BANDSAWING MACHINE

VM SERIES US

VM1200/2500

OPERATOR'S MANUAL

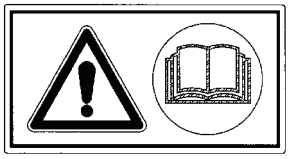
This product comes standard with:

- Circuit Diagrams
- Operator’s Manual

AMADA

VM1200&2500 US-E01-201008

PREFACE Read this manual carefully to obtain a thorough knowledge of machine operation and maintenance. Be sure to follow the instructions to ensure proper procedures and prevent injuries and accidents. Do not operate the machine by guesswork. Keep the manual at hand and refer to it whenever you are not sure of how to perform any of the procedures.



This manual classifies the hazardous situations into the following levels:

DANGER	**Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**
WARNING	**Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**
CAUTION	**Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**
NOTICE	**Indicates a potentially hazardous situation which, if not avoided, may result in damage to the machine and tooling.**
NOTE	**Indicates not a warning but an item of information which should be known to work.**

Operator's Manual:

VM Series Bandsawing Machine

Aug. 2010

Printed in Japan

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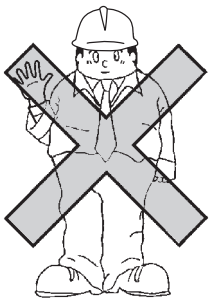
(Continued on next page.)

SAFETY RULES

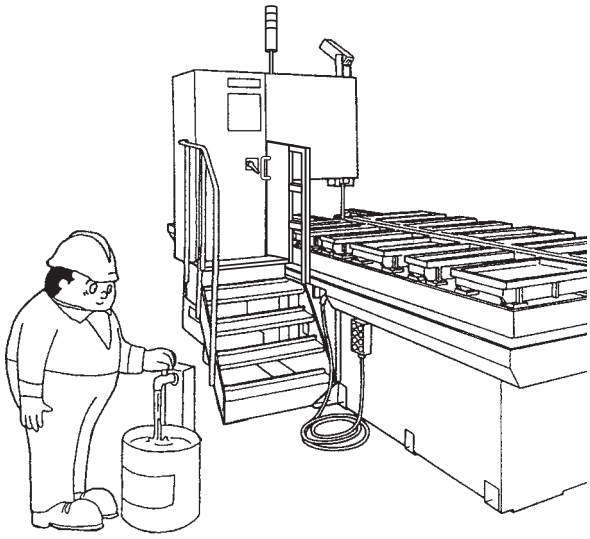
Observe these safety rules to prevent injuries and accidents. *(The illustrations may be partly different from the actual machine in detail.)*

a) Never wear gloves and loose clothing when operating the machine. It is dangerous if they are caught in the running machine.

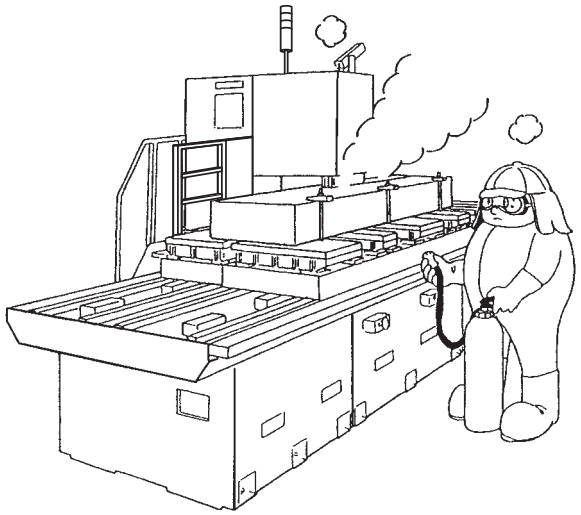


b) Use a water-soluble cutting fluid on this machine. Oil-based cutting fluids may emit smoke or catch fire, depending on the condition of their use. Never use oil-based cutting fluids on this machine.

When cutting a large workpiece, take care that the cutting fluid does not flow down the workpiece onto the shop floor.

