



TROUBLESHOOTING GUIDE FOR CNC MACHINES



PATIALA LOCOMOTIVE WORKS, PATIALA

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INDEX

S.N	Topic	Page No.
1	GENERAL TROUBLESHOOTING	03-09
2	TROUBLE SHOOTING FOR THREE PHASE VOLTAGE STABILIZERS	10-11
3	HYDRAULIC SYSTEMS TROUBLE SHOOTING	12-14
4	PREVENTIVE MAINTENANCE SCHEDULE	15-24
5	RESOURCES AND SPARES FOR CNC MACHINES	25-26

TROUBLESHOOTING OF CNC MACHINES

Objective

At the end of this unit you should understand:-

- Different type of machine maintenance.
- Best maintenance practices followed by CNC machines.
- Tools and accessories used in CNC machine tools maintenance work.
- Problems related to mechanical system in CNC machines
- Meaning of the term "Backlash", how to identify and measure Backlash.
- Causes of failure of electronic system in CNC machines and precautions to be observed.
- How to check pneumatic system in CNC machines. and
- Causes of excessive noise in CNC Machines and how to eliminate it.

DIFFERENT TYPE OF MACHINE MAINTENANCE.

1 CORRECTIVE MAINTENANCE:-

Maintenance performed, after the occurrence of a failure, to restore the machine tool to its original condition, to the extent possible.

2. PREVENTIVE MAINTENANCE:-

Maintenance preformed to retain the machine in its original condition, to the extent possible, by providing systematic inspection, periodical checking servicing, detection and prevention of failure likely to occur.

3. BACKLOG MAINTENANCE:-

Maintenance that is necessary to prevent the deterioration in the performance or functioning of the machine by which has not been carried out. Accordingly, backlog maintenance has a higher priority than deferred maintenance. The maintenance practices to be deferred and which comes under backlog list will have be reviewed annually and documented.

4. DEFERRED MAINTENANCE:-

Maintenance that is due to be carried out in the current financial year but which could not be carried out due to shortage of funds or unavailability of spare parts. Such maintenance should be added to the backlog Maintenance programme awaiting attention.

5. TPM (TOTAL PRODUCTIVE MAINTENANCE):-

Maintenance method integrates production function of the equipment and the maintenance function required. The maintenance of the machine and its schedule is considered and integral part of the production

schedule and the machine tools is maintained with the least disturbance to the production activity. Such maintenance schedules are well planned and leads to overall productivity of the plant and the equipment.

SYSTEM AND SUB SYSTEMS OF CNC MACHINES.

Various functions of CNC machines are executed with the help of the following systems and sub systems.

1. Mechanical systems.
2. Electronic Systems (CNC and drives)
3. Work holding systems.
4. Tool clamping systems.
5. Lubrication systems.
6. Coolant systems.
7. Hydraulic systems.
8. Pneumatic systems, and
9. Chip conveying systems.

FUNCTIONS OF MECHANICAL SYSTEMS.

Primary function of the mechanical systems in CNC machines are similar to conventional machines.

CNC Lathe machine consists of the following sub systems.

1. Headstock.
2. Axis assembly.
3. Tool post, and
4. Tailstock

CNC milling machine consists of following sub systems.

1. Axis assembly.
2. tool magazine, and
3. Bed

BEST MAINTENANCE PRACTICES.

Following are some of the best maintenance practices to be adhered to while carrying out maintenance of CNC machines.

1. Execution of maintenance activities as per TPM (Total Productive Maintenance) Chart.
2. "Solving" the "Cause" of the problem and not the "Symptom"
3. Use of "Right" tools, fixtures, equipment and spares.
4. Understanding the accuracy class of bearing, grade of oil and their correct specifications.
5. Understanding the working of the machine tools by studying the manuals, and
circle diagram supplied by the machine manufacturers.
6. Use of flow chart/cause and defect diagrams and the breakdown history for

- quick repair and maintenance /trouble shooting.
7. As far as possible carryout reassembly in a clean room.
 8. When the electrical cabinet is in open position do not allow the machine in the running condition.
 9. Do not bypass the interlocks.
 10. Follow proper procedure and communication protocols when reporting service/maintenance problems to the service staff of the CNC machine tool manufacturing company

MAINTENANCE TOOLS AND ACCESSORIES REQUIRED DURING CNC MACHINE TOOL MAINTENANCE WORK.

