

**Prince of Songkla University**

**The Faculty of Engineering**

**Final Examination Semester 1**

**Year 2005**

**Date : 4 Oct 2005**

**Time : 13.30 - 16.30**

**Subject : 226-341 Maintenance Engineering**

**Room : R300**

Name : ..... Student code : .....

Part	1	2	3	Total
<b>Full score</b>	<b>40</b>	<b>25</b>	<b>35</b>	<b>100</b>
Score				

**คำสั่ง**

1. นำตำราหรือเอกสารใด ๆ เข้าห้องสอบได้
2. นำ Dictionary และ เครื่องคิดเลขเข้าห้องสอบได้ ทุกชนิด ใช้ดินสอได้
3. ข้อสอบนี้ มีทั้งหมด 3 ส่วน คะแนนเต็ม 100 คะแนน คะแนนแต่ละส่วนไม่เท่ากัน ตรวจสอบก่อนเริ่มทำ ( *ให้ทำในกระดาษคำตอบเท่านั้น ตอบนอกกระดาษคำตอบไม่มีคะแนน* )
4. เขียน ชื่อ หรือ รหัส ในกระดาษคำตอบทุกหน้าก่อนเริ่มทำ เพื่อป้องกันความสับสน ในกรณีกระดาษคำตอบหลุดจากฉบับ

**ทูลงการสอบ โทษขันต่ำปรับตกลในรายวิชานั้น**

**และพัทการเรียน 1 ภาคการศึกษา**

**ดร. กลางเดือน โพนนา**



Name : ..... Student Code : .....

**Part 1 Answer all questions. Each question has 3 points (only question no. 11 has 10 points). Total score for this part is 40 points.**

1. What are the advantages and disadvantages of bidding when maintenance parts are purchased?

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2. What are the advantages and disadvantages of periodical inspection and precision inspection?

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3. What is the benefit of using the codes of maintenance Information and Data ?

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4. What should be included in the standard of inspection?

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Name : ..... Student Code : .....

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5. What are six big losses of machines in IE department?

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6. What should be considered before planning the maintenance data system?

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7. What should be considered when starting the design of forms?

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Name : ..... Student Code : .....

8. What should be considered for purchasing machine parts?

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9. In each day, a machine is operating at loading time of 9 hours per shift, the factory operates 2 shifts a day. Breakdown time is 0.5 hour and changeovers/set ups is 1.5 hour each day. It produces 1000 parts each shift. Its designed capacity is 55 parts per hour. However, the amount defective is 30 parts and the amount re-processed is 25 parts. What is the overall effectiveness for this machine?

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10. How can organization motivate contract maintenance staffs?

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Name : ..... Student Code : .....

11. Explain these following terms: (10 points)

11.1 OEE

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11.2 permanent store

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11.3 Long-term unit price system

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11.4 PQCDSM

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11.5 MTTR and MTBF

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Name : ..... Student Code : .....

## **Part 2**

**The rubber land latex company in Hat Yai wants to establish TPM system. You are assigned to be a member of the team. Please answer these following questions. All data can be assumed where necessary.**

**(25 points)**

- 2.1 How should you recommend the company for starting period? (5 points)
- 2.2 Define a TPM policy (5 points)
- 2.3 Design training program for people involved (5 points)
- 2.4 How can we measure results of these programs? (5 points)
- 2.5 What type of work should they do contract maintenance? (5 points)



Name : ..... Student Code : .....

A handwritten signature or mark, possibly a stylized 'Q' or a similar character, located in the bottom right corner of the page.

Name : ..... Student Code : .....

### **Part 3**

**The rubber land latex company has two major types of machines which are latex separator and high speed precision lathe. From all information in the attached sheets, establish the following items. (35 points)**

- 3.1 Instruction standard for operating the latex separator machine (including steps for starting and stopping the machine) (10 points)
- 3.2 Instruction standard for assembling procedure of bowl of the latex separator machine (5 points)
- 3.3 Lubrication standard for both machines (5 points)
- 3.4 Inspection standard for both machines (5 points)
- 3.5 Inspection and PM check sheet (5 points)
- 3.6 PM yearly plan (5 points)