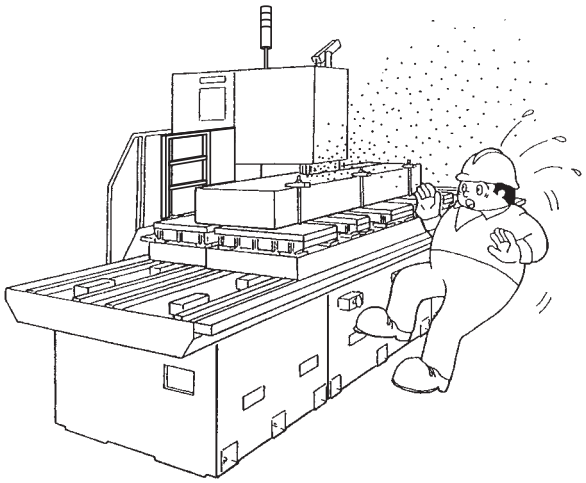


c) Prohibit any use of fire in the shop, and install a fire extinguisher or other fire control device near the machine when cutting titanium, magnesium, or any other material that produces flammable chips. Never leave the machine unattended when cutting flammable materials.

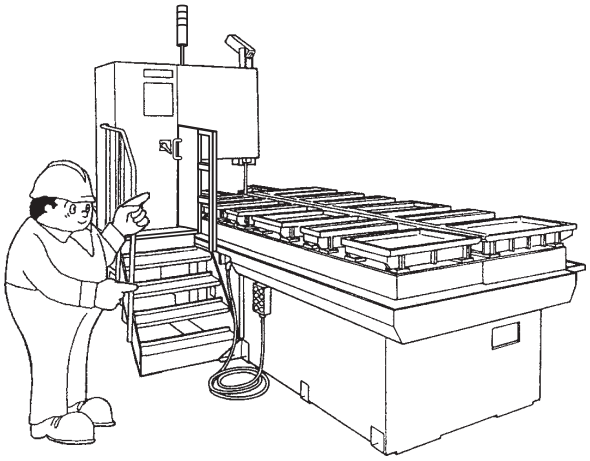


d) Never cut on this machine carbon or any other material that produces and disperses explosive dust. Sparks from motors and other machine parts may ignite and explode the air-borne dust.

The machine needs special measures for cutting explosive materials (for details, consult AMADA).

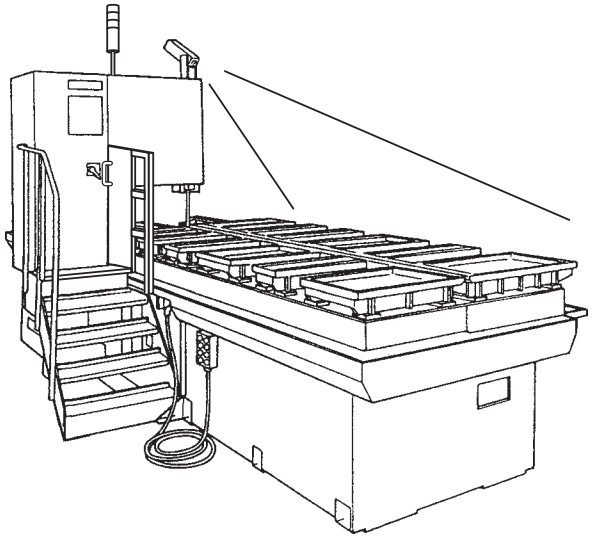


e) Confirm that the area around the machine is cleared of people and obstacles every time before starting the machine or operation.

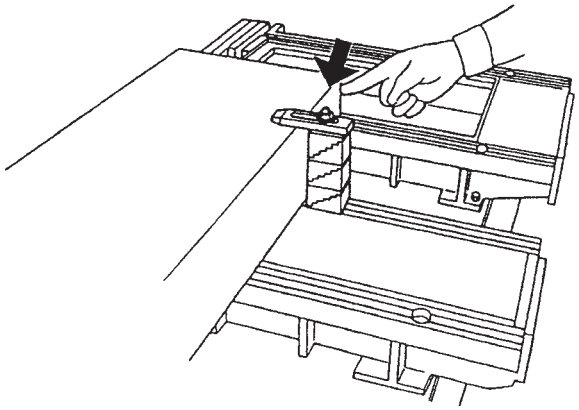


f) Set the MODE keyswitch at "0" when installing or removing the saw blade, or lubricating the saw blade tension slides and driven wheel bearing.

g) Never look directly into the source of the laser beam. You may lose your eyesight.

