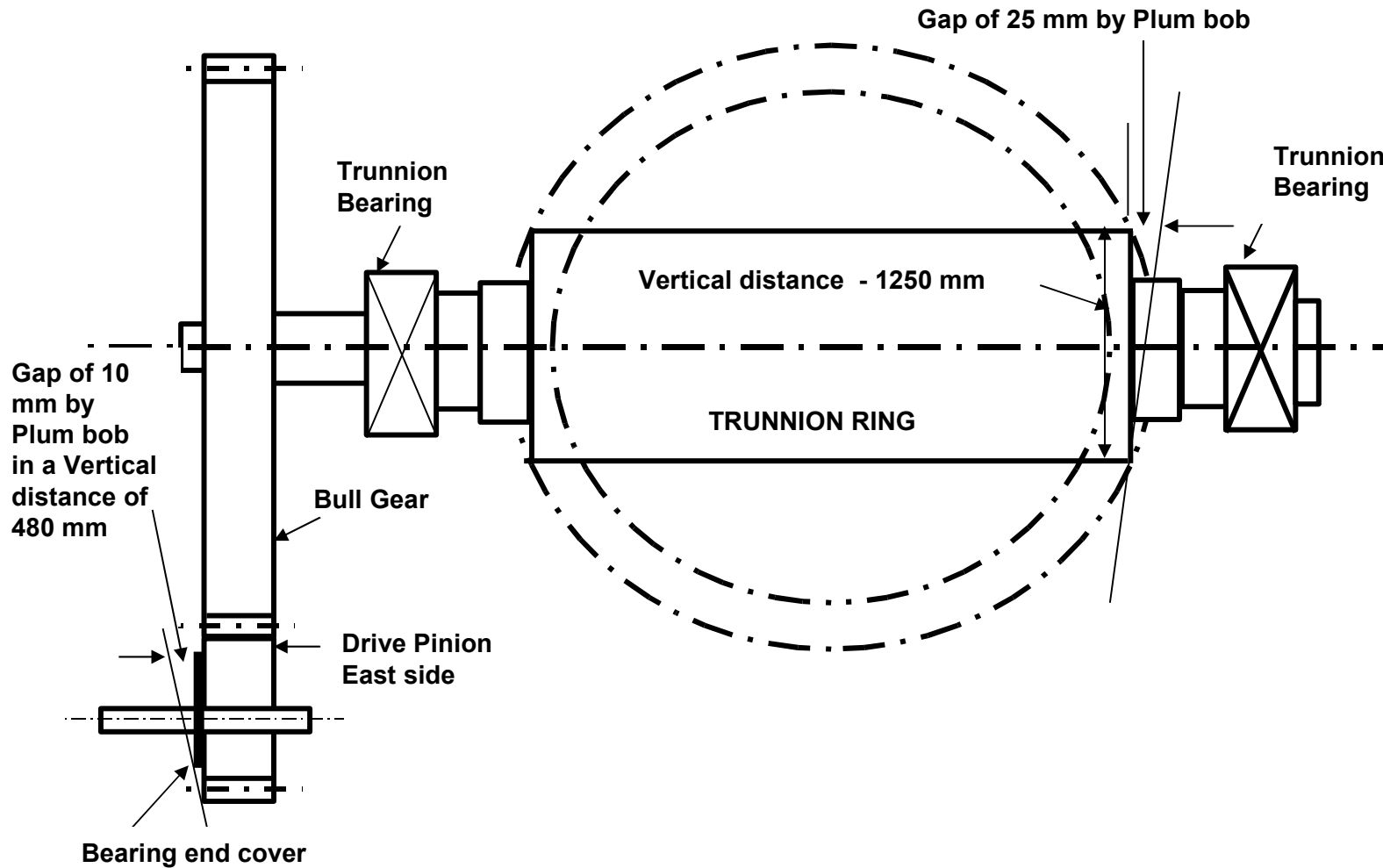


Failure of Vessel #2 non drive end
Bearing at LD#2

VESSEL WITH DRIVE ARRANGEMENT



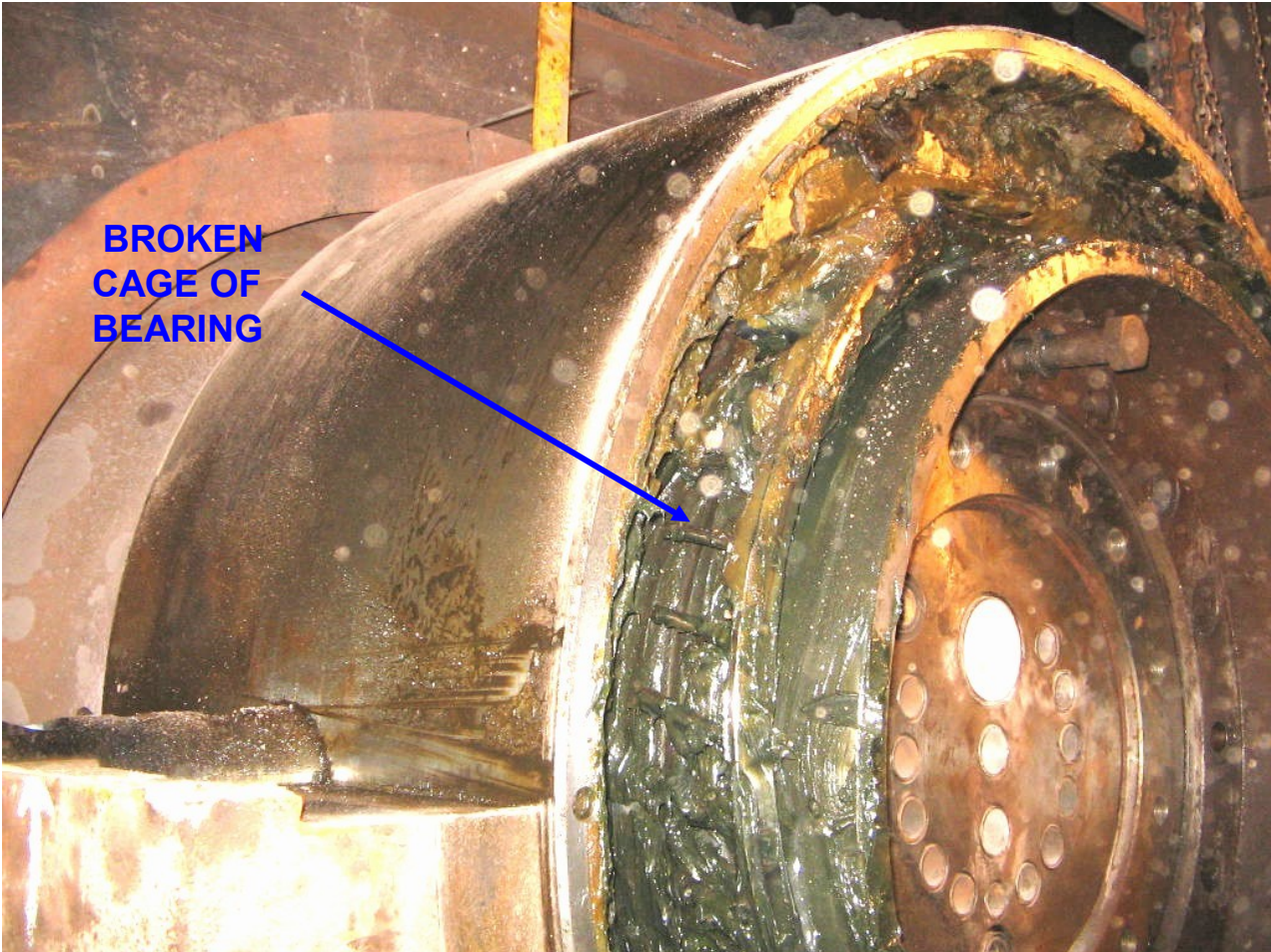
PROBLEM

- ON 1ST OCTOBER 2005, B SHIFT, INTERMITTENT CREAKING METALLIC SOUND NOTICED IN NON DRIVE END (NDE)TRUNNION BEARING
- GREASING DONE. THE VESSEL GIVEN IN SERVICE AND KEPT UNDER CONSTANT WATCH
- ON 2ND OCTOBER 2005, AT AROUND 1:00 AM, THE ABNORMAL SOUND INCREASED SIGNIFICANTLY AND THE NON DRIVE SIDE TRUNNION PIN LOWERED DOWN BY APPROXIMATELY 28 MM INDICATING BEARING BREAKAGE.

