FINAL

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NATIONAL TRANSPORTATION SAFETY COMMITTEE

Aircraft Serious Incident Investigation Report

PT. Merpati Nusantara Airline
Boeing 737-400 ; PK – MDO
Sultan Hasanuddin Airport, Makassar, South Sulawesi
Republic of Indonesia

16 January 2009

NATIONAL TRANSPORTATION SAFETY COMMITTEE
MINISTRY OF TRANSPORTATION
REPUBLIC OF INDONESIA
2012

This Final Report was produced by the National Transportation Safety Committee (NTSC), Ministry of Transportation Building 3rd Floor, Jalan Merdeka Timur No. 5 Jakarta 10110, Indonesia.

The report is based upon the investigation carried out by the NTSC in accordance with Annex 13 to the Convention on International Civil Aviation Organization, Aviation Act (UU No.1/2009), and Government Regulation (PP No. 3/2001).

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GLOSSARY OF ABBREVIATIONS

AD	Airworthiness Directive
AFM	Airplane Flight Manual
ALAR	Approach-and-landing Accident Reduction
ALS	Aircraft Landing System
AOC	Air Operator Certificate
ATC	Air Traffic Control
ATPL	Air Transport Pilot License
ATS	Air Traffic Service
Avsec	Aviation Security
BOM	Basic Operation Manual
°C	Degrees Celsius
CAMP	Continuous Airworthiness Maintenance Program
CASO	Civil Aviation Safety Officer
CASR	Civil Aviation Safety Regulation
CMM	Component Maintenance Manual
CPL	Commercial Pilot License
COM	Company Operation Manual
CRM	Cockpit Recourses Management
CSN	Cycles Since New
CVR	Cockpit Voice Recorder
DFDAU	Digital Flight Data Acquisition Unit
DGCA	Directorate General of Civil Aviation
DME	Distance Measuring Equipment
EFIS	Electronic Flight Instrument System
EGT	Exhaust Gas Temperature
EIS	Engine Indicating System
FL	Flight Level
F/O	First officer or Copilot
FDR	Flight Data Recorder
FOQA	Flight Operation Quality Assurance
GPWS	Ground Proximity Warning System
HGW	High Gross Weight
hPa	Hectopascals
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules

ILS	Instrument Landing System
Kg	Kilogram(s)
Km	Kilometer(s)
Kt	Knots (NM/hour)
Mm	Millimeter(s)
MTGW	Maximum Taxi Gross Weight
MTOW	Maximum Take-off Weight
NDT	Non Destructive Test
NM	Nautical mile(s)
KNKT / NTSC	*Komite Nasional Keselamatan Transportasi* / National Transportation Safety Committee
PIC	Pilot in Command
QFE	Height above aerodrome elevation (or runway threshold elevation) based on local station pressure
QNH	Altitude above mean sea level based on local station pressure
RESA	Runway End Safety Area
RPM	Revolution Per Minute
SCT	Scattered
S/N	Serial Number
SPM	Standard Practices Manual
TS/RA	Thunderstorm and rain
TAF	Terminal Aerodrome Forecast
TSN	Time Since New
TT/TD	Ambient Temperature/Dew Point
TTIS	Total Time in Service
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

INTRODUCTION

SYNOPSIS

On 16 January 2009, a Boeing Company 737-400 aircraft, registered PK-MDO, was being operated on an Instrument Flight Rules (IFR) scheduled passenger service from Sultan Hasanuddin Airport Makassar as flight MZ 762, with an intended destination of Frans Kaisiepo Airport, Biak. There were two pilots, five flight attendants, and 164 passengers on board including 14 infants.

The co-pilot was intended to be the handling pilot on this sector, while the Pilot in Command (PIC) was the support/monitoring pilot.

The flight was the second flight sector of the day for the pilots and the aircraft, after the first departure from Soekarno–Hatta Airport, Jakarta to Makassar. There was no abnormality reported on the first sector. The actual aircraft turn around time at Makassar was about 55 minutes prior the next departure.

The crew taxied out off apron and proceed to runway 31 for departure. There was another aircraft taxied out before them. The crew elected to taxi slowly to prevent hold on short of runway to give sufficient distance to the traffic ahead. The crew successfully managed the taxi speed and entered the runway for departure without stopping the aircraft.

The aircraft had a total takeoff weight of 60,400 kg and was configured for a takeoff with flap 5. The V1 for this weight and configuration was 145 knots.

Weather at the airport was raining and the runway was wet. The crew used full thrust take off power.