1. Digital millimeters.
2. Screw Driver, spanner and Allen Keys (Complete Set)
3. Megger (Insulation tester.)
4. Standard adapters for clamping the dial indicators while checking out of roundness of run of spindle.
5. Standard mandrels for testing geometrical accuracies/alignment check.
6. Clip on meter to measure AC/DC current in electrical power cables.
7. Spare Parts List.
 - a. Contingency spares parts list (Fuses, Belts and standby work holding systems.
 - b. Regular spare part list (Limited life time items like wiper, relays, soft jaws/collets, and other spare for periodic replacements.

DAILY MAINTENANCE CHECK LIST FOR CNC LATHES.

1. Check for proper functioning of the lubrication system during start of the machine tool.
2. Check oil levels of hydraulic pack unit, if necessary fill it fully with the oil of correct grade.
3. Check oil level of central lubrication unit, if necessary top it up fully with the oil of the correct specifications.
4. Check the grease work holding through the grease nipple provided on the 3 jaw chuck.
5. Check coolant in the coolant tank, top it up if necessary with the oil of correct grade up the level indicated on the right sight glass.
6. Check hydraulic system pressure and set pressure to 30 kg/sq. cm.
7. Check the maintain tailstock pressure as per recommendation of the manufacturer.
8. Check the functioning of A/C unit in the panel.
9. Check for any abnormal noise from the machine (headstock spindle, hydraulic system, motor,
gear box, turret etc.
10. Check oil level in the chip conveyor gear box.
11. Run the machine for warm up at the beginning of the day.

CAUSES FOR THE FAILURE OF ELECTRONICS SYSTEMS IN THE MACHINE TOOLS.

1. Dust failing on the electronic components.
2. Corrosive fumes (coming from coolant interacting with the hot chips)
3. Oil/Coolant dripping through cables.
4. Condensation of moisture.
5. Insects.
6. Poor Ventilation.
7. Improper power supply.
8. Improper earthing.
9. Loose connections and bare control wirings.
10. Non conformance to EMI (Electro Magnetic Interference) guidelines.

1) PRECAUTION TO BE OBSERVED.

1. Ensure secure panel and pendant sealing.
2. Maintain gasket in the good condition.
3. Ensure proper orientation and direction of the exhaust fans.
4. Ensure proper sealing at the entry of the cables.
5. Maintain right temperature of the A/C systems.
6. Ensure that no insects and pests come near the machine tool.
7. Ensure periodic cleaning of the filters of A/C Systems.
8. Ensure periodic tightening of cable connections and avoiding bare wires.
9. Ensure Guidelines against EMI (Electro Magnetic Interference) as laid down by.

2) ENSURE PROPER POWER SUPPLY

1. Ensure proper sequence and connections of isolation transformer, if installed.
2. Ensure proper rating of generators, if used.
3. Ensure that surge suppressor are installed on all switching/inductive devices.
4. Ensure proper rating of protective switchgears as per the recommendation by the manufacturer.
5. Ensure proper rating/cross section of cables as per the recommendation by the manufacturer.
6. Ensure switching sequence as per the recommendation of the manufacturer.
7. Do not mix, neutral and earth lines/wires.

ENSURE PROPER EARTHING OF POINTS INDICATED BY THE MACHINE TOOL MANUFACTURER.

1. Do not loop earth wire between the electronic components.
2. Ensure proper cross section of the earth wire at all the points.
3. Ensure the earth resistance at the incoming terminals as less 1 Ohm.
4. In case, one earthing pit caters to more than one machine, form tree structure.
5. Do not loop earthing between different machines.

6. Ensure proper surface, connectors and conductors for connections.
7. Ensure periodic maintenance of earthing pit.

COMMON REASONS FOR FAILURE AND PREVENTIVE MAINTENANCE.

