

# TOYOTA REPORT (summary)

## Preventive maintenance by fluid contamination control at machinery plant 4 and 5

### 1. BACKGROUND

In December 1992, we installed several TRIPLE R Oil Cleaners on the 4D3 rod line with the intention to reduce failure downtime and repair time caused by contaminated hydraulic fluid, and started Hydraulic Fluid Contamination Control. We were very surprised by the significant improvements and results achieved. We therefore immediately started Fluid Contamination Control with TRIPLE R in the whole plant 4 and 5.

### 2. OBJECT

- By achieving a smooth operation of the equipment and by preventing possible failures,
- Reduce the failure rate and improve the operation rate by reducing hydraulic troubles.
  - Increase the oil longevity and reduce the number of oil changes and oil usage.
  - Reduce the maintenance costs; costs for parts replacement, repair man-hour, etc.
  - Increase the reliability of machinery operation and achieve a stable cycle time.

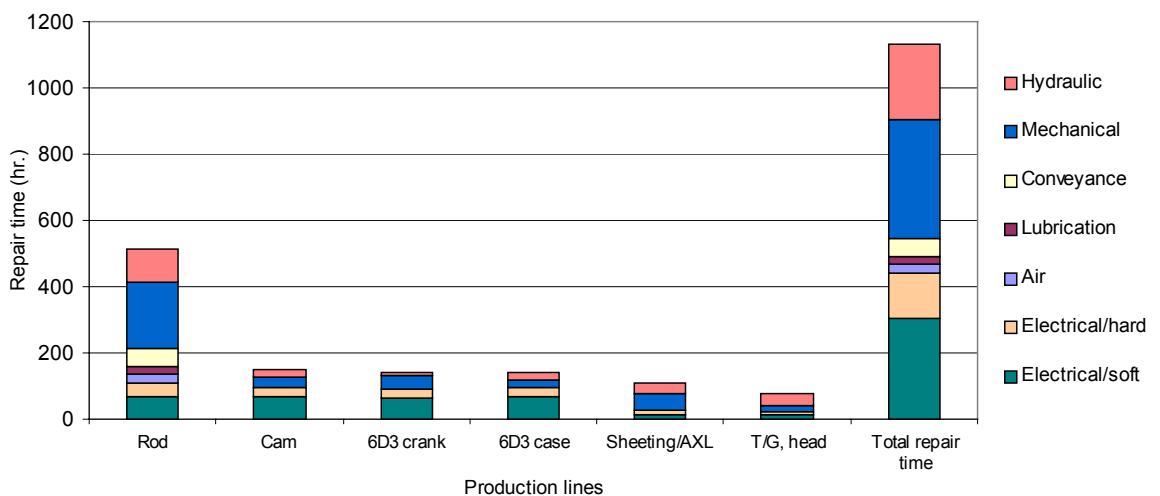
### 3. PROGRESSION REPORT

#### 3.1. Number of failures per line:

December 1992 - March 1993:

	1. Mechanical		2. Electrical	TOTAL
		Hydraulic failures among 1.		
Number of failures	490 cases	162 cases (= 33,1%)	434 cases	924 cases
Repair time	690 hr.	225 hr. (= 32,6%)	441 hr.	1.131 hr.

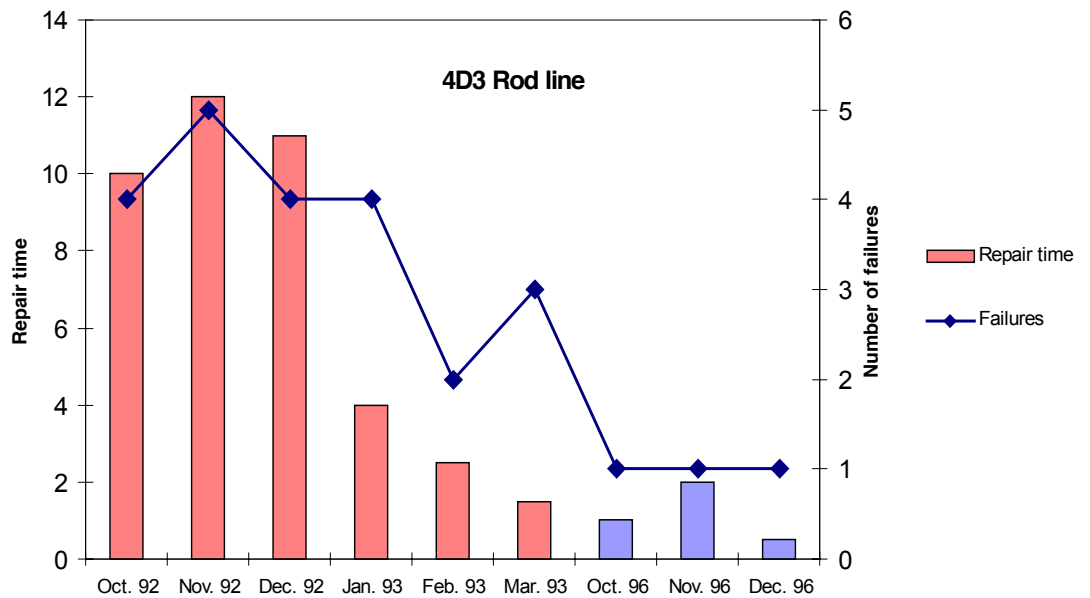
Approximatly 35% of these failures happened on the rod line.