The aircraft started to roll for takeoff. The PIC set the takeoff thrust while the co-pilot as pilot flying controlled the direction of the aircraft. The PIC call “80” to the co-pilot as the aircraft’s speed passed 80 knots. At a speed of approximately 125 kts, the PIC noticed a vibration on the aircraft and the acceleration discontinued. The PIC elected to abort the takeoff by retarding both thrust levers to idle and selecting to reverse thrust. The co-pilot reported that he noticed the speed brake lever extended and the auto brake disarm light illuminated, while the aircraft speed decelerated through 80 knots.

The PIC controlled the aircraft to keep it on the centreline by using the rudder pedal. The aircraft decelerated and when it reached the normal taxi speed, the PIC turned the aircraft to the left into the runway turning area. He intended to taxi the aircraft back to the apron. An airport security officer who was close to the aircraft and witnessed the incident, gave a hand signal to the PIC indicating that taxi should not be continued.

The PIC stopped the aircraft on the runway turning area. Both left tires were severely damaged. Both right main wheel tires deflated as the fuses had melted by overheat. Part of the left main landing gear door detached.

No one was injured during this serious incident.

This serious incident was the second occurrence to the same aircraft (PK-MDO) at the same airport (Makassar Airport). The first serious incident occurred on 20 October 2008.

The analyses of both serious incidents are quite similar.

1 FACTUAL DATA

1.1 HISTORY OF THE FLIGHT

On 16 January 2009, a Boeing Company 737-400 aircraft, registered PK-MDO, was being operated on an Instrument Flight Rules (IFR) scheduled passenger service from Sultan Hasanuddin Airport Makassar[1] as flight MZ 762, with an intended destination of Frans Kaisiepo Airport, Biak.

The co-pilot was intended to be the Pilot Flying on this sector, while the Pilot in Command (PIC) was the Pilot Monitoring.

The flight was the second sector of the day for the pilots and the aircraft, after the first departure from Soekarno–Hatta Airport, Jakarta to Makassar. The flight was uneventful.

The aircraft turn around time at Makassar was about 55 minutes.

The crew taxied out off apron and proceed to runway 31 for departure. There was another aircraft taxied out before them. The crew elected to taxi slowly to prevent hold on short of runway to give sufficient distance to the traffic ahead. The crew successfully managed the taxi speed and entered the runway for departure without stopping the aircraft.

There were two pilots, five flight attendants, and 164 passengers on board including 14 infants. The aircraft had a total takeoff weight of 60,400 kg and was configured for a takeoff with flap 5. The V1[2] for this takeoff configuration was 145 knots.

Weather at the airport was raining and the runway was wet.

The PIC executed full thrust[3] take off power and the co-pilot controlled the direction of the aircraft. The PIC call “80” to the co-pilot as the aircraft’s speed passed 80 knots. At a speed of approximately 125 knots, the PIC noticed a vibration on the aircraft and the acceleration discontinued. The PIC elected to abort the takeoff. The co-pilot reported that he noticed the speed brake lever extended and the auto brake disarm light illuminated, while the aircraft speed decelerated through 80 knots.

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1 Sultan Hasanuddin Airport, Makassar will be named Makassar for the purposes of this report.

2 V1 is maximum safety speed to decide continue or abort the take off.

3 Full thrust take off power is the maximum take off power allowed with regards to temperature and airport elevation. For less aircraft take off weight, lower take off power setting may be uses with refer to the assumed temperature suitable for the weight. This lower take off power setting commonly named ‘reduced take off thrust’.

The PIC controlled the aircraft to keep it on the centreline by using the rudder pedal. The aircraft decelerated and when it reached the normal taxi speed, the PIC turned the aircraft to the left into the runway turning area. PIC intended to taxi the aircraft return to apron. An airport security officer who was close to the aircraft and witnessed the incident gave a hand signal to the PIC indicating that taxi should not be continued.

The PIC stopped the aircraft on the runway turning area. Both left tires were severely damaged. Both right main wheel tires deflated as the fuses had melted by overheat. Part of the left main landing gear door detached.

No one was injured during this serious incident.

This serious incident was the second occurrence to the same aircraft (PK-MDO) at the same airport (Makassar Airport). The first serious incident occurred on 20 October 2008.

Figure 1: The aircraft after the incident being prepared to be towed to apron. (Note: the scratch on the runway was originated from the first occurrence on 20 October 2008)

1.2 INJURIES TO PERSONS

Injuries	Flight crew	Passengers	Total in Aircraft	Others
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	7	164	171	-
TOTAL	**7**	**164**	**171**	**-**

1.3 DAMAGE TO AIRCRAFT

Both tires on left main wheel (position number 1 and 2) were seriously damaged and only a small portion of the tires were remain intact to the wheel hubs. Moreover both brake assemblies and the wheel hubs were severely rubbed by the runway.