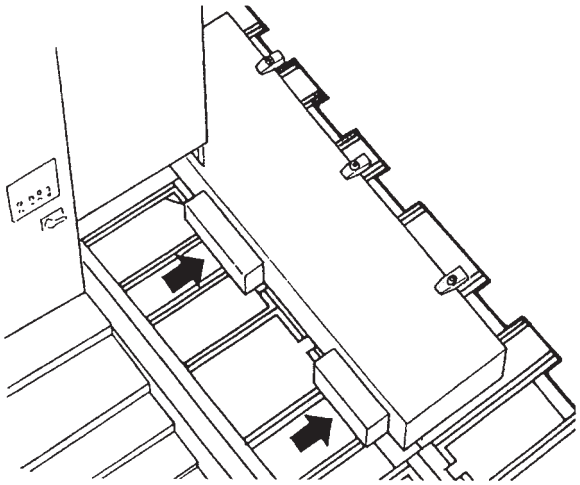


h) Never start the saw blade unless it has been confirmed that the work is firmly clamped. If the work cannot be securely clamped, be sure to clamp it using jigs. It is dangerous if the work falls or rolls during cutting.



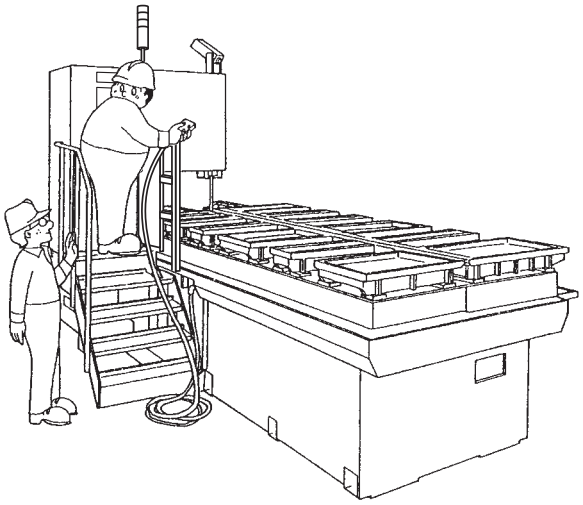
i) When cutting a thin piece from the work, take preventive measures to keep the cut piece from falling. It is dangerous if the cut piece falls.

Take care also that the cut piece may fall when the saw blade guides are operated.

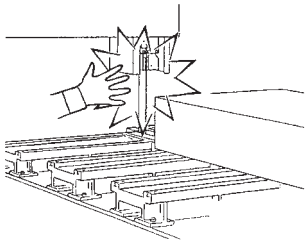


j) Never operate the machine with the wheel covers and other covers removed or opened. It is dangerous if your hands or clothing are caught in the running machine.

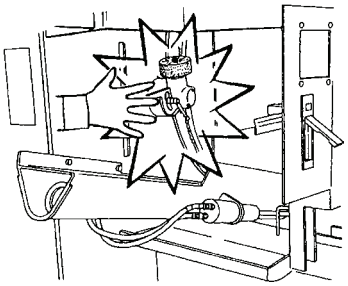
k) Never take your eyes off the machine or lean on the machine during operation. Be ready for a situation that demands immediate attention to prevent an accident.

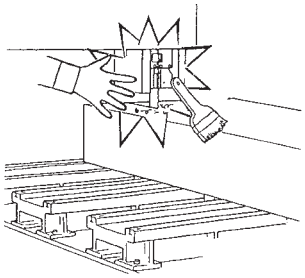


l) Never touch the running saw blade. It is dangerous if your hands or clothing are caught in the running saw blade.

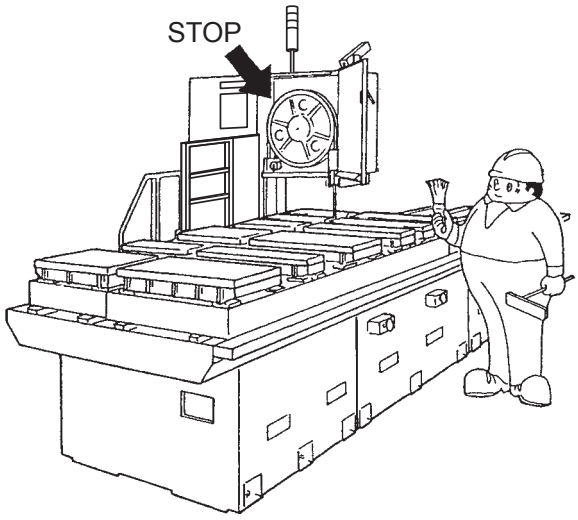


m) Never try to change the wire brush on the saw blade or remove chips when the saw blade is running. It is dangerous if your hands or clothing are caught in the running saw blade.