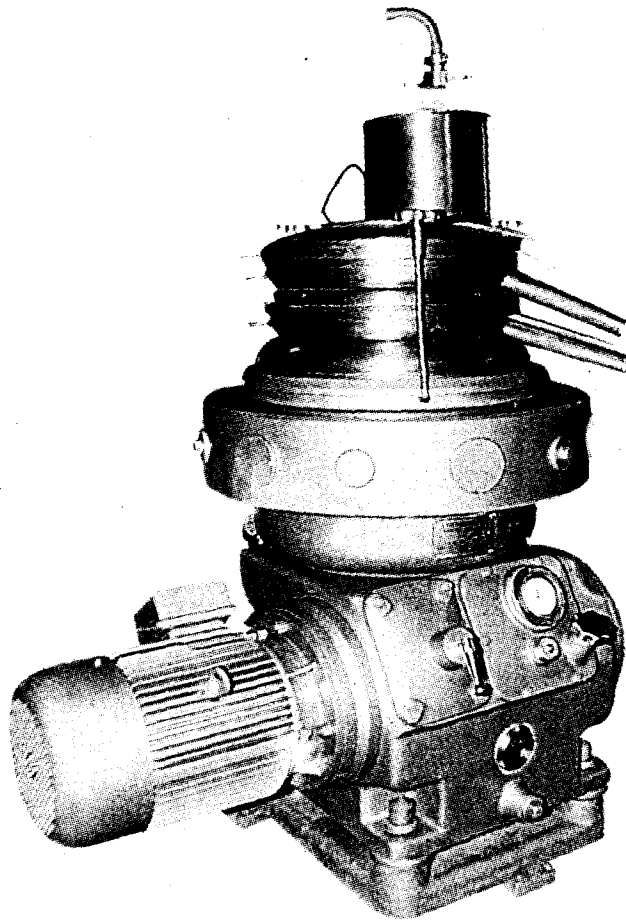


เครื่องฟอกนมข้น

ชนิด ๒๒๖-๓๔๑

(100 ลิตร)

# DR - 400(E) LATEX SEPARATOR OPERATION MANUAL



GUANGZHONG CENTRIFUGE MANUFACTURING CO. LTD.

THE PEOPLE'S REPUBLIC OF CHINA

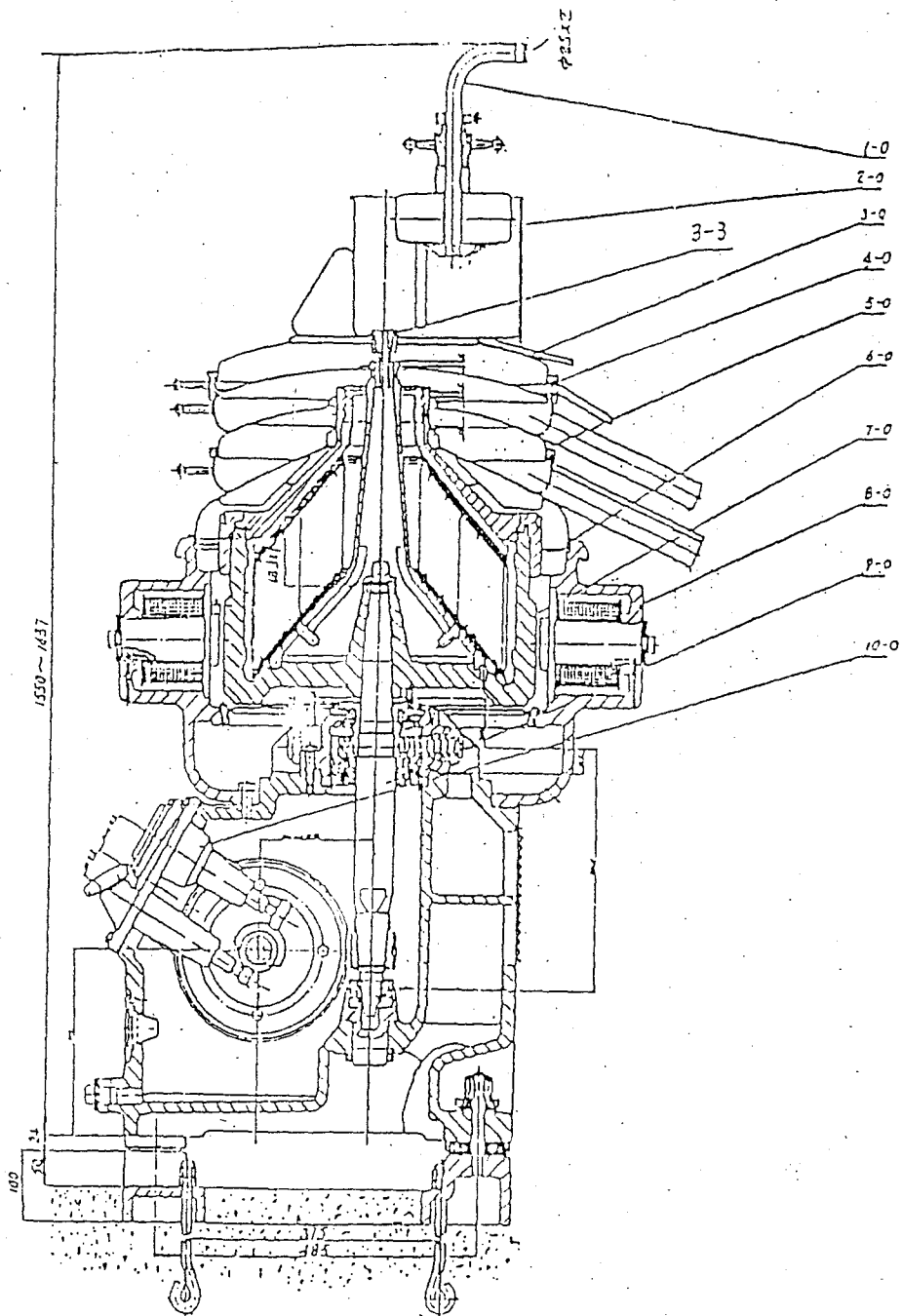


Fig.1 General drawing (motor direct-drive)

