DUAL CHECK SAFETY

DESCRIPTION, TROUBLESHOOTING, AND ALARM MESSAGES

Multi-Tasking CNC Lathes

T-42  
T-51  
T-65

Equipped with a Fanuc 31i-T Control

Original Instructions

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Litho in U.S.A.
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- NOTICE -

Damage resulting from misuse, negligence, or accident is not covered by the Hardinge Machine Warranty.

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This manual covers the Dual Check Safety feature of the Fanuc 31i-T control, as implemented on Hardinge T-42, T-51, and T-65 Multi-Tasking CNC lathes.

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CONVENTIONS USED IN THIS MANUAL

- WARNINGS -

Warnings must be followed carefully to avoid the possibility of personal injury or damage to the machine, tooling, or workpiece.

- CAUTIONS -

Cautions must be followed carefully to avoid the possibility of damage to the machine, tooling, or workpiece.

- NOTES -

Notes contain supplemental information.
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DOCUMENT REVISION RECORD
INTRODUCTION

GENERAL INFORMATION

Modern machine tools are typically required to comply with safety category 3 (EN 954-1). Dual Check Safety (DCS) is a feature on the Fanuc 31i-T control that monitors the actual position and speed of the servomotors, spindle motors, and the status of assigned Input/Outputs and cross-check with redundant Inputs/Outputs to verify operational status.

DCS also forces certain switches to be operated after a power-up and forces certain start-up procedures at assigned intervals.

Example:

If a machine has not been shut off in a 24 hour period an alarm will appear to force the MCC test and guard door actuation functions to be performed.

The integrated functionality provided by Dual Check Safety (DCS) complies with applicable European safety standards.

With the introduction of DCS there are now 2 ladders that run on the control; the Hardinge PMC ladder and the PMC DCS ladder that controls and monitors the Dual Check functions.

For those inputs and outputs assigned to DCS, there are 2 separate signals that are monitored by the PMC. If there is a component failure (or a component is bypassed) an alarm will appear because the 2 states of the switch (actual input and the redundant input) do not match.

MACHINE-SPECIFIC INFORMATION

Hardinge T-42, T-51, and T-65 lathes are equipped with two Fanuc input/output modules, designated 4600I/O and 4800I/O, to support the DCS feature. These input/output modules provide the termination points for each assigned input (X address), one signal to 4600I/O and the other (redundant signal) to 4800I/O. Output signals (Y address) are output from 4600I/O and 4800I/O also. These outputs are used to turn on two Omron safety relays to actuate a device. The relays are monitored through a Normally Closed contact on each relay, wired in series, and terminated at 5000I/O as an input (X address).
TROUBLESHOOTING

SAMPLE DCS ALARM

The complexity of trying to troubleshoot a DCS alarm is that the actual device that generated the error is not indicated on the alarm screen. Refer to Figure 2.1 for an example of alarm messages for a DCS error.

The alarm messages indicate a cross-check failure, but give no indication as to what component has failed.

PW**** alarms indicate that the machine must be powered down to clear the alarm.

The SV1068 alarm indicates that a DCS alarm has caused the MCC contactor to drop out to all axes.

Figure 2.1
TROUBLESHOOTING A DCS ALARM

METHOD 1 - USING THE CONTROL DISPLAY

1. Press the System function key to display the page shown in Figure 2.2.
2. Press the "+" soft key 7 times to access the page containing the DUAL CHECK soft key, shown in Figure 2.3.

Figure 2.2

Figure 2.3
3. Press the DUAL CHECK soft key to display the page shown in Figure 2.4.

4. Press the CROSS CHECK soft key to display the page shown in Figure 2.5.

This page displays the address that caused the error. A comparison of the bit patterns will show that X10.5 is “1” on the PMC column but “0” on the DSCPMC side. Using the schematic, it is possible to determine which component is the problem and where the termination point is on which module.
METHOD 2 - CHECKING THE INPUT/OUTPUT MODULES

- WARNING -
Exercise extreme care. This procedure requires working in the power case with the power ON. High voltage AC will be present in the power case when the power is ON.