1. Ensure prevention of dust and coolant fumes in the control panels and pendant.
2. Ensure proper setting of axis.
3. Ensure proper selection of motors.
4. Ensure proper bending/overhanging of connection belts.
5. Monitor periodically the vibrations on motors.

DEVIATIONS FROM NORMAL PERFORMANCE IN CNC MACHINES.

1. Size variation
2. Taper formation.
3. ovality (out of roundness or run out)
4. Surface finish less than desirable.
5. Decreased tool life.
6. Stalling of machine tool spindle.

FACTORS LEADING TO SIZE VARIATION.

ASPECTS OF SZIE VARIATION

1. Constant variation from work piece to work piece.
2. Erratic variation from work piece to work piece.
3. Sudden variation and the dimensions remaining constant.
4. Occasional variation.

CAUSES OF CONSTANT VARIATION.

1. Defective or improper functioning of encoder and coupling.
2. Slippage/Backlash (Identify and measure the value)
3. Slippage of coupling or belt.
4. Variation in coolant flow.

CAUSES OF ERRATIC VARIATION FROM WORK PIECE TO WORK PIECE.

- Cutting parameters change.
- Present of Backlash.
- Malfunctioning of encoder.
- Slippage of couplings.
- Improper turret clamping.
- Wear out of guide ways
- Wearout of ball screw bearing.
- Wearout of ball screw locking nut.
- Coolant flow not uniform.
- Not maintaining optimum tailstock pressure.

- Belt damage.
- Slippage of spindle belt.
- Improper selection of coolant/lubricants.
- Excessive run out of spindle.

WHAT IS BACKLASH?

It is a deviation from the actual position to the value displayed on the screen or simply the difference between physical position and the electronic reading.

In the case of rotary encoder, position measurement is indirect unlike a linear scale.

HOW TO IDENTIFY AND MEASURE BACKLASH ?

1. Mount the dial indicator on turret face and set zero on dial, reverse the axis movement and come back to the same point. The dial will now indicate the difference in value which indicate there is a backlash error.
2. How to compose for the backlash error?
 - a. Check for ball screw preloading end nuts.
 - b. Adjust belt tension.
 - c. Prevent coupling slippage.

POSSIBLE DEFECTS IN ENCODER OR COUPLING.

1. encoder coupling is loose.
2. Motor coupling is loose.
3. Encoder or axis belt worn out.

ENCODER-FAILURE MODES.

1. Missing pulses (rotary incremental encoder)
2. Loose coupling.
3. Power cables running parallel with control cables.
4. Improper shielding of cables.
5. discontinuities in encoder cables.

POSSIBLE DEFECTS IN GUIDE WAYS.

1. Improper flow of lubrication oil.
2. Wipers damaged.
3. Chips or dust entry into guideways.
4. Wearing out of jibs.
5. Wrong selection of lubrication oil.
6. Bellows with cracked openings.

PROBLEMS RELATED MECHANICAL SYSTEMS IN THE MACHINE.

(A) NOISE DURING SPINDLE RUNNING.

Causes are:-

1. Misalignment of spindle belt.
2. Belt rubbing with the mounting bracket of the motor.

3. Misalignment of timer belt puller,.
4. Slackness of timer belt.
5. Failure or seizure of spindle bearing.
6. Failure of encoder assembly bearing.
7. Bolts of motors mounting and bolts of brackets are loose.
8. Bell crank lever screw rubbing with spindle.
9. Spindle pulley and motor pulley face run out or misalignment (always ensure that the spindle is run with balanced tool holders)

(B) EXCESSIVE SPINDLE RUN OUT.

Causes are:-

1. Improper clamping of the test mandrel.
2. Improper spindle bore
3. Loosening of flange covers.
4. Excessive tensioning of spindle belt.
5. Belt misalignment.
6. Improper tightening of locknut after reconditioning and fitting.
7. Improper pull stud used.
8. Wearing of Collets.
9. Breakage of tool clamping disc springs.
10. Use of wrong tool holders.

CHECKING OF PNEUMATIC SYSTEM.