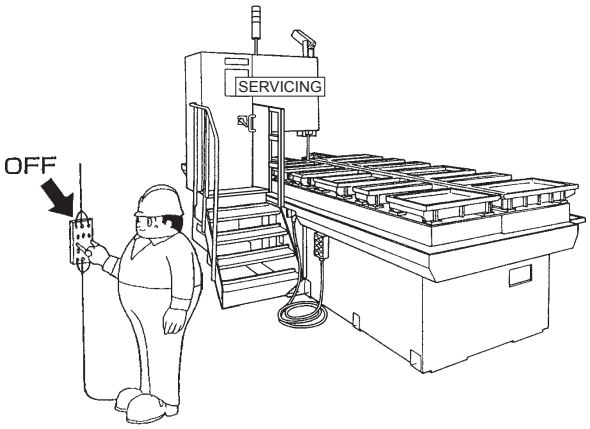




n) Stop the saw blade whenever cleaning the machine. It is dangerous if your hands or clothing are caught in the running saw blade.



o) Turn off the shop circuit breaker switch before servicing the machine. Then post a sign to inform people that the machine is under maintenance.

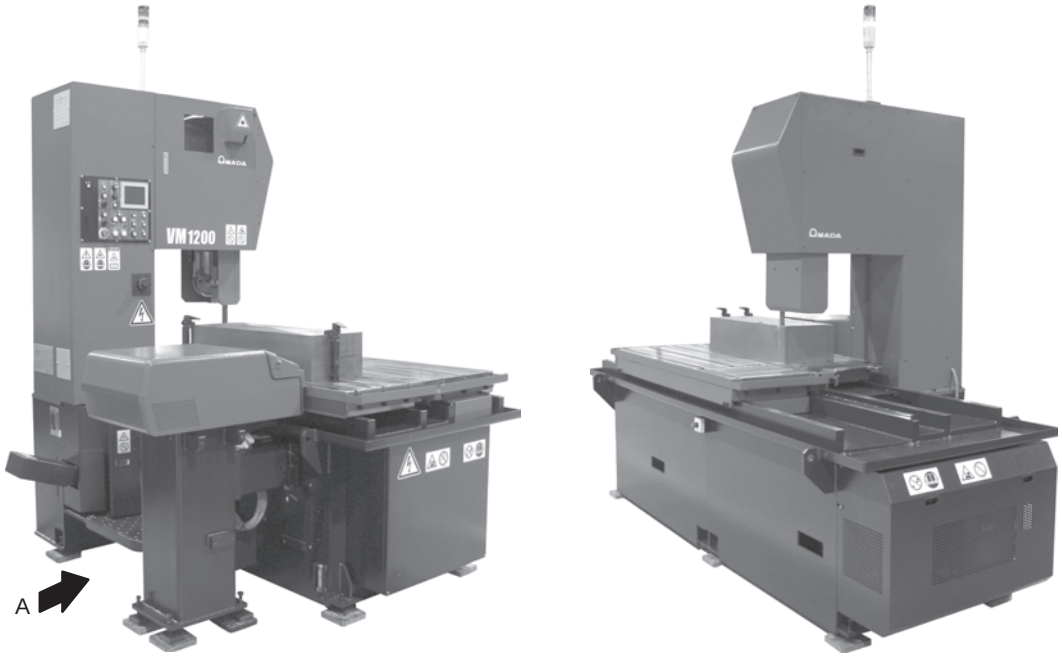


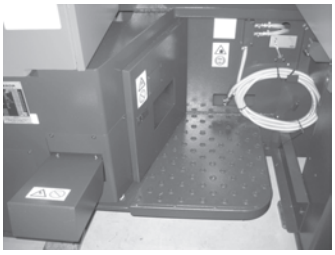
p) When stepping onto the table for performing maintenance, wear a helmet and safety shoes, and take care not to slip.

q) Never modify the machine's parts or electric circuits or change them with unauthorized parts or circuits. Doing so will cause machine problems and damage and disrupt the safety of the machine and the operator.