**3.2. Progression of failures and repair time on the 4D3 rod line, before TRIPLE R and with TRIPLE R:**

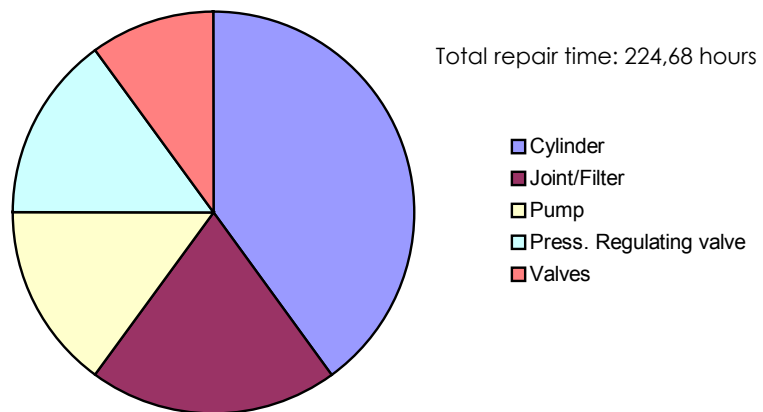
	Oct. 92 – Dec. 92	Jan. 93 – Mar. 93	Oct. 96 – Dec. 96
Number of failures	13 cases	9 cases	3 cases
Repair time	33 hr.	8 hr.	3 hr.

The figures show a dramatic reduction of hydraulic troubles in 4 years, although the number of machines had doubled.



**3.3. Component failure ratio ( from December 1992 – March 1993 ):**

Before TRIPLE R installation



### 3.4. Failures due to oil deterioration or oil oxidation:

COMPONENT	Common failure	Countermeasure
Cylinder	Oil leakage from rod seal Erosion of rod piston	Replace by new one Replace by new one
Filters	Blockage of strainer	Regular replacement and cleaning
Pumps	Abrasion of rotors and blades Abrasion of axles and sealing	Replacement by new parts and sealings
Pressure regulating valves	Working failure due to foreign matters	Adjustment of pressure Replace by new one
Valves	Working failure of spool Seizing	Replacement of the valves
Others	Change of the oil characteristics	Replace oil and clean tank

## 4. TAKEN ACTION

### 4.1. Installation of TRIPLE R Oil cleaner:

We made an installation plan in accordance to the analysed number of failures and repair times from Oct. 1992 to Mar. 1993.

Because we gave priority to the machines which had a lot of troubles, and also because of the budgets available, we could not immediately install TRIPLE R on all the machines of the line that had the most troubles (4D3 rod line).

Lines	Mar. 1993	Sep. 1993	Mar. 1994	Sep. 1994	Mar. 1995	Sep. 1995	Mar. 1996	Sep. 1996	TRIPLE R/ total	Ratio
1 Rod	13	2	1		7	1	2	1	27/47	57%
2 Cam				10	1	3		2	16/72	22%
3 Crank	1		1			1		3	6/21	29%
4 Case	1			1	3	3	3	2	13/51	25%
5 Sheeting		3	4		3	8	8	5	31/43	72%
6 T/G, head				2	3		4	5	14/36	39%
TOTAL	15	5	6	13	17	16	17	18	107/297	36%