1. Check for oil level in the lubrication unit.
2. Check for the proper air pressure in the regulator.
3. Check for proper air blast during tool changing.
4. Check for the moisture in pneumatic line (moisture in pneumatic lines should be avoided.)
5. Air leakage (this may be due to clogging of filters)

TROUBLE SHOOTING FOR THREE PHASE VOLTAGE STABILIZERS

Sr. No.	SYMPTOMS	PROBABLE CAUSE	REMEDIAL ACTION
1	No output voltage	<ul style="list-style-type: none"> a) MCB / Contactor defective. b) Under / Over volt protection card not making proper contact with PCB connector. c) Input voltage out of range. d) Output voltage beyond the specified limit of O / P voltage trip level. 	<ul style="list-style-type: none"> a) Replace MCB / Contactor – if defective. b) Tighten PCB connector. c) Wait till input attains specified operating range. d) If input voltage is within the limit, the U/V, O/V PCB 0006 is defective replace. If not, wait till input voltage regains its specified value.
2	Output voltage frequent tripping	<ul style="list-style-type: none"> a) Supply voltage very near to end limits. b) Output volt alarm levels set very near the nominal voltage. c) Loose contact. 	<ul style="list-style-type: none"> a) Select stabiliser with wider input range. b) Set the trip levels further away and increase time delay before trip. c) U/V and O/V card may be faulty. 0006
3	Increase voltage at output	<ul style="list-style-type: none"> a) Auto / Manual switch in 'MANUAL' Mode. b) 'O/P' voltage disturbed. c) Lower/Higher limit micro switch connections loose. d) Voltage regulation control card defective. e) Neutral connections may be loose or not connected. f) Carbon brush contacts to be checked. g) Motor may be faulty. 	<ul style="list-style-type: none"> a) Position it in 'AUTO' mode. b) Set the 'O/P voltage' while keeping the Auto / Manual switch in auto mode. c) Check the Micro switch connection. d) Replace the Voltage regulator PCB 2222R. e) It must be connected properly. f) Replace the brush if defective. g) Replace the motor.
4	Incorrect output Voltage with U/V - O/V LED.	<ul style="list-style-type: none"> a) Carbon brush damaged. b) Motor terminal incorrectly connected. c) Output of sensing transformer AS- 2, AS- 1 may zero. d) Volt Adjust preset may open. 	<ul style="list-style-type: none"> a) Replace the carbon brush. b) Reverse the motor connections. c) Replace defective Transformer. d) Replace 'Volt Adjust'preset.

Sr. No.	SYMPTOMS	PROBABLE CAUSE	REMEDIAL ACTION
4	Incorrect output Voltage with U/V - O/V LED.	e) Voltage regulator PCB 2222R defective. f) Electronic ground may be open. g) Variac with motor assembly tight.	e) Replace PCB. f) Check all the connections. g) Clear it properly.
5	Erratic Output voltage in 3 phase system.	a) Check all the points under 3 above. b) Neutral not connected.	a) Do the corrections if required. b) Connect Neutral properly.
6	Corrections not taking place.	a) Control card may be faulty. b) AS-1, AS-2 may be faulty. c) Micro switch connection may be open. d) Check Motor.	a) Replace PCB. 2222R b) Replace if defective. c) Check all the point if defective. d) Replace the motor if defective.
7	Not working in auto & manual mode.	a) Check motor supply. b) Check AS-1, AS-2. c) Check other mechanical section (Grub screw, gear section, brush arm movement) d) Check micro switch in addition, micro switch connections. e) Check RC Circuit of Motor. (Resistor – Capacitor)	a) Replace the motor if defective. b) Replace Transformer if defective. c) Change if defective. d) Replace the switches if defective. e) Replace with same value if found defective.