Warning plates

Keep the warning plates well noticeable and never remove them.





View at A

Warning signs and messages

● **Read the operator's manual.**

● **Do not operate the machine unattended.**

● **Oil-based cutting fluids may catch fire. Do not use them.**

● **Some chips can violently burn. Do not cut titanium, magnesium, and especially carbon.**

● **You may lose your eyesight. Do not look directly into the source of the laser beam.**
Class 2M laser product

● **Do not touch the running saw blade.**

● **Do not reach into the running chip conveyor.**

● **Do not operate the machine with the wheel covers and hydraulic unit cover removed.**

● **You may get an electric shock. Turn off the power, and open the electrical enclosure.**

● **Keep away from the table during operation.**

● **Do not clean the upper saw blade guide and table with compressed air.**

● **When cleaning the machine by discharging the cutting fluid from the cleaning hose nozzle, wear protective goggles.**

CUTTING PRECAUTIONS

The selection of an appropriate saw blade and cutting method is important in cutting the work safely and efficiently. Select an appropriate saw blade and cutting method by fully considering the work to be cut and the requirements of your job (such as cutting accuracy, cutting speed, economy, and safety control).

Selecting saw blade

The tooth form, pitch, and grade of an appropriate saw blade change with the material, shape, size, and fixing method of the work to be cut. An appropriate saw blade also varies with the requirements of your job (such as cutting accuracy, cutting speed, and economy) even when the same work is to be cut. Consult AMADA about the selection of saw blades for specific jobs.

The saw blade supplied as standard equipment on the machine measures 41 mm {1.61 in.} in width, 1.3 mm {0.051 in.} in thickness, and 4670 mm {183.8 in.} in length.

Cutting method

According to its material, the work may be cut wet (or with a cutting fluid), or dry (or without a cutting fluid). The materials to be cut wet or dry are listed in the table below.

Wet cutting

Use a water-soluble cutting fluid on this machine.

Select an appropriate cutting fluid by referring to Appendixes 1 to 3. The main composition and characteristics of cutting fluids vary from manufacturer to manufacturer. Some cutting fluids may adversely affect the human body. For the main composition, characteristics, effect on the human body, and other details, consult the manufacturers of specific cutting fluids. Do not use cutting fluids of unknown composition.

Oil-based cutting fluids may emit smoke or catch fire, depending on the condition of their use. Never use oil-based cutting fluids on this machine.

Never use oils other than cutting fluids (kerosene, for example) because they have the high possibility of causing a fire.

Dry cutting

The machine needs special measures for performing dry cutting. Consult AMADA. If dry cutting is performed without taking special measures, chips may accumulate in machine parts and may cause the operation or insulation failure of the machine.

The machine also needs special measures for cutting carbon and other materials that produce and disperse explosive dust. Consult AMADA. If such an explosive material is cut on the machine without special measures, sparks from motors and other machine parts may ignite and explode the air-borne dust.

Even if the machine is equipped with special measures for cutting explosive materials, carbon and other air-borne dust may still explode. Be sure to prohibit any use of fire in the shop and install a fire extinguisher or other fire control device near the machine. Never leave the machine unattended during cutting operation.