Figure 2: The damage of wheel hub number 1 and 2

Both tires on the right main landing gear (number 3 and 4 tire) deflated due to overheat.

The left outer main landing gear door was detached from the aircraft.

1.4 OTHER DAMAGE

There was no other damage reported.

1.5 PERSONNEL INFORMATION

The pilots held valid licenses and ratings for the operation of the aircraft. This section covering flight crew is not relevant to this serious incident.

1.6 AIRCRAFT INFORMATION

1.6.1 General

Registration Mark	:	PK-MDO
Manufacturer	:	Boeing Manufacturer
Country of Manufacturer	:	United State of America
Type/ Model	:	B737-400
Serial Number	:	24069
Date of manufacture	:	November 1988
Certificate of Airworthiness	:	Valid until 03 August 2009
Certificate of Registration	:	Valid until 18 June 2010
Category	:	Transport
Time Since New	:	50,966 hours 55 minutes
Cycles Since New	:	29,949 cycles
Last Major Check	:	48,711 hours
Last Minor Check	:	50,931 hours

The aircraft was within weight and centre of gravity limits at the time of the serious incident.

1.6.2 Wheels Data

All four wheel hubs of the main landing gear installed in the aircraft were applicable for Boeing 737 – 200 and 737-300/400*/500[4].

ALS CMM (Aircraft Landing System Component Maintenance Manual) stated that both wheel assembly types must be overhauled every 24 months or 1800 Cycles whichever occur first.

ALS (Aircraft Landing System) recommends operators adopt a life-limit replacement plan for the machine bolts (60) in an effort to reduce inspection time and potentially reduce in-service failure rates. ALS

[4] * note is for Maximum Taxi Gross Weight (MTGW) limitation applicable to this configuration is 144,000 pounds (65,318 Kg).

initially recommends that the life limit be set at 8,000 landings. Adjustments to the life limit may be made, depending on the individual operator's acceptable in-service failure rate. If a life-limit replacement plan is adopted, NDT inspections of machine bolts are optional. Refer to ALS SPM (ATA 32-49-01), check section for more detailed information regarding implementation of a life-limit replacement plan.

Cadmium plating should be restored on the machine bolt after 10 nut installations to maintain joint lubricant, critical to achieving proper joint preload during installation. Instruction for re-plating the machine bolts is found in the rear section. As an alternative, if the self-locking nuts (50B) are replaced after 10 uses, the machine bolts do not need to be re-plated. Refer to ALS SPM (ATA 32-49-01). Check section for additional information regarding ALS recommendation for maintaining cadmium plating in the joint through a self-locking nut replacement plan

1.7 METEOROLOGICAL INFORMATION

Not relevant to this serious incident.

1.8 AIDS TO NAVIGATION

Not relevant to this serious incident.

1.9 COMMUNICATIONS

There was no radio communications considered to be relevant to this serious incident.

1.10 AERODROME INFORMATION

Airport Name	:	Sultan Hasanuddin
Airport Address	:	Makassar PO Box 90552
Airport Authority	:	PT. Angkasa Pura I (Persero)
Coordinate	:	05º 03' 39" S 119º 33' 16" E
Elevation	:	47 feet
Runway Length	:	2,500 meters
Runway Width	:	45 meters
Azimuth	:	13 – 31 (127 degrees / 307 degrees magnetic)
Surface	:	Asphalt
Strength	:	12,500 lbs

1.11 FLIGHT RECORDERS

The aircraft was equipped with a Solid State Digital Flight Data Recorder (SSFDR) and a Solid State Cockpit Voice Recorder (SSCVR) with a 30 minutes recording time. After the serious incident, the APU was running throughout all preparation and towing process for more than 2 hours. The power sources to the SSFDR and SSCVR were not isolated immediately following the serious incident, resulting in the SSCVR being overwritten by data not related to the occurrence.

The SSCVR was read out at the Merpati Maintenance Facility in Surabaya under the supervision of NTSC investigators. The SSCVR was conformed to be consisted of conversations between engineers in the cockpit and on the ground about the preparation and towing processes.

The SSFDR recorded data had been collected and custody by NTSC for further analysis.

1.12 WRECKAGE AND IMPACT INFORMATION

The number one wheel hub which was severely worn-out had four missing tie bolts (see Figure 3).

Figure 3: The number one wheel hub

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

Not relevant to this serious incident.

1.14 FIRE

There was no pre and post- impact fire.

1.15 SURVIVAL ASPECTS

Not relevant to this serious incident.

1.16 TESTS AND RESEARCH

Not relevant to this serious incident.