HYDRAULIC SYSTEMS TROUBLE SHOOTING

Trouble	Probable cause	Remedy
Pump not delivering	Reservoir fluid level low	Add fluid and check level of reservoir to ensure pump in-take line is submerged in fluid.
	Intake pipe plugged	Remove obstruction
	Coupling or shaft sheared or disengaged.	Dismantle pump and check shaft and rotating group for damage. Replace necessary parts.
	Pump driven in wrong direction of shaft rotation	Check installation reverse the direction or rotation of motor if necessary.
System not developing pressure	Contamination in actuating control.	Can control
	Pump not delivering fluid for any of the	Check circulation by watching fluid in reservoir
	Relief valve setting not high enough	Test with pressure gauge
	Relief valve sticking often	Remove contamination in relief valve
	Leak in Hydraulic control system (Cylinders or valves)	Test independently by progressively blocking of the circuit.
	Free circulation of fluid to reservoir	Ensure that the directional valve is not in open centre position of that fluid is discharging to tank through an open line or improperly adjusted valve.
Pump making noise	Partly clogged intake line or restricted intake pipe	Pump must receive intake fluid freely or cavitation takes place
	Air leak at pump intake pipe joints.	Tighten as required, pour fluids on joints while listening for change in sound operation.
	Air bubbles in fluid	Check that the return lines are below fluid level and well separated from intake line.
	Coupling misalignment	Check for damaged shaft bearing on other parts, if necessary replace and realign the coupled shafts

s. no.	What to inspect	What to inspect for
1	Exterior surroundings near the motor	Dust, Grease, Oil, high temperature, rust and corrosion, mechanical damage, condition of gaskets if any
2	Interior of motor	Excess vibration which may have loosened nuts, bolts or other mechanical connections.
3	Contactors, relays, solenoids.	Check control circuit voltage, inspect for excess heating of parts evidenced by discoloration of metal, charred insulation of coils free movement of moving elements, dust, grease corrosion, loose connections.
4	Contact tips	Check for excessive pittings roughness, copper oxide. Do not file silver contacts.
5	Flexible leads	Look for frayed or broken strands. Be sure lead is flexible and not brittle.
6	Coils	Look for over heating, charred insulation or mechanical injury.
7	Magnets	Clean faces, check shading coil inspect for misalignment bonding.
8	Fuses and fuse clips	Check for proper rating, snug fit, I.F. Copper, polish forrules, check fuse clip pressure.
9	Overload relays	Check for proper heater size, trip by hand, check heater coil and connection, inspect for dust, corrosion.

SURGE QUENCH CIRCUIT ELEMENTS:

when a clutch coil with its associated inductivity is switched off, excessive high surge voltages are developed which could have an adverse effect on the coil insulation. In order to obviate this each clutch is protected by a surge quench element in the particular machine by a varistor (Voltage dependent resistor).

SUPPLY DISCONNECT DEVICE:

A manually operated isolating switch/circuit breaker is provided to disconnect the whole electrical equipment of the machine tool from the supply.

The practice of planned maintenance at fixed intervals employing a long book strongly recommended. The following are suggested items for regular checks.

- A. Check temperature of oil
- B. Check pressure settings through system.
- C. Check noise level of the pump.
- D. Check leakage rates from piston equipment under indentical pressure and temperature.
- E. Clean exterior of all equipment.
- F. Check for oil leakages & reseal where necessary.
- G. Check air cooling system of the Hydraulic power pack.
- H. Sample the oil for chemical conditions and level of contamination
- I. Check filters and clean or replace as necessary.

Should a pump fail and distribute debris in the system, it will be necessary to flush and change oil before putting a new pump. Failure to do this will result in premature failure of the replacement. For further details and stock nos. please refer hydraulic circuit diagram.

NOTE: "Maintenance activities include Preventive Maintenance, Minor Repairs, Minor Maintenance, Major Maintenance, and Emergency Repairs."

PREVENTIVE MAINTENANCE

DAILY

WEEKLY

MONTHLY

HALF YEARLY

YEARLY

DAILY:

1. MECHANICAL EQUIPMENT:

- 1.1 Ensure that the machine is clean with no build up of swarf near fixtures or around discharge apertures.
- 1.2 Ensure that all the slide rails are clean.
- 1.3 Visually examine all guards for security and damage.
- 1.4 Ensure that in boring machines the boring bars are clean and apply a thin film of oil.