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|---------------------|-----------------------|-------------------|
| 1-0 Feed pipe       | 7-0 Bowl              | 16 Electric motor |
| 2-0 Float           | 8-0 Machine frame     | 001 Nut           |
| 3-0 Upper cover     | 9-0 Vertical shaft    | 002 Washer        |
| 4-0 Overflow device | 10-0 Tachco meter     | 003 Bolt          |
| 5-0 Upper collector | 11-0 Clamping_hook    |                   |
| 6-0 Lower collector | 12-0 Horizontal shaft |                   |

## 1. APPLICATION AND SPECIFICATION

This high speed sinking disk type separator is designed for the concentration of field latex and the removal of sludge. The bowl is made of high strength anti-corrosive stainless steel. Every bowl is strictly inspected to ensure high strength, so it is absolutely safe and reliable. The bowl is precisely balanced and runs steadily. All other parts in contact with process materials are made of stainless steel. They are good-looking, durable and easy to clean.

It carries such advantages as compact structure, convenient operation easy maintenance, excellent separation effect, etc.

### SPECIFICATION:

Separating factor	11,725
Bowl - Diameter	400mm
- Speed (Max.)	7,250R. P. M.
Disk gap	0.5mm
Nozzles (Adjusting screwed pipe, Fig. 6 Pt. 7-3)	
- Quantity	1 Set ( 15pcs)
- Length	9.5; 9.8; 10; 10.5; 11; -11.25; -11.5; -11.75; -12; 12.5; 13; 13.5; 14; 14.5; 15
Feed tubes (Fig. 1 Pt. No. 3-3)	
- Quantity	1 Set ( 5 pcs)
- Diameter	8.5, 8.75, 9, 10.5, 11.5
Electric motor - Type	Y160B-4B, Tropical $\Delta$ connection
- Power	11 KW
- Speed	1,460 R. P. M.
Through put capacity	300-600L/H, when the dry rubber content in the field latex is more than 25%, and the dry rubber content in the concentrate is more than 60%
Overall dimensions (L x W x H)	1,504 x 840 x 1,774mm
Weight	Appr. 1,000kg

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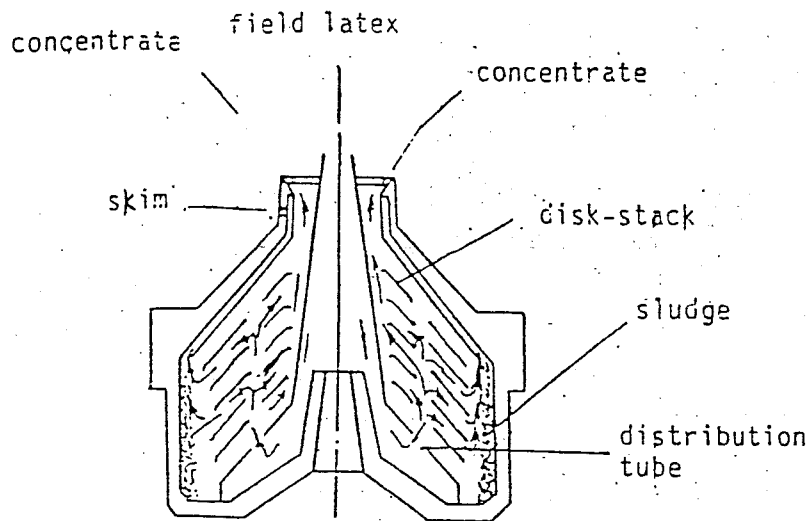


Fig. 3 Latex concentration

### 3. INSTALLATION

#### 3.1. FOUNDATION REQUIREMENT

The foundation plane is shown in Fig. 4. Enough space should be taken account for assembling and disassembling the horizontal shaft, the bowl and the covers. Generally speaking, the separator should be installed on the smooth and robust concrete foundation, and the support should be sunk into the foundation in order to lower the height of the machine (see Fig. 1). The weight of the foundation should be at least two or three times heavier than that of the machine. In addition, the surface of the foundation should be laid with porcelain tiles in order to make cleaning easy.

When the support and the machine frame are installed, a level gauge must be used to ensure that the level degree is within 0.008 mm per 100mm. Whenever unlevelling is found, metal pads should be put between the support and the foundation or between the damping rubber cover and the machine frame.