1.17 ORGANIZATIONAL AND MANAGEMENT INFORMATION

1.17.1 PT. Merpati Nusantara Airlines

PT. Merpati Nusantara Airlines is a government own company. The company was based in Jakarta and operates since 1962. PT. Merpati Nusantara Airlines hold AOC number 121/002.

The company operated 1 Boeing B 737-400, 5 B737-300 and 3 B737-200, also operated 2 Fokker F 100, 1 Fokker F-28, 1 Fokker F-27, 2 MA60, 2 CN 235, 3 CASA C212-200 and 6 DHC6 Twin Otter.

The company operated domestic flight within Indonesia and also regional flight to Dilli and Kuala Lumpur

1.18 ADDITIONAL INFORMATION

1.18.1 Similar Occurrence

This serious incident was the second occurrence to the same aircraft (PK-MDO) at the same airport (Makassar Airport). The first serious incident occurred on 20 October 2008 as reported on KNKT.08.10.21.04.

The analyses of both serious incidents are quite similar.

1.18.2 Other finding

During the course of investigation, it was revealed of peeling off hard chromium plating on the lower strut of the left hand main landing gear. However, this finding would not jeopardise safety of the flight and was not relevant to this serious incident (see Figure 4).

Figure 4: The lower strut left hand main landing gear

1.19 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES

The investigation was conducted in accordance with NTSC approved policies and procedures, and in accordance with the standards and recommended practices of Annex 13 to the Chicago Convention.

2 ANALYSIS

2.1 SEQUENCE OF WHEEL FAILURE

The investigation determined that during takeoff roll, the wheel number one experience tire deflation due to loosening of the wheel hub halves. It was due to the failure of four out of sixteen tie bolts.

The wheel number two then suffered tire overloading. It led to burst of tire number two.

At a speed of approximately 125 knots, the PIC noticed a vibration on the aircraft and elected to abort the takeoff.

The runway was wet and the braking action during aborted takeoff had led to hydroplaning. It was indicated by the reverted rubber on the tire number 3 and 4 (see Figure 5). The hydroplaning caused a blocking of the brake system. Furthermore, the hydroplaning caused all wheels did not rotate. Wheels number 1 and 2 which tire had deflated experienced wheel hubs friction with the runway. The friction was so intense so that the wheel hubs and the brakes assemblies abraded to about ten centimetres deep.

The number 3 and 4 wheels which at that time still had tire pressure experienced reverted rubber due to friction with the runway.

The heavy friction on the wheels led to acceleration discontinued.

Figure 5: Reverted rubber

2.2 BOLTS FAILURE

The four tie bolts failed due to premature fatigue (see Figure 6). The disintegration of those bolts occurred during the take off roll. The bolt pieces were recovered at the runway of Makassar airport.

Figure 6: Fatigue failure on the tie bolt

Fatigue cracks were originated from the bolt threads. The sequences of bolt failure were identified. The first occurrence of failure was characterized by the largest fatigue area. The fatigue crack propagation occurred sometimes during the operation. The crack on the bolt thread was likely initiated at locations where corrosion started. The high strength bolt start to corrode at location which cadmium plating peeled off.

If a tie bolt broken, the adjacent tie bolts will carry extra load causing a series of bolt fatigue failure. Following tie bolts fatigue failure, all the remaining bolts shall be rejected.

2.3 WHEEL HUB LOAD RATING

Similar to what has been written in the report KNKT.08.10.21.04, the following analysis valid also to this second occurrence.

The wheel hubs installed in the aircraft (P/N 2606671) were applicable to Boeing 737-200 and as well as Boeing 737-300/400*/500. There is another type of wheel hub (P/N 2609801) which is designated to Boeing 737-400 that is applicable to higher load rating (B737-400 HGW (High Gross Weight)). The higher load rating to the HGW wheel hub was due to a large dimension of wheel hub bearings.

The fatigue crack initiation on the bolts was most likely due to damage of cadmium plating. The CMM instructed to perform cadmium re-plating

after ten times of wheel hub assembling. However it was not done, so that initial corrosion to the bolt thread may lead to the fatigue crack initiation.

2.4 MAINTENANCE ASPECT IN WHEEL MANAGEMENT

Similar to what has been written in the report KNKT.08.10.21.04, the following analysis valid also to this second occurrence.

ALS CMM (Aircraft Landing System Component Maintenance Manual) state that both wheel assembly types must be overhauled every 24 months or 1,800 Cycles whichever occur first.

The inspection of all bolts may refer to paragraph 1.17.1.

The operator did not perform as per Component Maintenance Manual, more specifically on the cadmium re-plating after ten times of wheel hub assemblies.