2. ELECTRICAL:

- 2.1 With the supply on check that indicator light circuits are operating with all the filaments.
- 2.2 Press master start push button start all motors and ensure that correct starting cycle occurs. Stop the motors by operating the emergency stop push button. Reset the emergency system.
- 2.3 Stand by during the initial start up and first automatic cycle and check overall machine operation.

- 2.4 Ensure that the electric supply to the machine is switched off after the production

3. HYDRAULIC EQUIPMENT:

- 3.1 Visually check floor around the machine for evidence of leakage from unions, piping hydraulic elements like control components of cylinders. If leakages are noticed take corrective action to avoid leakage. If there is fluid on the floor, have it cleaned up after leakage has been found and rectified.

- 3.2 : Check all oil levels of hydraulic tanks, especially after the leakage has been found

4. MACHINE OPERATOR/ TOOL SETTER:

- 4.1 Whilst the above are being carried out, inspect the general machine assemblies for damage.

- 4.2 Inspect all tooling for signs of damage. Ensure that all the tooling is secure.

- 4.3 As soon as all checks have been made, start up the machine, ensure component presence and initiate the automatic cycle.

WEEKLY:

1. MECHANICAL EQUIPMENT:

In addition to the daily inspection 1.1 to 1.4 described above carry out the following:

- 1.5 Check lubricant level in multi-spindle boxes, standard unit gear boxes, rapid traverse gear boxes, Top up with the recommended lubricant as necessary, referring to the working instructions.
- 1.6 Visually inspect the machine for loose pipe clips, signs of chafing of pipes And hoses and for any visible damage to mechanical parts.
- 1.7 Ensure that when production is completed, that clamping devices are in free condition, and the machine units should in the initial start condition.
- 1.8 Clean the machine thoroughly with brush or cotton waste.Oil all bright parts with a thin film of oil like unit guide-ways, spindles, guide bars of the Jig plate after the end of a week's production.
- 1.9 Ensure that where swarf and paddle systems are used, examine paddles to see that they swing satisfactorily and are not distorted.

2. ELECTRICAL:

In addition to the daily inspection 2.1 to 2.4 as described above, carry out the following:

- 2.5 Visually examine, wherever possible, limit switch actuating arms to ensure that they are not distorted or damaged in any way and that there is no evidence of malfunction.

- 2.6 Visually examine all conduit and flexible tubing for impact or other damage and for chafing of the flexible tubing.
- 2.7 Open control cubical doors and check control equipment for signs of over bearings, security of equipment etc.

3. HYDRAULICS:

In addition to the daily inspection 3.1 to 3.2 as described above, carry out the following:

- 3.3 Check all flexible pipes for signs of damage, chafing etc.
- 3.4 Ensure that when production is completed that compressed air to the machine is off

MONTHLY:

1. MECHANICAL EQUIPMENT:

In addition to weekly inspection 1.1 to 1.9 described above, carryout the following:

1.10 Remove all belt guards and examine the drive belts for correct tension.

NOTE: If a damaged bolt is found among any multi-belt set-up the complete set must be changed

1.12 Charge all nipples with the recommended lubricant. These will be found on some fixtures, roller assemblies etc. Check the machine lubrication diagram for details.

2. ELECTRICALS:

In addition to weekly inspection 2.1 to 2.7 described above carryout the following:

2.8 Ensure electrical cam fixing is rigid and is butting against the end stop.

2.9 Ensure that the external surroundings of the motors are condition free of dust, grease, oil, rust and corrosion. Check for mechanical damage, and condition of gaskets if any.

2.10 Ensure that the flexible lead is proper without broken strands and the lead is flexible.

3. HYDRAULICS:

In addition to weekly inspection 3.1 to 3.4 described above carryout the following;

HALF-YEARLY

1. **MECHANICAL:** In addition to monthly inspection 1.10 carryout the following:
- 1.11 Check for clearance between guideways of unit and L-Pieces which should not exceed 0.63 mm
 - 1.12 Ensure that the oil seals in the multi-spindle box are OK. Replace it there is leakage of oil or mist.
Ensure that the liner bushes and guide bushes are rigidly fixed.
Check the dimensional accuracy of the guide bushes and change them if found oversize.
 - 1.13. Ensure that the limit switches are rigidly fixed. Ensure that these are not disturbed or damaged in any way and that there is no evidence of function.
 - 1.14 Ensure that the locking nuts in the rod for quill advance and retraction are tight in milling machine.
 - 1.15 Ensure that all the dogs actuating the limit switch in the table.