Materials to be cut wet or dry

	JIS	DIN	NF	BS	AISI
Wet Cutting	SUM11–43 SS S20C–S55C SUP3–13 SCr415–445 SCM415–822 SNC415–815 SNCM220–815 SUS201–631 SK1–7 SKS2–5,7– SKD1,11,12 SKT SKH2–59 SF Aluminum Aluminum alloy Copper Copper alloy Magnesium Titanium Nickel base alloy Monel Inconel	9S20–9SMn36 St33–St52-3 CK22–CK55 (C22–C55) 55Cr3–50CrV4 34Cr4–41Cr4 34CrMo4–42CrMo4 X10CrNiS189–X20Cr13 C105W1–C70W2 105WCr6 X210Cr12 X155CrVMo12 1 X100CrVMo5 1 55NiCrMoV6 S18-1-2-5–S2-10-1-8 St37-3–St52-3 Aluminum Aluminum alloy Copper Copper alloy Magnesium Titanium Nickel base alloy Monel Inconel	S250Pb–45MF6.3 1C22–1C55 55C3–50CV4 20MC5–45C4 18CD4–42CD4 30NC11 20NCD2 Z10CNF18.09–Z20C13 $Y_2$140–$Y_1$70 105WC13 Z200C12 Z160 CDV12 Z100 CDV5 55NCDV7 Z80WCV18-04-01– Z110DKCWV09-08-04-02-01 F37–F52 Aluminum Aluminum alloy Copper Copper alloy Magnesium Titanium Nickel base alloy Monel Inconel	220M07–226M44 40A–50F 070M20–070M55 250A53–735A50 530A30–530A40 708M20–708A47 655M13 805A20 303S21–420S29 BW1C–BW1A BD3 BD2 (BA2) BH19 BT1–BM42 Aluminum Aluminum alloy Copper Copper alloy Magnesium Titanium Nickel base alloy Monel Inconel	1110–1144 30–70 1020–1055 1075–6150 5120–5147 4130–4145 8615–4340 303–420 W1-13–W1-7 D3 D2 (A2) H19 T1–M42 Class A–D Aluminum Aluminum alloy Copper Copper alloy Magnesium Titanium Nickel base alloy Monel Inconel
Dry Cutting	FC10–35 FCMB FCMP SKD1 Carbon	GG10–GG35 GTS-35-10 X210Cr12 Carbon	Ft10D–Ft35 Z200C12 Carbon	150–350 B150/4–B690/2 BD3 Carbon	A48-20B–A48-50B 45006–90001 D3 Carbon

Cutting flammable materials

Chips of titanium or magnesium violently burn when they catch fire. Once these chips burn, the resultant fire may explosively propagate through surrounding chips. When an oil-based cutting fluid is used on the machine, it may also be ignited and spread the fire.

When cutting such flammable materials, be sure to clean the machine of accumulated chips at the start and end of every operation. During automatic operation, stop the machine as required to remove the chips. Take care so that the cutting fluid is discharged in a sufficient amount during the cutting operation.

When cutting a flammable material, be sure to prohibit any use of fire in the shop, install a fire extinguisher or other fire control device near the machine. Never leave the machine unattended during the cutting operation.

When carrying or disposing of chips, take due care so that they do not catch fire. Be sure to prohibit any use of fire where the chips are stored.

Cutting unknown materials

Before cutting an unknown material, consult the supplier of the material, burn a small amount of chips from the material in a safe place, or follow any other procedure to check to see if the material is flammable or not.

Appendix 1: Classification of water-soluble cutting fluids

	Color when diluted	Main composition
Soluble	Milky white or clear	Mineral oil
Semi-synthetic	Clear	Mineral oil
Synthetic	Clear	Polymer

NOTE

● Dilute each product to the specified ratio.

Appendix 2: Characteristics of water-soluble cutting fluids

Advantage	Disadvantage
• Have high cooling effect • Not flammable • Economical • Do not require cleaning of cut products (especially when soluble)	• Remove paint • Lose rust protection effect when deteriorated • Foam • Putrefy • Decline in performance, depending on quality of water used for dilution