3 CONCLUSIONS

3.1 FINDINGS

- The aircraft was certified as being airworthy at the time of serious incident.
- The aircraft was within weight and centre of gravity limits at the time of the serious incident
- Both pilots held valid licenses and ratings for the operation of the aircraft.
- The investigation determined that tire number one had deflated prior to the aborted take off, while tire number two deflated during the aborted take off due to overload.
- Failure of number one and number two tires caused severe aircraft vibration which was observed by the flight crew.
- During the aborted take off, the number three and four wheels experience hydroplaning as indicated by reverted rubber.
- The hydroplaning caused the wheels did not rotate. It caused also the rubbing of the wheel hubs and brake assemblies number one and two to the runway.
- The rubbing action caused the discontinued acceleration as observed by the pilot.
- There are two types of wheel hubs applicable for B 737. The wheel hub installed in the aircraft were applicable to Boeing 737-200 and as well as Boeing 737-300/400*/500. Another type of wheel hub is designated to Boeing 737-400 and applicable to higher load rating.
- The sequences of bolts failure were identified as a series of disintegration due to fatigue failure.
- The lack of cadmium re-plating to the tie bolts initiated corrosion fatigue.

3.2 CAUSES

- The tire failure of the left landing gear was initiated by the failure of 4 of 16 bolts installed that experienced fatigue crack.
- The operator failed to perform maintenance program to the wheel hub tie bolts especially to the cadmium re-plating.

4 SAFETY ACTIONS

At the time of issuing this Draft Report, the National Transportation Safety Committee had not been informed of any safety actions resulting from this serious incident.

5 SAFETY RECOMMENDATION

As a result of the investigation into this serious incident, the National Transportation Safety Committee made the following recommendations.

5.1 RECOMMENDATION TO PT. MERPATI NUSANTARA AIRLINES

The National Transportation Safety Committee recommends that the PT. Merpati Nusantara Airline should perform cadmium re-plating to the tie bolts after ten times wheel hub assembling as stated in the CMM.

5.2 RECOMMENDATION TO PT. MERPATI NUSANTARA AIRLINES

The National Transportation Safety Committee recommends, Refer to Honeywell Aircraft Landing System (ALS) CMM chapter 32-40-09, the PT. Merpati Nusantara Airline should:

- For single bolt failures, each tie bolt adjacent to the broken bolt should be removed and scrapped.
- For multiple bolt failures, all tie bolts in the wheel should be scrapped

5.3 RECOMMENDATION TO PT. MERPATI NUSANTARA AIRLINES

The National Transportation Safety Committee recommends, Refer to Honeywell Aircraft Landing System (ALS) CMM page 518, Attachment Hardware Inspection, the PT. Merpati Nusantara Airline should:

- Operator should adopt a life-limit replacement plan for the wheel hub machine bolts to the life limit at 8,000 landings.
- Cadmium plating should be restored on the machine bolt after 10 nut installations.

5.4 RECOMMENDATION TO THE DIRECTORATE GENERAL OF CIVIL AVIATION (DGCA)

The National Transportation Safety Committee recommends that the Directorate General Civil Aviation to oversight the operators in the above mentioned issues.

6 APPENDIX

Appendix A: Excerpt Honeywell Component Maintenance Manual

Honeywell

Honeywell International Inc.
Aircraft Landing Systems (CAGE 55284)
3520 Westmoor Street
South Bend, Indiana 46628-1373
https://pubs.cas.honeywell.com

737-200/300/400/500

MAIN WHEEL ASSEMBLY

PART NUMBERS 2606671-1, 2606671-2 AND 2606671-3

COMPONENT MAINTENANCE MANUAL
with ILLUSTRATED PARTS LIST

NOTICE: This is a reprint. All basic and revised pages have been combined into one document replacing Publication No. 12-558 and revisions thereto.