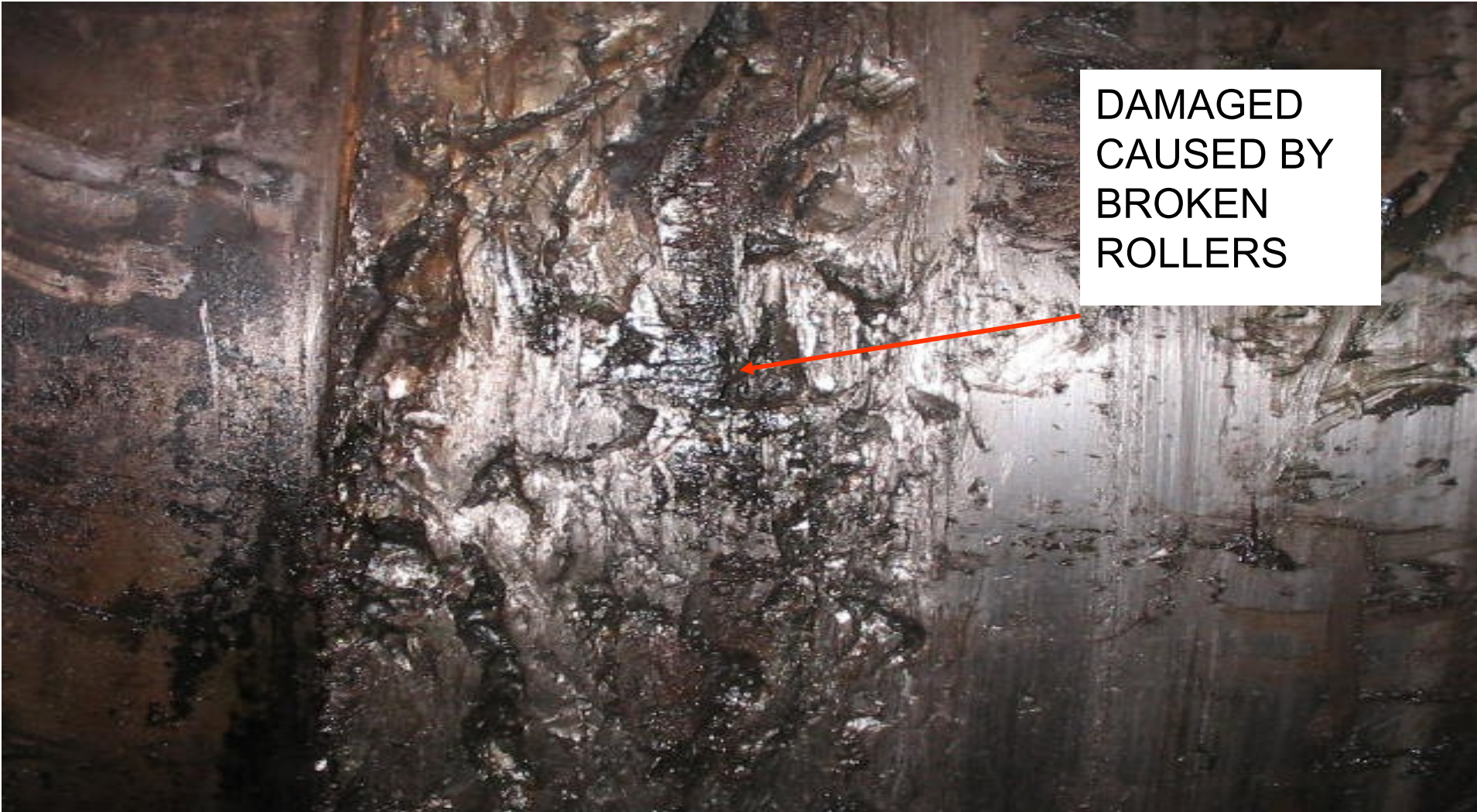
VISUAL OBSERVATION

- THE LOWER HALVES OF VESSEL SIDE END COVER AND LABYRINTH RING WERE FOUND DISTORTED AND DAMAGED
- THE SEAL OF THE VESSEL SIDE WAS FOUND IN BADLY DAMAGED CONDITION
- MANY ROLLERS OF THE INNER ROW WERE FOUND BROKEN
- ALL PINS OF INNER CAGE WERE FOUND BROKEN AND ALL THE ROLLERS HAD COME OUT
- MOST OF THE ROLLERS OF THE OUTER ROW WERE FOUND IN REASONABLY GOOD CONDITION BUT FOR NORMAL WEAR AND TEAR