#### 3.2. INSTALLATION POINTS

3.2.1. The studs (Fig. 9 Pt. 823) and the damping rubbers should be fitted carefully. The studs should not touch the machine frame for eliminating vibration. The first nut on each stud should not be mounted so tightly that the damping rubbers can not be carried into effect. Be sure to lock the studs by the second nuts.

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## 4.2. PREPARATIONS BEFORE START

4.2.1. Before start, the following items should be checked:

Bowl.....Running freely and without noise.

Fasteners.....Tightened.

Braking system.....Loosened.

Gear box.....Filled with the lubrication oil.

Feed pipe.....Tightened.

Rotary direction of motor.....To ensure the bowl rotating clockwise

## 4.3. START AND OPERATION

### 4.3.1. START

The machine can be started when all parts are in good condition. It is a normal appearance that the friction sheets of the clutch will run at full speed. The starting time can be regulated by changing the three brake blocks (Fig. 8 Pt. 12-18).

### 4.3.2. FEED

When the machine runs at full speed, clean water will be first fed into the bowl fully without shutting the water cock until the water flows from the skim outlet, and then, let the field latex in.

### 4.3.3. OPERATION

4.3.3.1. While the machine is running, the level of the lubrication oil should be kept in the middle position of the oil view window. The tachometer should be read within 6880-7250r.p.m. and the counter, 117-123.5r.p.m..

4.3.3.2. Whenever the feed tubes are clogged, cleaning should be effected while the field latex is still being fed, because stopping feed should be avoided as far as possible otherwise clogging would appear in the bowl and the outlets.

4.3.3.3. When the machine runs for a period of time, a lot of sludge will be deposited on the surfaces of the disks, the periphery of bowl and the distribution tubes. The clog would also happens in the nozzles and the feed tubes. In this case, the machine should be stopped to clean the bowl, the collectors, etc.. In General, they should be cleaned every 2-4 hours running.

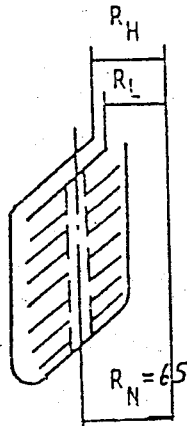


Fig. 5

#### 4.4. STOP

If the machine is to be stopped, do not forget shutting up the feed valve before depress "STOP" button. When the bowl slows down gradually, clean water should be fed into the bowl till no concentrate flows out of the upper collector, and clean water flows out of the lower collector. The bowl can also be cooled by washing, otherwise it is difficult to loosen the bowl nut (Fig. 6 Pt. 7-7) because of heat expansion.

When the bowl slows down to about 5000r. p. m., depress "BRAKE" button. A strong magnetic field will stop the bowl in a short time. The braking time should be 95 seconds, obtained by adjusting IR in the control box.

If the braking system is out of order, let the bowl slow down itself, and use the manual brake when it is slow enough.

#### 5. ASSEMBLING PROCEDURE OF BOWL (See Fig. 6)

5.1. To clean every part of the bowl before assembling.

5.2. To assemble the feed pipe (Pt. 7-1-0) into the bowl (Pt. 7-9-0) with Tool-5, and make sure that the concave of the pipe is on the position of the pin (Pt. 7-13).

5.3. To assemble the first disk (Pt. 7-10-0) into the bottom of the feed pipe and make the rest 117 pieces (Pt. 7-11-0) in right order exactly. You will finish the inner assembly for bowl after putting the disk cover (Pt. 7-5-0), and then, the bowl cover (Pt. 4).

5.4. Be sure that the concave of the cover must be on the position of the raise on the bowl body. The bowl cover should be compressed with tool 26.