Open the left power case door with the main circuit breaker ON:
1. Release the three latches on the left power case door, Figure 2.6.
2. Rotate the interlock bypass counterclockwise, Figure 2.7, and open the left power case door.

Figure 2.6

Figure 2.7
Since most of the Input/Output signals terminate at either 4600 I/O or 4800 I/O, check at these termination points to verify voltage levels using the schematic for specific points. Refer to Figure 2.8.

T1 and T2 on the Input/Output modules are for outputs (Y Address).

T3 and T4 on the Input/Output modules are for inputs (X Address).

Green LED indicators next to the terminal strip numbers show the status of each Input/Output point.
It is possible to find the problem by checking the LED combination between the two modules. When everything is working correctly, the LED’s will match on both modules. Refer to Figure 2.9. An LED not lit on one or the other module would indicate the problem. Refer to Figure 2.10. Locate the termination point on the schematic to identify the component. Close and secure the power case door when troubleshooting is complete.
DUAL CHECK SAFETY ALARM DESCRIPTIONS

INTRODUCTION

When the Dual Check Safety function detects an abnormal condition in the safety check and generates an alarm, the alarm can be canceled by a control reset operation if the abnormal condition is cleared.

Dual Check Safety PW alarms require that the power be turned OFF to clear the alarm

ABBREVIATIONS

<table>
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<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>DCS</td>
<td>Dual Check Safety</td>
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<tr>
<td>DCS PMC</td>
<td>Dual Check Safety Programmable Machine Controller</td>
</tr>
<tr>
<td>FSSB</td>
<td>Fanuc Serial Servo Bus</td>
</tr>
<tr>
<td>PMC</td>
<td>Programmable Machine Controller</td>
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</tbody>
</table>

BOOT SYSTEM ALARM

CRC CHECK ERROR: NC BASIC
CRC error occurred in CNC BASIC ROM. Install CNC BASIC ROM in flash memory again.

DUAL CHECK ALARM

DS0022 DUAL CHECK SAFETY IS NOT WORKED
Dual Check Safety function is unavailable by setting a parameter No.1902 #6 to 0.
SERVO ALARMS (SV)

SV0474 EXCESS ERROR (STOP: SV)
The servo detected that the positional deviation during stopping exceeded the parameter (No. 1839, No.1842) setting value.

SV0475 EXCESS ERROR (MOVE: SV)
The servo detected that the positional deviation during traveling exceeded the parameter (No. 1838, No.1841) setting value.

SV0476 ILLEGAL SPEED CMD. (SV)
The servo detected that the specified speed on the axis exceeded the safety speed (parameter No. 13821 to 13824, No. 13826 to 13829) during safety monitoring (the safety check request signal (*VLDVx) is 0). When the guard is open, confirm a proper value is set to parameter (No. 13821 to 13824, No. 13826 to 13829), and the operation is done within the safety speed.

SV0477 ILLEGAL MACHINE POS. (SV)
The servo detected that the machine position on the axis is not in the safety area (parameter No.13831 to 13838) during safety monitoring (the safety check request signal (*VLDVx) is 0).
When the guard is open, confirm a proper value is set to parameter No.13831 to 13838 and do an operation in the safety area.
Safe machine position monitoring is done after the machine reference position is established.

SV0478 ILLEGAL AXIS DATA (SV)
The servo detected that an error occurred on the axis during axis data transfer.
If the alarm occurs after performing axis number setting for the servo amplifier, set parameter No.2212 #4 to 1, and reset the bit to 0, and then turn off the power to the entire system.
When a multi-axis amplifier is used, the alarm may not be cleared even if the above operation is performed once. In this case, repeat the operation on the axis for which the alarm persists until it is cleared. If necessary, replace the servo amplifier.

SV0481 SAFETY PARAM ERROR (SV)
Error detected for safety parameter check function by the servo.
SV0484 SAFETY FUNCTION ERROR (SV)
An error occurred in the safety functions of the servo:
1. The servo or CNC detected a failure to execute servo software safety functions.
2. A mismatch between the servo software results of the safety functions and the CNC results of the safety functions occurred.
3. An error occurred in a servo CPU test.
4. An error occurred in a servo RAM test.
In the case of 1, 3 and 4, replace the axis control card.