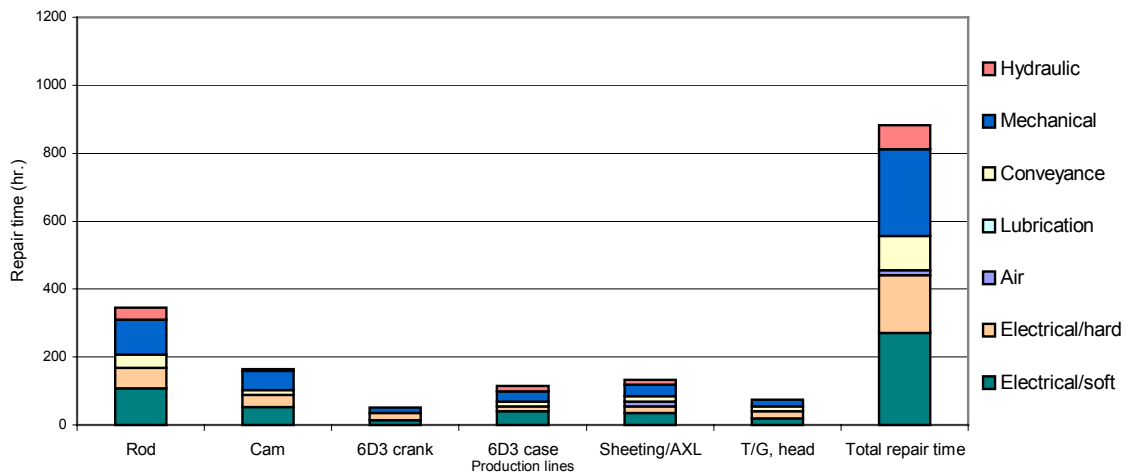
### 4.2. Other actions:

	Actions	Object	Q.	Remarks
1	Installation of oil gauge	Early detection of oil leakage.	3	Rod 6D1 Broaching machine ( from 400L to 30L). Sheet metal baling machine ( from 800L to 50L). Others: Fuji TFM.
2	Installation of hydraulic heater	Stable cycle time.	2	Pulse rise time: Sheet metal baling machine ( from 2hrs. every Monday to 0 hr.).
3	Pumps (from metering to variable)	Reduction of pump failures. Stable cutting speed.	5	Rod 4D3 Conveyance broaching machine loaders (from 11+5,5kW to 3,7 kW). Stable oil temperature.
4	Replacement of old piping	Prevention of oil leakage.	3	Case 6D3 Sleeve press ( 40L/work ). Rod 4D3, Toji TFM ( 50L/work ).
5	Re-evaluation of tank capacity	Reduce oil consumption.	7	Case 6D3 Trial assembling machine ( from 750L to 400L). Rod 4D3 bolthole TFM (from 850L to 350L).

## 5. RESULTS

### 5.1. Failures and repair time from December 1995 to March 1996:

	1. Mechanical		2. Electrical	TOTAL
		Hydraulic failures among 1.		
Number of failures	525 cases	69 cases (= 13,1%)	456 cases	981 cases
Repair time	542 hr.	71 hr. (= 13,1%)	441 hr.	983 hr.



### 5.2. Detail of results and comparison of the two periods:

	Repair time		Oil life	Maintenance cost	NAS grade
	Mechanic	Hydraulic	Oil used	Man-hour	
Period A	690 hr	225 hr	83.280 L.	225hr x 4.387 = 987.075 Yen	Over NAS 12
Period B	542 hr	71 hr	57.812 L.	71hr x 4.387 = 311.477 Yen	NAS 6 - 7
Results	-21,4%	-68,4%	-30,5%	675.598 Yen/year	

Period A : from April 1992 to March 1993

Period B : from April 1995 to March 1996; **remark that in this period the number of machines had doubled compared to period A!**

## 6. FUTURE AGENDA

Planning	Mar. 1997	Sep. 1997	Mar. 1998	Sep. 1998	Mar. 1999	Sep. 1999	Mar. 2000	Objects
1 Installation of TRIPLE R	15	15 units per period in average				15	212/297 units (75%)	
2 Filter change Patrol check	Has started	Regular filter changes & checks					Self maintenance-1: filter changes	
3 Fixing valves for sampling	68	69	Every time we install TRIPLE R				Self maintenance-2: regular sampling	
4 Installation of oil gauge	2	2 units per period				2	Reduction of oil use	
5 Installation of hydraulic heater	1	1	1	1	1		Stable oil temperature Improving cycle time	

## 7. TOYOTA GROUP FACTORIES using TRIPLE R

- TOYOTA      Kamigo  
                 Miyoch  
                 Miyochi  
                 Tutumi  
                 Takaoka  
                 Honshiya  
                 Hirose  
                 Kinuura  
                 Tahara  
                 Shimoyam
  
- DENSO      Anjiyo  
                 Nishio  
                 Ikeda  
                 Daian  
                 Takatana
  
- AISHIN SEIKI      Honshiya  
                 Handa  
                 Nishio  
                 Ogawa
  
- TOYOTA JIDOSHIYOOKI      Oobu  
                 Nagakusa  
                 Kariya
  
- AISHIN AW      No1 plant  
                 No2 plant  
                 Okazaki
  
- FUTABA
- SANGO
- INOATTKU
- TOYOTA GOSEI
- TOYOTA BOSHIYOKU
- TOKAIRIKA
- KOYO SEIKO
- TOKAI GOMU
- TOYOTA KOUKI