D. Attachment Hardware Inspection.

4.0	Attachment Hardware	Inspection Intervals: Tire Change	Inspection Intervals: Overhaul
NOTE:	ALS recommends operators to adopt a life-limit replacement plan for the machine bolts (60) in an effort to reduce inspection time and potentially reduce in-service failure rates. ALS initially recommends that the life limit be set at 8,000 landings. Adjustments to the life limit may be made, depending on the individual operator's acceptable in-service failure rate. If a life-limit replacement plan is adopted, NDT inspections of machine bolts are optional. Refer to the ALS SPM (ATA 32-49-01) for more detailed information regarding implementation of a life-limit replacement plan.		
NOTE:	Cadmium plating should be restored on the machine bolt after 10 nut installations to maintain joint lubricity, critical to achieving proper joint preload during installation. Instructions for replating the machine bolts are found in the Repair section. As an alternative, if the self-locking nuts (50B) are replaced after 10 uses, the machine bolts do not need to be replated. Refer to the ALS SPM (ATA 32-49-01) for additional information regarding ALS recommendation for maintaining cadmium plating in the joint through a self-locking nut replacement plan.		
4.1	Visual - Inspect machine bolt (60) date codes if a life-limit replacement plan is used. Retire machine bolts exceeding the established life limit.	X	X
4.2	Visual - Examine shop records to determine number of accumulated self-locking nut (50B) installations on the machine bolts (60). If 10 reuses or tire changes have been previously accomplished, replace the machine bolt or restore the cadmium plating per the Repair section. If the self-locking nuts are replaced or replated after 10 reuses, this step may be omitted.	X	X
4.3	Visual - Inspect machine bolt (60) for corrosion and mechanical damage per the ALS SPM (ATA 32-49-01). Replace machine bolt as required. Missing cadmium plating on the shank or head of the machine bolt is not cause for rejection unless corrosion pitting is observed.	X	X
4.4	NDT - Perform magnetic particle inspection on machine bolts (60) per the ALS SPM (ATA 32-49-01). Retire machine bolts with crack indications. This inspection may be omitted if a life-limit replacement plan is used.	X	X
NOTE:	ALS recommends operators replace the self-locking nuts (50B) after 10 uses to ensure cadmium plating is present in the thread interface. Refer to the ALS SPM (ATA 32-49-01) for additional information on this subject. Instructions for replating the self-locking nuts are found in the Repair section.		
4.5	Visual - If a 10-reuse replacement policy is used for the self-locking nut (50B), examine shop records to determine number of accumulated self-locking nut installations on the machine bolts (60). If 10 reuses or tire changes have been previously accomplished, replace the self-locking nut.	X	X

4.0	Attachment Hardware	Inspection Intervals	
		Tire Change	Overhaul
4.6	Visual - Inspect self-locking nut (50B) for corrosion and mechanical damage per the ALS SPM (ATA 32-49-01). Replace self-locking nut as required.	X	X
4.7	Measurement - Inspect locking feature of self locking nut (50B) for minimum reusable torque as shown in Figure 801 and the ALS SPM (ATA 32-49-01). Discard nuts not meeting this requirement. This step may be omitted if a 10-reuse replacement plan is used.	X	X
4.8	Measurement - At operator option based on service experience with nut loosening, check locking feature of self-locking nuts (95, 140) for minimum reusable torque per Figure 801. Discard nuts not meeting the minimum requirement.		O
4.9	Visual - Inspect all miscellaneous attachment hardware not mentioned above for corrosion and damage.	X	X

E. Thermal Fuse Plugs, Valve Assembly, Safety Relief Valve, and Plugs Inspection.

5.0	Thermal Fuse Plugs (180, 182 as Applicable), Valve Assembly (5), Safety Relief Valve (75A), and Plugs (183, 184 as Applicable)	Inspection Intervals	
		Tire Change	Overhaul
5.1	Visual - Inspect threads for damage.		X
5.2	Visual - Inspect preformed packing groove or land on each component. Ensure no sharp edges or burrs are present that might cut a preformed packing upon installation.		X
5.3	Visual - Inspect thermal fuse plugs (180, 182) for a melted or partially melted condition. If melted, refer to Paragraph 4. for additional instructions.	X	X
5.4	Measurement - Check safety relief valve (75A) for air leakage by installing in a suitable fixture and pressurizing to 300 psi (21 bars). No leakage is allowed. Replace defective safety relief valves.		X

IPL Fig. & Item No.	Item	Lubrication*	Torque Value Pound-Inches (Newton-Meters)	
			Minimum Reusable	Wrench Torque (Target/Nominal Torque Value is Underlined)
1-5	Valve Assembly	None	N/A	175 ± 25 (19.8 ± 2.8)
1-50B	Self-Locking Nuts (With tire installed)	AMS 2518 or MIL-T-5544	19 (2.1)	Preliminary: 875 (98.9) Final: 1750 ± 50 (197.7 ± 5.6)
1-50B	Self-Locking Nuts (With tire installed)	MIL-T-83483 or MIL-PRF-83483	19 (2.1)	Preliminary: 800 (90.4) Final: 1600 ± 50 (180.8 ± 5.6)
1-75A	Safety Relief Valve	MIL-L-23398 or MIL-L-46147	N/A	175 ± 25 (19.8 ± 2.8)
1-135	Machine Screws	None	N/A	70 ± 10 (7.9 ± 1.1)
1-95, 140	Nut	None	2 (0.2)	45 ± 5 (5.1 ± 0.6)
1-182	Thermal Fuse Plug	None	N/A	80 ± 5 (9.0 ± 0.6)
1-183	Machine Thread Plug	MIL-L-23398 or MIL-L-46147	N/A	175 ± 25 (19.8 ± 2.8)