SV0488 SELF TEST OVER TIME
The MCC OFF Test was not completed within the specified time (parameter No. 1946).
Check the MCC contact.

SV0489 SAFETY PARAM ERROR (CNC)
An error for the safety parameter check function is detected on n-th axis by CNC.

SV0490 SAFETY FUNCTION ERROR (CNC)
An error occurred in CNC safety functions:
1. The servo detected a failure to execute CNC safety functions.
2. A mismatch between the CNC results of the safety functions and the servo results of the safety functions occurred.
Replace the CPU card.

SV0494 ILLEGAL SPEED CMD (CNC)
The CNC detected that the specified speed exceeded the setting (parameter No. 13821 to 13824 for position control, No. 13826 to 13829 for velocity control) during safety monitoring (the safety check request signal (*VLDVx) is 0).
When the guard is open, confirm a proper value is set to parameter (No. 13821 to 13824, No. 13826 to 13829), and the operation is done within the safety speed.

SV0495 ILLEGAL MACHINE POS. (CNC)
The CNC detected that the machine position is not in the safety area (parameter No.13831 to 13838) during safety monitoring (the safety check request signal(*VLDVx) is 0).
When the guard is open, confirm proper values are set to parameter No.13831 to 13838, and operation is done in the safety area.
The safe machine position monitoring is done for the axis whose machine reference position is established.
SV0496 ILLEGAL AXIS DATA (CNC)
   The CNC detected that an error occurred during axis data transfer. If the alarm occurs after performing axis number setting for the servo amplifier, set parameter No.2212 #4 to 1, and reset the bit to 0, and then turn off the power to the entire system.

   When a multi-axis amplifier is used, the alarm may not be cleared even if the above operation is performed once. In this case, repeat the operation on the axis for which the alarm persists until it is cleared. If necessary, replace the servo amplifier.

SV0498 AXIS NUMBER NOT SET (CNC)
   The CNC detected that the axis number is not set with the servo amplifier.

   Turn off the power to the entire system. Then an axis number is automatically set.

SV1068 DUAL CHECK SAFETY ALARM
   The alarm which shut off the MCC (system common) occurred in the dual check safety function.

SV1069 EXCESS ERROR (SERVO OFF: CNC)
   The CNC detected that the positional deviation at servo off time exceeded the parameter (No. 1840) setting value.

SV1070 EXCESS ERROR (SERVO OFF: SVDSP)
   The servo detected that the positional deviation at servo off time exceeded the parameter (No. 1840) setting value.

SV1071 EXCESS ERROR (MOVE: CNC)
   The CNC detected that the positional deviation during moving exceeded the parameter (No.1838, No.1841) setting value.

SV1072 EXCESS ERROR (STOP: CNC)
   The CNC detected that the positional deviation during stopping exceeded the parameter (No.1839, No.1842) setting value.
SPINDLE ALARMS (SP)

SP0755 SAFETY FUNCTION ERROR
An error occurred in safety functions of the n-th spindle:
1. The CNC detected that the safely function of the n-th spindle was not executed.
2. A mismatch between the CNC results of the safety functions and the spindle results of the safety functions occurred.

SP0756 ILLEGAL AXIS DATA
The CNC CPU detected that the connection state and the hardware setting of the spindle amplifier were incompatible on the n-th spindle. If an alarm occurs because of the configuration change of the spindle amplifier, set the spindle amplifier correctly.

SP0757 SAFETY SPEED OVER
The CNC CPU detected that during safety monitoring (the safety check request signal (*VLDPs) is 0), the spindle motor speed was greater than the safety speed (parameter No. 4372, 4438, 4440, or 4442) on the n-th spindle. Operate within the safety speed.

SP1700 SAFETY PARAMETER ERROR
The CNC CPU detected an error in the safety parameter check function.
ALARMS REQUIRING POWER OFF (PW)

PW0008 CPU SELF TEST ERROR (DCS PMC)
The DCS PMC detected an error in the CPU self test function and RAM check function.

PW0009 CPU SELF TEST ERROR (PMC)
The PMC detected an error in the CPU self test function and RAM check function.