# HIGH SPEED PRECISION LATHE

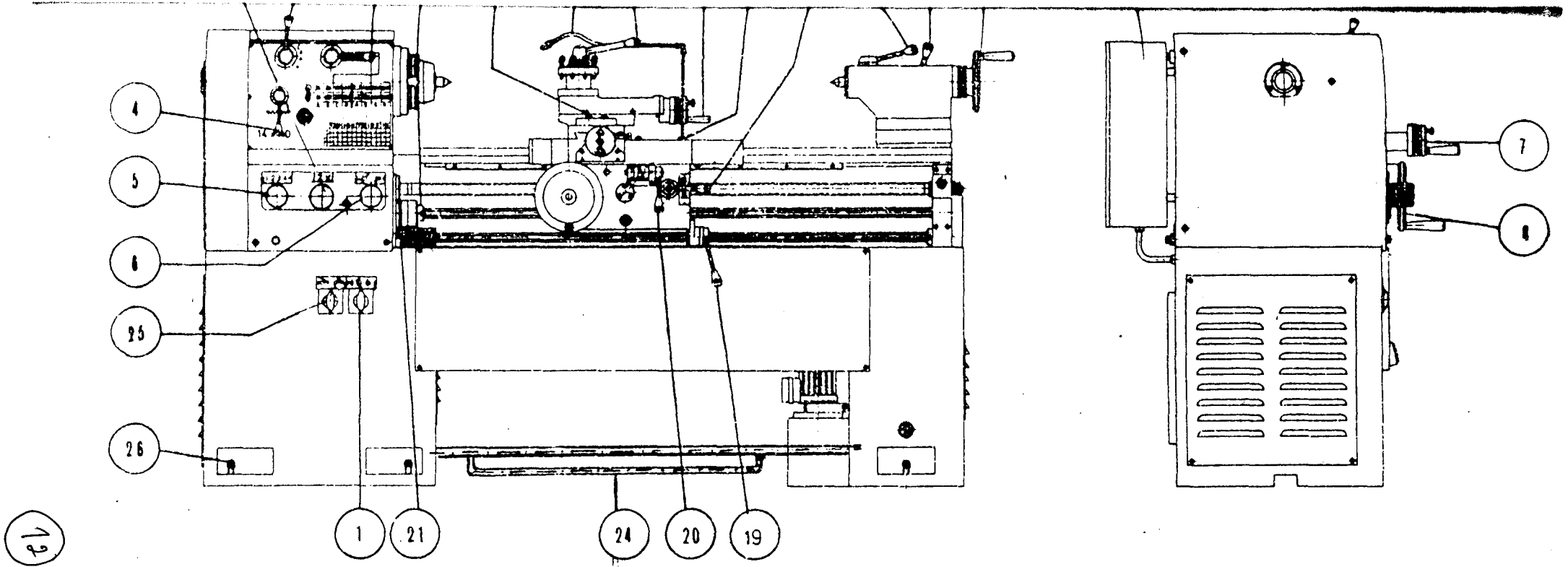
# CMZ

## INSTRUCTION BOOK

MODEL T360 x 1000

SERIAL N<sup>o</sup> 9806

DATE OF GOING OUT 26-8-96

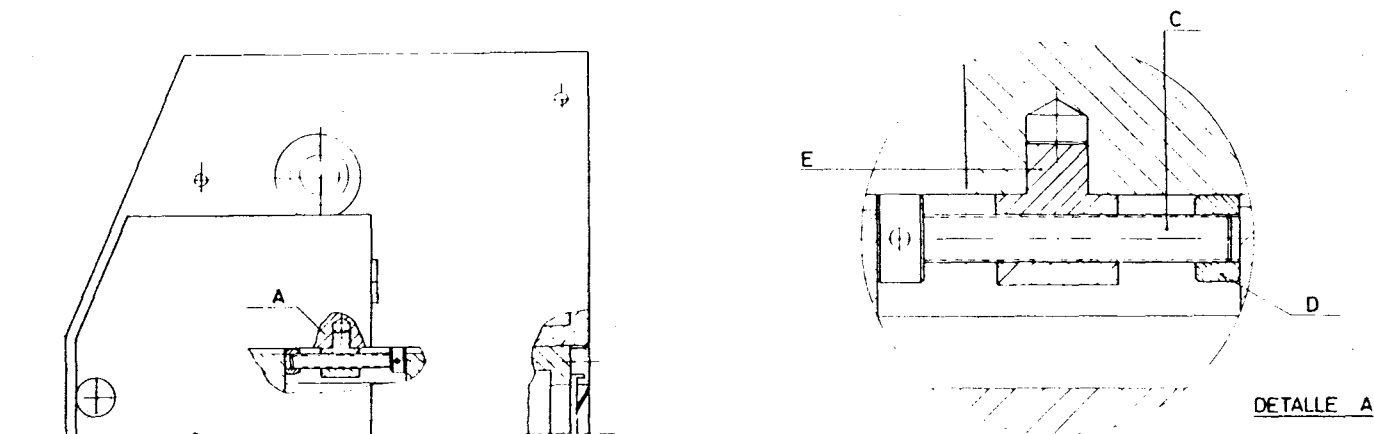


- |                                      |   |                                    |
|--------------------------------------|---|------------------------------------|
| 1- Two speed electric switch         | 10- Spindle handwheel of the swivelling carriage. | 19- Forward-reverse electric lever |
| 2- 4 Positions speed lever           | 11- Coolant                                       | 20- Longitudinal and cross power   |
| 3- High-Low speed lever              | 12- Tool-holder turret                            | 21- Cone type Norton lever         |
| 4- Feeds and threads lever           | 13- Locking screw                                 | 22- Clutch                         |
| 5- Feed change lever                 | 14- Half nut lever                                | 23- Electric Box (special order)   |
| 6- Lead-screw and rolling rod change | 15- Tailstock rod locking lever                   | 24- Foot brake                     |
| 7- Handwheel of the cross spindle    | 16- Tailstock cam-lock                            | 25- Coolant switch                 |
| 8- Longitudinal carriage hand-wheel  | 17- Tailstock's hand-wheel                        | 26- Levellings' screws             |
|                                      | 18- Compound swivelling basis                     | 27- Thread selector control        |



It is possible that the headstock can loose .