2. ELECTRICAL:

In addition to the monthly inspection 2.1 to 2.10 described above carry out the following:

- 2.11 a) Ensure that the electrical distributor is fixed rigidly. Check proper function of micro switches. Clean and fix back the switches.
- b) Check the electrical distributor pin for wear out where the cam rubs. Replace pin if the pin is completely worn out

YEARLY:

1. **MECHANICAL:** In addition to the half-yearly inspection 1.11 to 1.15 carryout the following:
 - 1.16 Refer unit drawing. Check up for the radial play and axial in the spindles. Adjust the play if it is more than 0.01 mm
 - 1.17 Ensure that the lubrication is correct to the guide bars, Guide bushes. Check up springs for proper action and grease them.
 - 1.18 Check in fixtures. Movement of pins and wear on them. Replace if found proper size. Check component loading pads, putting pads for wear and replace if found worn out.
 - 1.19 Check the wipers on table guide ways, on clamping unit guide-ways. Replace the damaged ones.
 - 1.20 Ensure that all the holding down bolts are tightened and recheck alignment.
 - 1.21 Check the spindle loading head and reloads the bearing.
 - 1.22 Check levelling of table, units and tighten the foundation bolts of the machine.

Trouble Shooting and Remedy:

Sl. No	Trouble	Probable Cause	Remedy
1	Machine Vibrates while running.	A) Improper leveling	Level the machine as per test chart
		b) Job not balanced	Balance properly and reduce speed
2	Machine Vibrates while machining chatter marks on works on piece	a) Improper leveling	Level the Machine
		b) Improper tensioning of Belts	Adjust the Belt Tension
		c) Excessive tool overhang	Reduce overhand of tool and clamp more rigidly
		d) work holding not rigid	Check the chuck clamping and ensure rigid clamping
		e) Ram slide, Cross slide and Tool slide jibs may be loose	Tighten the jibs properly
		f) Hydraulic Clamping not rigid	Ensure the pressure on the hydraulic clamps on the cross slide
		g) Wrong Tool	Check for proper tool material and tool geometry
		h) Wrong cutting parameters	Select proper speeds and feed rates
		i) improper tool height	Set the correct tool height
3 a)	Machine cuts tapers on the facial run out face	Cross slide Misalignment	Check the machine bed level w.r.t the cross slide guide ways alignment and ensure the parallelism of both with each other in leveled position
3 b)	Machine cuts tapes on the radial run out face	Columns misalignment	Check the machine bed level w.r.t the Column guide ways alignment and ensure the perpendicular of both to each other in leveled position
3 c)	Machine Cuts taper in general	Tool worn out	Replace with new Tools having proper tool specifications and geometry.