PW0010 SAFE I/O CROSS CHECK ERROR (DCS PMC)
The DCS PMC detected an error in the system defined safety I/O in the I/O cross check function.

PW0011 SAFE I/O CROSS CHECK ERROR (PMC)
The PMC detected an error in the system defined safety I/O in the I/O cross check function.

PW0012 USER I/O CROSS CHECK ERROR (DCS PMC)
The DCS PMC detected an error in the user defined safety I/O in the I/O cross check function.

PW0013 USER I/O CROSS CHECK ERROR (PMC)
The PMC detected an error in the user defined safety I/O in the I/O cross check function.

PW0014 CPU TEST ALARM (CNC)
An error occurred in a CNC CPU test.

PW0015 SAFETY PARAM ERROR
The CNC detected an error in the safety parameter check function.

PW0016 RAM CHECK ERROR
The CNC detected an error in the RAM check function.

PW0017 INEXECUTION OF SAFETY FUNCTIONS
The CNC detected an abnormal condition in the execution of CNC safety functions.

PW0018 CRC CHECK ERROR
The CNC detected a CRC check error in the CNC ROM.
SERIAL SPINDLE ALARMS (SP)

SP9016 SSPA:16 RAM ERROR 16
An error occurred in a spindle RAM test. Replace the spindle amplifier control printed circuit board.

SP9069 SAFETY SPEED OVER 69
The spindle detected that the speed of the spindle motor exceeded the safety speed (parameter No. 4372/No.4438/No.4440 /No.4442) during safety monitoring (the safety check request signal (*VLDPs) is 0).
1. Check the safety speed parameter (parameter No.4372/No.4438/No.4440/No.4442).
2. Perform operation at a speed not exceeding the safety speed.

SP9070 ILLEGAL AXIS DATA 70
Check the spindle amplifier connection state and spindle amplifier hardware setting. If this alarm is issued because the spindle amplifier configuration is changed, correct the setting on the spindle amplifier side. When two spindle amplifiers are used, cable K90 needs to be connected to connector JA7A of the second spindle amplifier. For details on cable K90, refer to ái Series Servo Amplifier Descriptions (B-65282EN).

SP9071 SAFETY PARAMETER ERROR 71
Set the safety parameter again.
The following are spindle safety parameters:
No.4372, No.4438, No.4440, No.4442, No.4448

SP9072 MISMATCH RESULT OF MOTOR SPEED CHECK 72
Replace the spindle amplifier control printed circuit board.

SP9074 CPU TEST ERROR 74
Replace the spindle amplifier control printed circuit board.

SP9075 CRC ERROR 75
Replace the spindle amplifier control printed circuit board.

SP9076 INEXECUTION OF SAFETY FUNCTIONS 76
Replace the spindle amplifier control printed circuit board.
SP9077 MISMATCH RESULT OF AXIS NUMBER CHECK 77
   Replace the spindle amplifier control printed circuit board.

SP9078 MISMATCH RESULT OF SAFETY PARAMETER CHECK 78
   Set the safety parameter again.
   The following are spindle safety parameters:
   No.4372, No.4438, No.4440, No.4442, No.4448

SP9079 INITIAL TEST ERROR 79
   Replace the spindle amplifier control printed circuit board.
SERVO ALARMS TO TURN MCC OFF SIGNAL (*MCFVX) TO “0”

SV0301 APC ALARM: COMMUNICATION ERROR

Since the absolute position detector caused a communication error, the correct machine position could not be obtained (data transfer error). The absolute position detector, cable, or servo interface module is thought to be defective.

SV0302 APC ALARM: OVER TIME ERROR

Since the absolute position detector caused an overtime error, the correct machine position could not be obtained (data transfer error). The absolute position detector, cable, or servo interface module is thought to be defective.

SV0303 APC ALARM: FRAMING ERROR

Since the absolute position detector caused a framing error, the correct machine position could not be obtained (data transfer error). The absolute position detector, cable, or servo interface module is thought to be defective.

SV0304 APC ALARM: PARITY ERROR

Since the absolute position detector caused a parity error, the correct machine position could not be obtained. (data transfer error) The absolute position detector, cable, or servo interface module is thought to be defective.