- ABOUT 80% PINS OF OUTER CAGE WERE FOUND BROKEN
- THE TRUNNION PIN WAS BADLY DAMAGED
- SIDE COLLAR OF THE INNER RACE WAS FOUND DAMAGED ON THE INNER SIDE. THIS DAMAGE WAS FOUND TO BE MORE IN THE LOWER MOST (IN VERTICAL POSITION OF THE VESSEL) PORTION OF INNER RACE

DAMAGED BEARING



DAMAGED PIN OF VESSEL

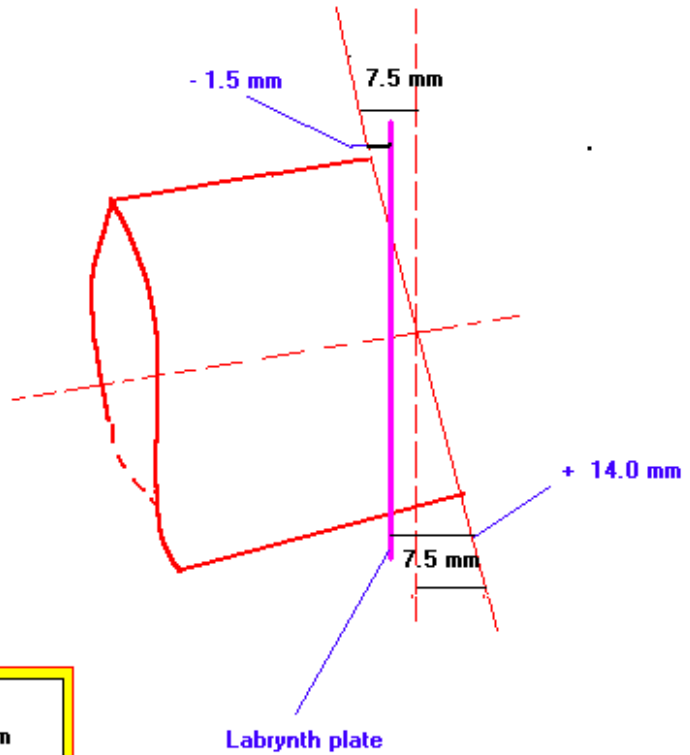
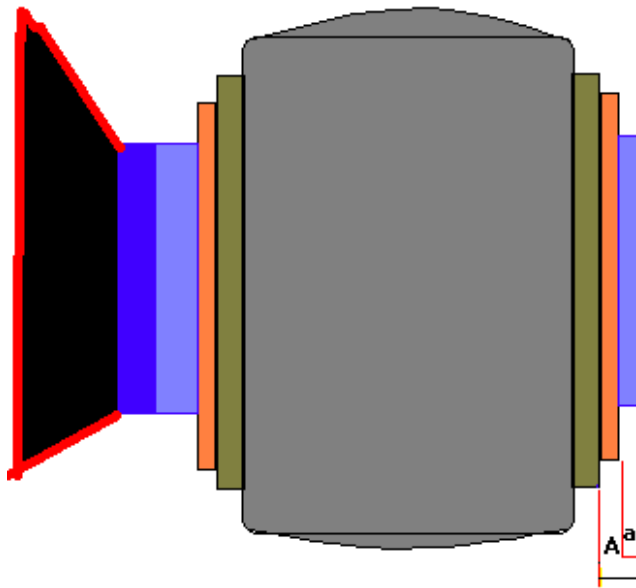