Resources for CNC machine spares

SN	Resources	Spares/ Make
1.	M/s C-Tech Enterprises 104 Guru Mansion, 5/69 Padam Singh Road Karol Bagh New Delhi 110 005	Optical Scale, Encoder, Cables (Heidenhain Make)
2.	M/S Texcel Marketing Corporation , 19/3-49, 2nd Main Road, Near Shobha Hospital, Prashanthnagar, Nagarbhavi Main Road, Bangalore 560 040.	Optical Scale , Control Cards, Modules (Heidenhain, SIEMENS Make)
3.	M/S Jyoti Electro-Mech 18/182A, The Mall, Kanpur-208 001	Optical Scale, Encoder, Cables (Heidenhain Make)
4.	M/S Fagor Control Systems Pvt. Ltd. 67/11-3, "Lakshmi Arcade", UBMec Road, Yeshwanthpur Industrial Suburb, Bengaluru, Karnataka, 560022, India.	Optical Scale, Encoder, Cables (Fagor Make)
5.	M/S Jag Automation Pvt. Ltd. 8, Industrial Area , Phase – II, Panchkula – 134113.	Optical Scale, Encoder, Cables Control Cards, Modules etc (Heidenhain, Siemens Make)
6.	M/S Air Master Rectifiers Pvt. Ltd. , G – 78, Triveni Commercial Complex, Sheikh Sarai, Phase – 1 , New Delhi-110017 India.	IGBT, IC, POWER DIODES
7.	M/S T.H.Electrical& Controls Sco 12-S, 1st Floor, Anami House, Jeewan Nagar Chowk, Focal Point, Ludhiana 141010	Control Cards, Modules, IC, IGBT Mitsubishi make
8.	M/S Elematronic Devices Inc. KailashVaibhav, 2 nd Floor, G - Wing , Behind Godrej Park Site, Vikhroli (West) , Mumbai	IGBT, IC, POWER DIODES General items
9.	M/S Laxmi Traders 3873,2 nd Floor, Shankar Market, Behind M.C. School, G.B. Road, Delhi 110 006.	IGBT, IC, POWER DIODES General items
10.	M/S Indica Engineers, Plot No. 182/74, Industrial Area, Phase-I, Chandigarh 160 002	IGBT, IC, POWER DIODES General items
11.	M/S Madhusudan Traders Shop No. – 164, Opp Guru Nanak Atta Chakki, Bajwa Colony, Patiala	VFD,IGBT, IC, POWER DIODES L&T, Yashkawa, ABB, Delta
12.	M/S Point Hydraulics Pvt Ltd 28, Satua Baba Katra, GolaDinanath, Varanasi 221001	VFD, IGBT, IC, POWER DIODES L&T, Yashkawa, ABB, Delta
13.	M/s S.R. Enterprises, Plot No. 1, Indra Complex - 5, Ground Floor, Bread Factory Road	Control Cards, Modules (Rexroth Make)

14. M/S	Monika Engineers Rukmani tower, 77-a, Industrial Estate. MillerganjLudhiana 141003.	Power supplies, sensors, switches General Items
15. M/S	Namarta Trade Links, SCO – 40, Sector – 7C, Madhya Marg, Chandigarh.	Power supplies, sensors, switches General Items
16. M/s	Indotech Engineers #36, Under Dholewal Flyover. DholewalChowk, Ludhiana 141003.	Power supplies, sensors, switches General Items
17. M/s	Phoenix Contact India Pvt Ltd. F-26/2, Okhla Industrial Area, Phase – II, New Delhi – 110020.	Power supplies, sensors, switches General Items
18. M/S	Vishesh Enterprises, Plot No. 12/A, ChittaMandir Road, Village Gadhauli, Yamunanagar	VFD,Power supplies, sensors, switches
19. M/s	Fanuc India Pvt Limited # 41A, Electronics City Bangalore 560 100	L&T, Yashkawa, ABB, Delta Control cards, modules OEM
20. M/S	Pepperl + Fuchs(India) Pvt Ltd. 6 th Floor, Block – II, Vatika Business Park, Sohna Road, Sector – 49, Gurgaon – 122002	Linear position sensors, switches OEM
21. M/S	GiviMisurePvt Ltd. VITC Export Bhavan, 1st Block, Plot No. 488, Kiadb Complex, 14th Cross, Iv Phase, Peenya Industrial Area, Banglore – 560 058.	Optical scales OEM
22. M/S	B.I. Enterprise, B-210, Arjun Centre, Govandi Station Road. Govandi (E) Mumbai 400 088	Switches, sensors, multiple limit switch OEM
23. M/S	Larson & Toubro Limited Sco 32, Sector 26-D, Madhya Marg, Chandigarh 160 019	VFD's , control cards OEM
24. M/S	Rockwell Automation India Pvt. Ltd. A-66, Sector – 64	VFD's, control cards For Allen Bredley Make
25. M/S	Noida (U.P.) 20130. India Agromach Spares Corporation 194/D, Gaiwadi Compound, Girgaum Road Mumbai - 400004, Maharashtra, India.	VFD's, control cards For Indramat& Rexroth make
26. M/S	Siemens Ltd Plot 78, Sector 18, Jil Building, Tower - B, Gurgaon 122015	OEM