SV0305 APC ALARM: PULSE ERROR

Since the absolute position detector caused a pulse error, the correct machine position could not be obtained. The absolute position detector or cable is thought to be defective.

SV0306 APC ALARM: OVER FLOW ERROR

Since the amount of positional deviation overflowed, the correct machine position could not be obtained.

SV0307 APC ALARM: MOVEMENT EXCESS ERROR

Since the machine moved excessively, the correct machine position could not be obtained.

SV0360 ABNORMAL CHECKSUM (INT)

The checksum alarm occurred on the integrated pulse coder.
SV0361 ABNORMAL PHASE DATA (INT)
   The phase data abnormal alarm occurred on the integrated pulse coder.

SV0362 ABNORMAL REV. DATA (INT)
   The speed count abnormal alarm occurred on the integrated pulse coder.

SV0363 ABNORMAL CLOCK (INT)
   The clock alarm occurred on the integrated pulse coder.

SV0364 SOFT PHASE ALARM (INT)
   A digital servo soft detected an abnormality on the integrated pulse coder.

SV0365 BROKEN LED (INT)
   The digital servo software detected abnormal data on the integrated pulse coder.

SV0366 PULSE MISS (INT)
   A pulse error occurred on the integrated pulse coder.

SV0367 COUNT MISS (INT)
   A count error occurred on the integrated pulse coder.

SV0368 SERIAL DATA ERROR (INT)
   The communications data could not be received from the integrated pulse coder.

SV0369 DATA TRANS. ERROR (INT)
   A CRC error or stop bit error occurred in the communications data from the integrated pulse coder.

SV0380 BROKEN LED (EXT)
   Separate detector error

SV0381 ABNORMAL PHASE (EXT)
   An abnormal alarm in the position data occurred on the separate linear scale.

SV0382 COUNT MISS (EXT)
   A count error occurred on the separate detector.

SV0383 PULSE MISS (EXT)
   A pulse error occurred on the separate detector.
SV0384 SOFT PHASE ALARM (EXT)
The digital servo software detected abnormal data on the separate detector.

SV0385 SERIAL DATA ERROR (EXT)
The communications data could not be received from the separate detector.

SV0386 DATA TRANS. ERROR (EXT)
A CRC error or stop bit error occurred in the communications data from the standalone detector.

SV0387 ABNORMAL ENCODER (EXT)
An abnormality occurred on a separate detector. For more information, contact the scale manufacturer.

SV0445 SOFT DISCONNECT ALARM
The digital servo software detected a disconnected pulse coder.

SV0448 UNMATCHED FEEDBACK ALARM
The sign of the feedback signal from the standalone detector is opposite to that from the feedback signal from the integrated pulse coder.

SV0453 SPC SOFT DISCONNECT ALARM
Software disconnection alarm of the pulse coder. Turn off the power to the CNC, then remove and insert the pulse coder cable. If this alarm is issued again, replace the pulse coder.

SV0460 FSSB DISCONNECT
The FSSB connection cable was disconnected or broken. The amplifier was turned OFF. In the amplifier, the low voltage alarm occurred.

SV0462 SEND CNC DATA FAILED
The correct data could not be received on a slave side because of the FSSB communication error.

SV0463 SEND SLAVE DATA FAILED
The correct data could not be received in the servo software because of the FSSB communication error.

SV0474 EXCESS ERROR (STOP: SV )
The servo detected that the positional deviation during stopping exceeded the parameter (No. 1839, No.1842) setting value.
SV0475 EXCESS ERROR (MOVE: SV)

The servo detected that the positional deviation during traveling exceeded the parameter (No. 1838, No.1841) setting value.

SV1067 FSSB: CONFIGURATION ERROR (SOFT)

The FSSB configuration error occurred. (Detected in software).

There is a difference in the type of connected amplifier and FSSB setting.

SV5134 FSSB: OPEN READY TIME OUT

In the initialization, the FSSB could not be in an open ready state. The axis card is thought to be defective.