When the headstock lose paralellism with the bed, it is possible to re-adjust it, by means of the adjustable screw "B". First must be loosed the 4 bolts which tight the headstock to the bed, and then turning the adjustable bolt "B", the whole headstock will rotate around the fixed point located in the front end of the head. When the right alignment is obtained, then tighten again the 4 bolts.

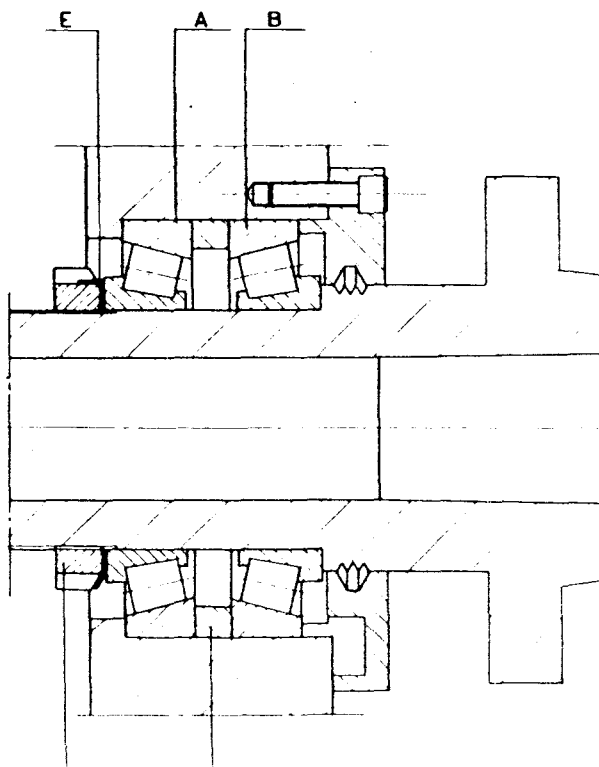


#### ADJUSTMENT OF MAIN BEARINGS

Bearings are fitted in our Plant in such a way that normally there is no need to re-adjust them. In cases of vibrations or other problems, that obligate to re-adjust them, please follow these steps.

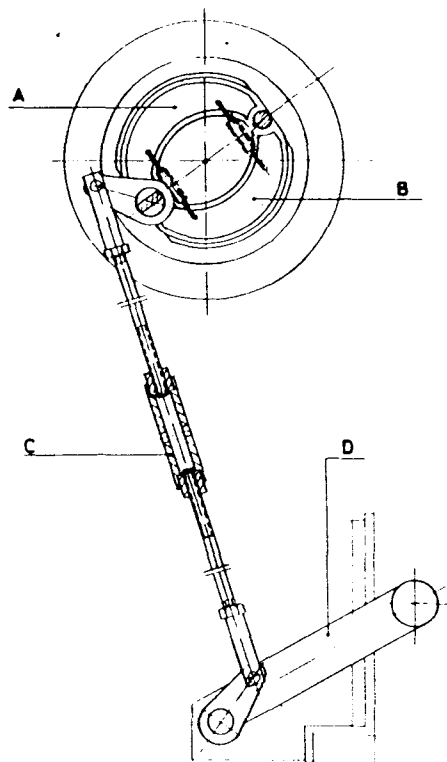
- 1) Remove headstock cover. 2) Straighten the safety washer "E".
  - 3) Screw in the adjustable nut "D" clockwise with approx. 75 lbs.
  - 4) Check with indicators the radial and thrust movement of the spindle.
- After having re-adjusted all bearings, check to turn the spindle by hand. A tight bearing will create heat and will short its performance.
- 5) Bend the safe wash "E" again.

We use Bearing Timken N° 30216 class 7.