DAMAGED
CAUSED BY
BROKEN
ROLLERS

ROOT CAUSE

- THE TRUNION PIN HAS A DEFLECTION OF 1.2 DEGREES (18 MM OVER 850 MM)
- THE BEARING CENTRE HAD SHIFTED BY 70 MM TOWARDS CONVERTER INSIDE THE BEARING HOUSING (MAXIMUM SHIFT ALLOWED IS AROUND 60 MM).

Length of projected grease nipple is 32 mm



'a' at top - 1.5 mm
'a' at bottom + 14.0 mm
'A' at top + 23.5 mm
'A' at bottom + 39.0 mm

REMEDIAL ACTION

ROOT CAUSE	REMEDIAL ACTION
AXIAL SHIFTING OF PIN BY 70 MM AGAINST ALLOWABLE LIMIT OF 60 MM	BEARING CHANGED AND PLUMMER BLOCK REPOSITIONED TO CREATE SPACE FOR MOVEMENT EITHER SIDE
ANGULAR MISALIGNMENT OF PIN WITH RESPECT TO BEARING HOUSING BY 1.2 DEG	THE TRUNION AND PIN OF ALL THE VESSELS WILL BE REPLACED . THE PIN AND BEARING SIZES WILL BE INCREASED FROM 800 MM TO 850 MM

RECOMMONDATIONS	HORIZONTAL DEPLOYMENT
<p>TO CHECK THE SHIFTING OF NON DRIVE END PIN AT SCHEDULED INTERVAL</p>	<ul style="list-style-type: none"> •VESSEL # 1 NDE PIN SHIFTING CHECKED AND FOUND SHIFTED TOWARDS VESSEL BY 58 MM . IMMEDIATELY VESSEL PUT DOWN AND REPOSITIONED THE PLUMMER BLOCK •VESSEL # 3 PIN SHIFTING CHECKED AND FOUND SHIFTED BY 36 MM . THIS IS WITH IN LIMIT
<p>TO CHECK THE ANGULAR MISALIGNMENT OF PIN</p>	<ul style="list-style-type: none"> • VESSEL # 1 PIN ANGULAR MISALIGNMENT CHECKED AND FOUND 1.1 DEG (LIMIT IS 1.5 DEG) •VESSEL # 3 PIN CHECKED AND FOUND NO ANGULAR MISALIGNMENT
<p>TO ROTATE THE BEARING BY 90 DEG ONCE IN A YEAR</p>	<ul style="list-style-type: none"> •VESSEL 2 NDE SIDE IS PLANNED IN JAN 06

Mr.T.Watanabe's Comment

1. Conclusion should not be arrived at directly
2. Analysis part being important, should be shown
3. Originating points for Fatigue cracks should shown
4. Micro structure analysis must be shown
5. Ideas can be thought of for making inner rollers stronger

THANKS