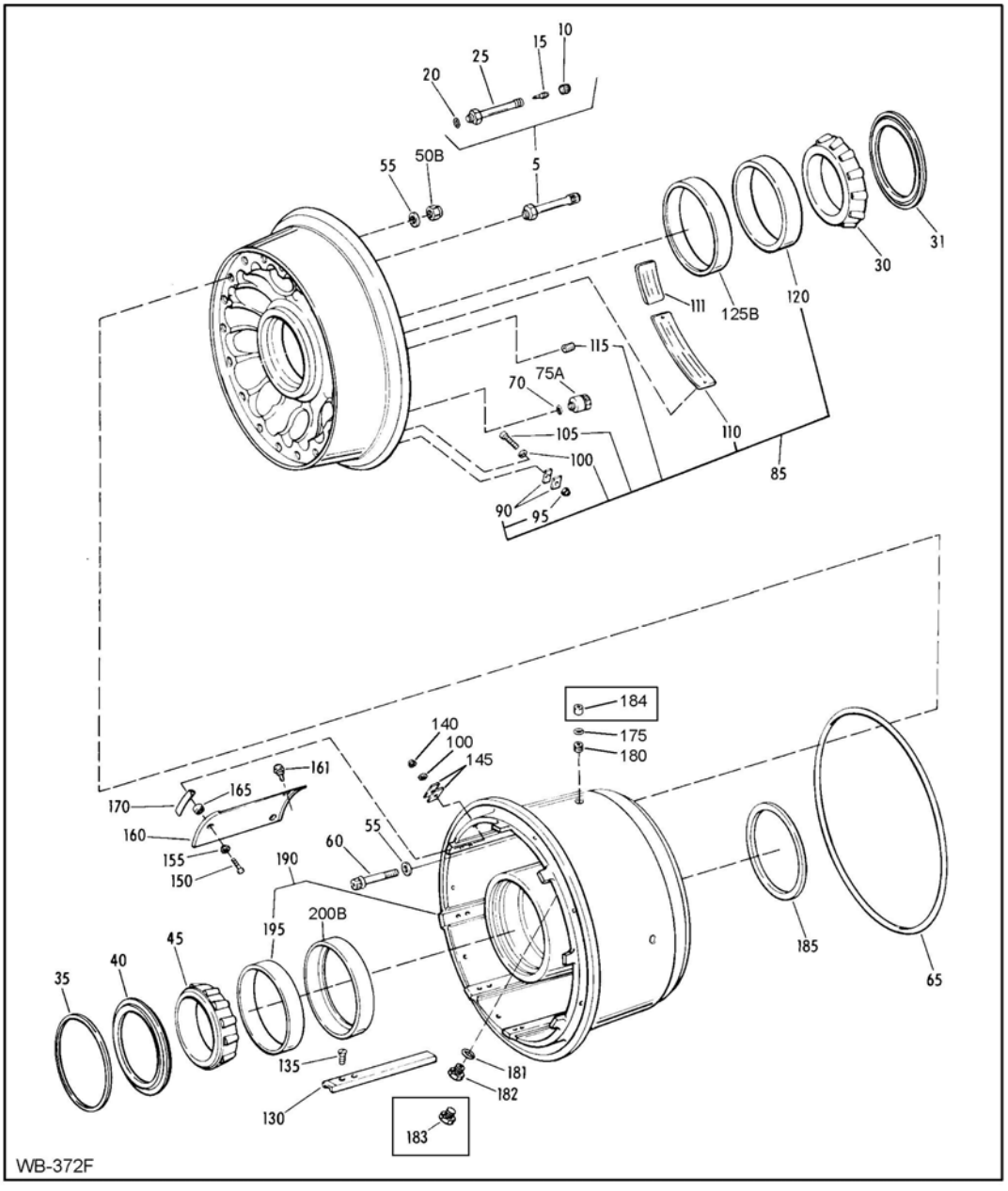
CAUTION: IF ANY BOLT OR NUT IS INADVERTENTLY TIGHTENED TO A VALUE THAT IS 10% OR MORE ABOVE THE SPECIFIED FINAL TORQUE VALUE, THEN THAT BOLT AND NUT SHOULD BE SCRAPPED. ALSO, INSPECT MATERIAL UNDER THE NUT AND BOLT FOR YIELDING.