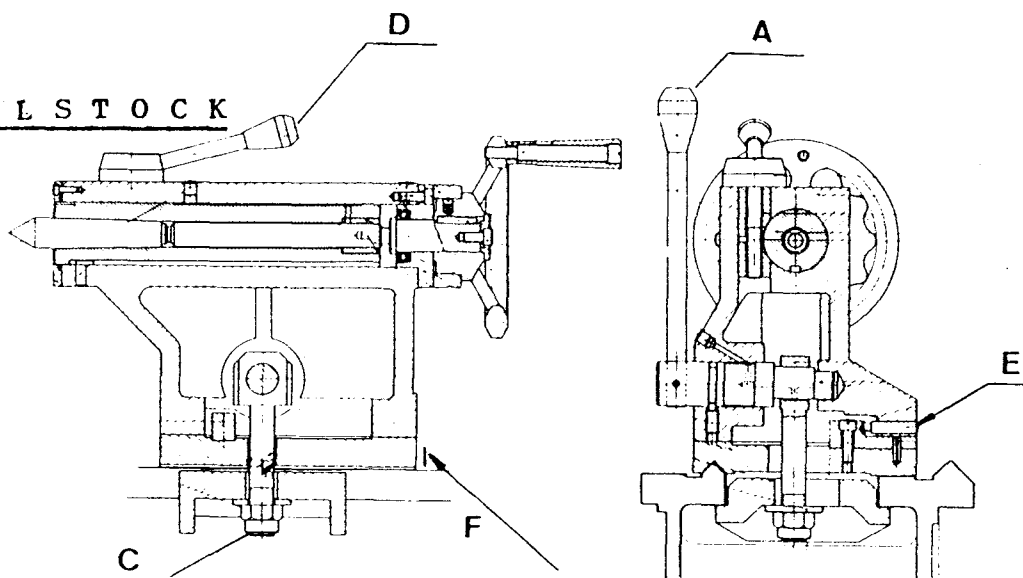


## FOOT BRAKE

The machine is equipped with a simple mechanical drum type brake as shown in the following sketch. To adjust brake turn nut "C" clockwise.



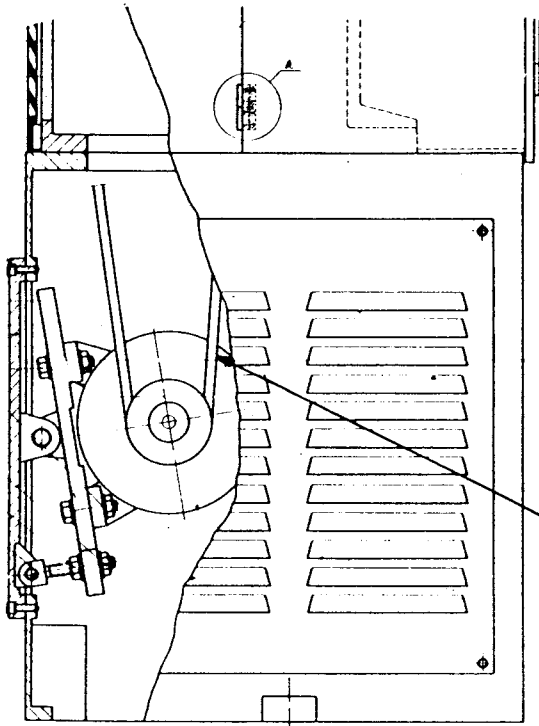
## TAILSTOCK



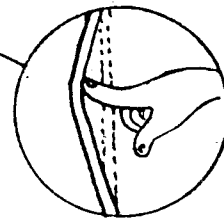
For its complete standing over the bed, the tailstock has one tightening system, that consists in one shaft-excentrical which is moved by lever (A).

To regulate the excentrical put the lever on blocking position (according to the operator opinion) and tight lightly the nut (C). The blocking of the quill is made by means of lever (D).

RE-ADJUST OF TAILSTOCK: You must displace the upper part of the tailstock by means of the adjustable screw. If the cone convexes towards the tailstock, the displacement will be made towards the tool. In the opposite case going far from the tool. To replace the tailstock, there is a reference line on the rear end of the tailstock.

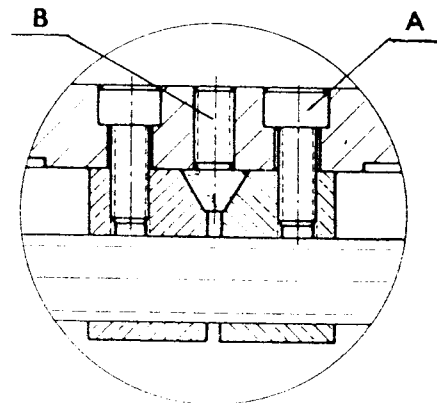
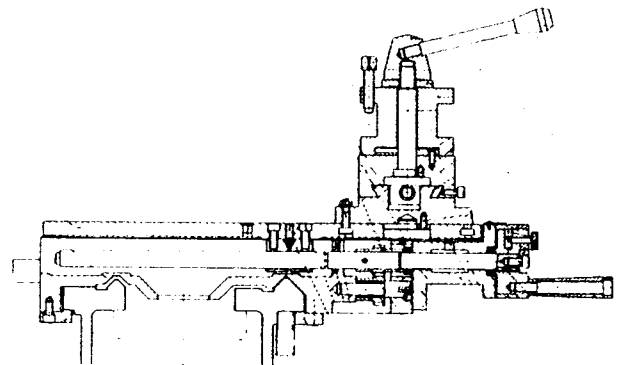


After the first 15 days of work, the "V" belts will have an enlargement. As a practical reference, adjust the belts leaving 3/4" deflection when pressing it slightly with your fingers.



**RE-ADJUST CROSS-SLIDE LEAD SCREW**

The nut of the cross lead-screw is exposed to normal wearing. To eliminate the back-lash, loose Allen bolt "A" and tighten set-screw "B" until back-lash is compensated. Lock screw "A".



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Power decrease

- e) Re-adjusting of main spindle bearings
- f) Re-adjusting carriage gibs.
- a) Increase of belt tension
- b) Replacement of belts.