SV5136 FSSB: NUMBER OF AMP. IS INSUFFICIENT

The number of amplifier identified by the FSSB is insufficient for the number of control axes. The setting of the number of axes or the amplifier connection is in error.

SV5137 FSSB: CONFIGURATION ERROR

An FSSB configuration error occurred. The connecting amplifier type is incompatible with the FSSB setting value.

SV5139 FSSB: ERROR

Servo initialization did not terminate normally. The optical cable may be defective, or there may be an error in connection to the amplifier or another module. Check the optical cable and the connection status.

SV5197 FSSB: OPEN TIME OUT

The initialization of the FSSB was completed, but it could not be opened.

The connection between the CNC and the amplifier in is incorrect.

SV5311 FSSB: ILLEGAL CONNECTION

1. This alarm is issued if axes, whose servo axis numbers (parameter No. 1023) are even and odd numbers, are allocated to the amplifiers connected to the FSSB of different paths.

2. This alarm is issued if an attempt is made to set up for use of the pulse modules connected to the FSSB of different paths.
**SPINDLE ALARMS TO TURN MCC OFF SIGNAL (MCFPS) TO “0”**

**SP1220 NO SPINDLE AMP**
Either the cable connected to a serial spindle amplifier is broken, or the serial spindle amplifier is not connected.

**SP1225 CRC ERROR (SERIAL SPINDLE)**
A CRC error (communications error) occurred in communications between the CNC and the serial spindle amplifier.

**SP1226 FRAMING ERROR (SERIAL SPINDLE)**
A framing error occurred in communications between the CNC and the serial spindle amplifier.

**SP1227 RECEIVING ERROR (SERIAL SPINDLE)**
A receive error occurred in communications between the CNC and the serial spindle amplifier.

**SP1228 COMMUNICATION ERROR (SERIAL SPINDLE)**
A communications error occurred between the CNC and the serial spindle amplifier.

**SP1229 COMMUNICATION ERROR SERIAL SPINDLE AMP**
A communications error occurred between serial spindle amplifiers (motor Nos. 1 and 2, or motor Nos. 3 and 4).

**SP1245 COMMUNICATION DATA ERROR**
A communication data error was detected on the CNC.

**SP1246 COMMUNICATION DATA ERROR**
A communication data error was detected on the CNC.

**SP1247 COMMUNICATION DATA ERROR**
A communication data error was detected on the CNC.

**SP1976 SERIAL SPINDLE COMMUNICATION ERROR**
The amplifier No. could not be set to the serial spindle amplifier.

**SP1977 SERIAL SPINDLE COMMUNICATION ERROR**
An error occurred in the spindle control software.
SP1978 SERIAL SPINDLE COMMUNICATION ERROR
   A time-out was detected during communications with the serial spindle amplifier.

SP1979 SERIAL SPINDLE COMMUNICATION ERROR
   The communications sequence was no longer correct during communications with the serial spindle amplifier.

SP1980 SERIAL SPINDLE AMP. ERROR
   Defective SIC-LSI on serial spindle amplifier.

SP1981 SERIAL SPINDLE AMP. ERROR
   An error occurred during reading of the data from SIC-LSI on the analog spindle amplifier side.

SP1982 SERIAL SPINDLE AMP. ERROR
   An error occurred during reading of the data from SIC-LSI on the serial spindle amplifier side.

SP1983 SERIAL SPINDLE AMP. ERROR
   Could not clear on the spindle amplifier side.

SP1987 SERIAL SPINDLE CONTROL ERROR
   Defective SIC-LSI on the CNC.

SP9073 MOTOR SENSOR DISCONNECTED
   The motor sensor feedback signal is not present.

SP9081 1-ROT MOTOR SENSOR ERROR
   The one-rotation signal of the motor sensor cannot be correctly detected.

SP9082 NO 1-ROT MOTOR SENSOR
   The one-rotation signal of the motor sensor is not generated.

SP9083 MOTOR SENSOR SIGNAL ERROR
   An irregularity was detected in a motor sensor feedback signal.
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<td>-</td>
<td>Initial Release.</td>
</tr>
<tr>
<td>February 3, 2012</td>
<td>A</td>
<td>Added T-51 and T-65 lathes.</td>
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