NOTE: Torque wrenches must be accurate and capable of reproducing specified values per Federal Specification GGG-W-686. Aircraft Landing Systems (ALS) recommends torquing to the target/nominal value.

NOTE: Packing lubrication that contacts the threads of the inflation valve, safety relief valve, and thermal fuse screws need not be removed before installation.

* When lubrication is specified, lubricate threads and bearing surfaces at each installation with the specified compound. Use full strength. Do not dilute. Lubricants may be purchased from lubrication vendors per the referenced MIL or AMS specifications identified above.

Table of Torque Values
Figure 801



Main Wheel Assembly Exploded View
Figure 1

	FIG. ITEM	PART NUMBER	AIRLINE PART NO.	NOMENCLATURE	EFF. CODE	UNITS PER ASSY.
	1-20B	732		. . PACKING, Preformed . . . . . (V27783) (V55284, 2602195)		1
	–20C	2602195		. . PACKING, Preformed		1
	25	TR761-02		. . STEM, Valve . . . . . (V79934) (V55284, 2606690)		1
	–25A	VS827-1		. . STEM, Valve . . . . . (V17875) (V55284, 2606690)		1
	–25B	6027-1		. . STEM, Valve . . . . . (V27783) (V55284, 2606690)		1
	–25C	2606690		. . STEM, Valve		1
R	–26	151387		. . PACKING, Preformed . . . . . (For service repair) (See Figure 646)		AR
	30	27690*		. BEARING, Tapered roller . . . . . (V60038) (V55284, 103S187, superseded by P/N 2606294, use until exhausted) (Outboard) (V55284, 2606294, supersedes P/N 103S187)		1
	31	2610036		. SEAL, Grease (Optional) . . . . . (Added by SB 2606671-32-028)		1
	35	2606169-11		. RING, Retaining		1
	40	2606693		. SEAL, Grease		1
	–41	2608896		. . WASHER, Grease seal nib repair		AR
	45	596*		. BEARING, Tapered roller . . . . . (V60038) (V55284, 103S205, superseded by P/N 2606298, use until exhausted) (V55284, 2606298, supersedes P/N 103S205)		1
	–50	LH3840T-9		DELETED		
	–50A	65270-918		DELETED		
	50B	2604374		. NUT, Self-locking		16
	55	2602542		. WASHER, Recessed		32
	60	2602540		. BOLT, Machine		16
	65	2607266		. PACKING, Preformed		1

* This P/N bearing, when ordered from ALS, meets Timken Performance Code 20629 (629 Code). To obtain 629 Code bearings from Timken distributors, the 629 Code must be specified, otherwise standard product may be shipped.

FIG. ITEM	PART NUMBER	AIRLINE PART NO.	NOMENCLATURE	EFF. CODE	UNITS PER ASSY.
1-70	TR-RG6		. PACKING, Preformed ..... (V79934) (V55284, 2602195)		1
–75	A3323-9		DELETED		
75A	2605243		. VALVE, Safety relief		1
–80	D1002-2		DELETED		
85	2606692		. WHEEL HALF ASSEMBLY, ... Outboard (Superseded by P/N 2608058, use until exhausted) (Permanently marked as P/N 2606688 or 2607087)	A,C	1
–85A	2608058		. WHEEL HALF ASSEMBLY, ... Outboard (Supersedes P/N 2606692) (Superseded by P/N 2607949-1, use until exhausted) (Permanently marked as P/N 2607949)		1
–85B	2607949-1		. WHEEL HALF ASSEMBLY, ... Outboard (Supersedes P/Ns 2608058 and 2606692) (Permanently marked as P/N 2607949)		1
90	146287		. . WEIGHT, Balance ..... (0.12 oz) (3.40 g)		AR
–90A	153230		. . WEIGHT, Balance ..... (0.21 oz) (5.95 g)		AR
–90B	153237		. . WEIGHT, Balance ..... (0.41 oz) (11.62 g)		AR
–90C	2606616		. . WEIGHT, Balance ..... (0.15 oz) (4.25 g)		AR
–90D	2606715		. . WEIGHT, Balance ..... (0.29 oz) (8.22 g)		AR
95	22FH1032		. . NUT, No. 10-32 (V56878) ..... (V55284, 146204) (Superseded by P/N NAS679A3, use until exhausted)		AR
–95A	1801-02		. . NUT, No. 10-32 (V56878) ..... (V55284, 146204) (Superseded by P/N NAS679A3, use until exhausted)		AR
R –95B	NAS679A3		. . NUT, Self-locking ..... (Supersedes P/N 146204)		AR