LEVELLING PROCESS

LEVELLING PROCESS



LEVELLING PROCESS

LEVELLING PROCESS



MAINTENANCE

We would like to explain in this chapter the causes of eventual problems and how to take care of them. For the life of the machine it is necessary to lubricate it properly.

Main causes of inaccurate turning.- Usually the main causes are due to an improper mounting of the machine. You must verify that the machine is properly levelled.

ELECTRIC:

Main motor does not operate: a)check if there are hot wires on the machine.  
b)Check if the foot brake micro switch is closed (located in the front base).

Main motor does not stop after stepping on the brake:  
a)Check micro switch of the foot brake, located in the front base

MECHANICS

Vibrations

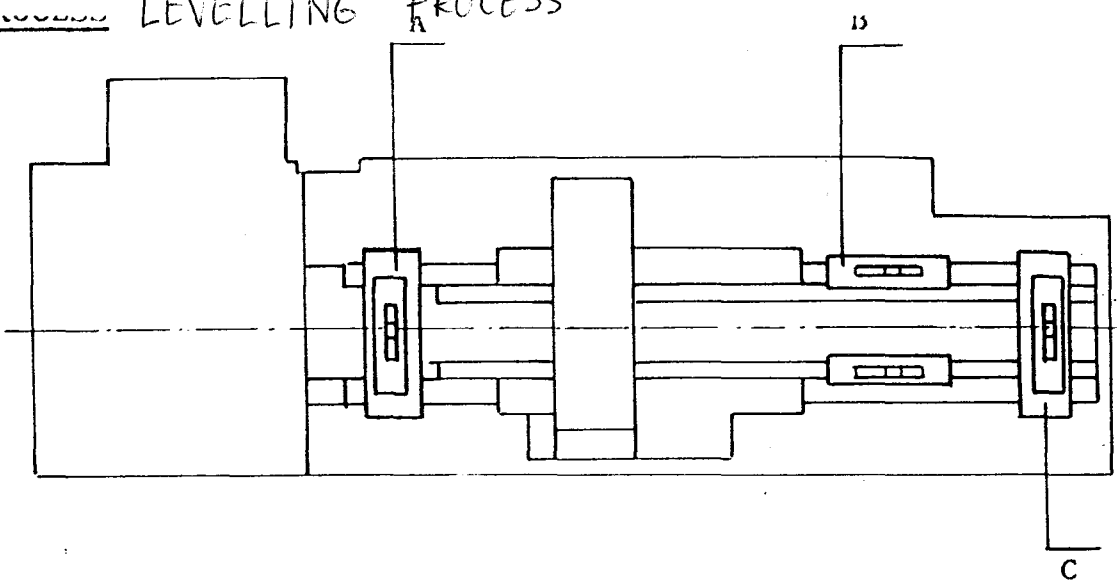
- a)Check foundation and level of the machine.
- b)Check balance of chucks and parts.
- c)Too high cutting speeds
- d)Better selection of cutting tools.
- e)Re-adjusting of main spindle bearings
- f)Re-adjusting carriage gibs.

Power decrease

- a)Increase of belt tension
- b)Replacement of belts.

GENERAL CHARACTERISTICS

Lathe T	<u>T-360</u>	EP	<u>1000</u>
		Nº of manufacture	<u>3806</u>
Main motor	<u>4</u>	HP	
		Trademark	<u>REG</u>
Motor number	<u>-</u>	RPM	<u>1500</u>
Voltage of motor	<u>220/380V</u>	Frequency	<u>50</u> Hz
Motor and switchboard connected to	<u>380</u>	V.	



To obtain a correct performance of the machine it is extrictly necessary to place the machine on proper foundation and to level the machine as follow:  
 Using a high quality precision level and ground plates, check positions "A" and "C" to control the twisting position of the bed. Position "B" check the longitudinal position of the bed. The tolerance allowed either in longitudinal or cross wise if of .00015 per foot.




**LUBRICATION**

Once the machine has been mounted, remove all antirust and protected coating with cleaning oil or solvent.  
 The machine does not have oil in their different boxes, so you must fill-up according to the following chart, up to the center of their sight glasses. Check first turning the spindle by hand and be sure that all the moving parts of the machine operate freely.  
 Do not operate the machine with power until reading the next paragraph.

MECHANISMS	OIL TYPE	CHANGE EVERY	CAPACITY	OBSERVATIONS
HEADSTOCK	SHELL TELLUS OIL-27	1,000 hours	8 Litres	Check sight glass every day.
Quick change Box	shell Tellus oil-33	""	3 Litres	""
APRON	shell Tellus oil-33	""	0.2 Litres	""
Tailstock Bed ways Carriage Bed-end support Gear change transmision	shell TENA OIL-72	Daily lubrication		

**IMPORTANT:** For the first time, change the oil after the first 200 hour  
 For the first 200 hours, try to operate the machine in low speeds.

Can be used similar oils.

-  Points of daily lubrication
-  Points of lubrication once a year
-  Sight glasses for oil level