Appendix 3: Cutting fluids suited for specific materials

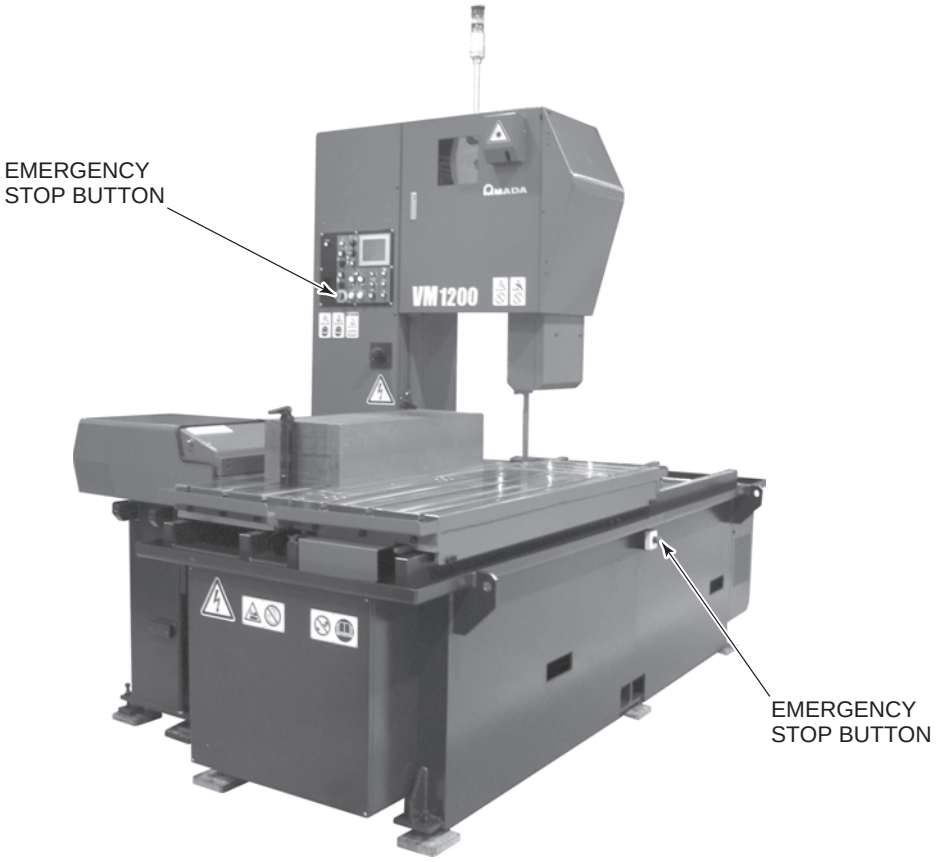
This table shows the general machinability of materials with different cutting fluids.

JIS	SUM11–43 FC10–35 S20C–S30C FCMB SS	S40C–S55C SCM415–822 SNCM220–815 SKS2, 4, 5 SF	SCr415–445 SUP3–13 SNC415–815 SK1–7 SKS3, 7– SUS201–631 SKD1, 11, 12 SKH2–59 SKT	Aluminum Aluminum alloy Magnesium Copper Copper alloy Titanium	Nickel base alloy Monel Inconel
DIN	9S20–9SMn36 GG10–GG35 CK22–CK35 (C22–C35) GTS-35-10 St33–St52-3	CK45–CK55 (C45–C55) 34CrMo4–42CrMo4 St37-3–St52-3	34Cr4–41Cr4 55Cr3–50CrV4 C105W1–C70W2 X10CrNiS189–X20Cr13 105WCr6 X210Cr12 X155CrVMo12 1 X100CrVMo5 1 S18-1-2-5–S2-10-1-8 55NiCrMoV6	Aluminum Aluminum alloy Magnesium Copper Copper alloy Titanium	Nickel base alloy Monel Inconel
NF	S250Pb–45MF6.3 Ft10D–Ft35 1C22–1C25	1C45–1C55 18CD4–42CD4 20NCD2 F37–F52	20MC5–45C4 55C3–50CV4 30NC11 $Y_2$140–$Y_1$70 Z10CNF18.09–Z20C13 105WC13 Z200C12 Z160CDV12 Z100CDV5 Z80WCV18-04-01– Z110DKCWV09-08-04-02-01 55NCDV7	Aluminum Aluminum alloy Magnesium Copper Copper alloy Titanium	Nickel base alloy Monel Inconel
BS	220M07–226M44 150–350 070M20–080A30 40A–50F	060A40–070M55 708M20–708A47 805A20	530A30–530A40 250A53–735A50 655M13 BW1C–BW1A 303S21–420S29 BD3 BD2 (BA2) BT1–BM42 BH19	Aluminum Aluminum alloy Magnesium Copper Copper alloy Titanium	Nickel base alloy Monel Inconel
AISI	1110–1144 A48-20B–A48-50B 1020–1030 30–70	1040–1055 4130–4145 8615–4340 Class A–D	5120–5147 1075–6150 W1-13–W1-7 303–420 D3 D2 (A2) T1–M42 H19	Aluminum Aluminum alloy Magnesium Copper Copper alloy Titanium	Nickel base alloy Monel Inconel
Soluble	▲	●	●	●	▲
Semi-synthetic	▲	●	●	●	▲
Synthetic	●	●	▲	●	▲

●: Best ▲: Good

EMERGENCY STOP BUTTON LOCATION

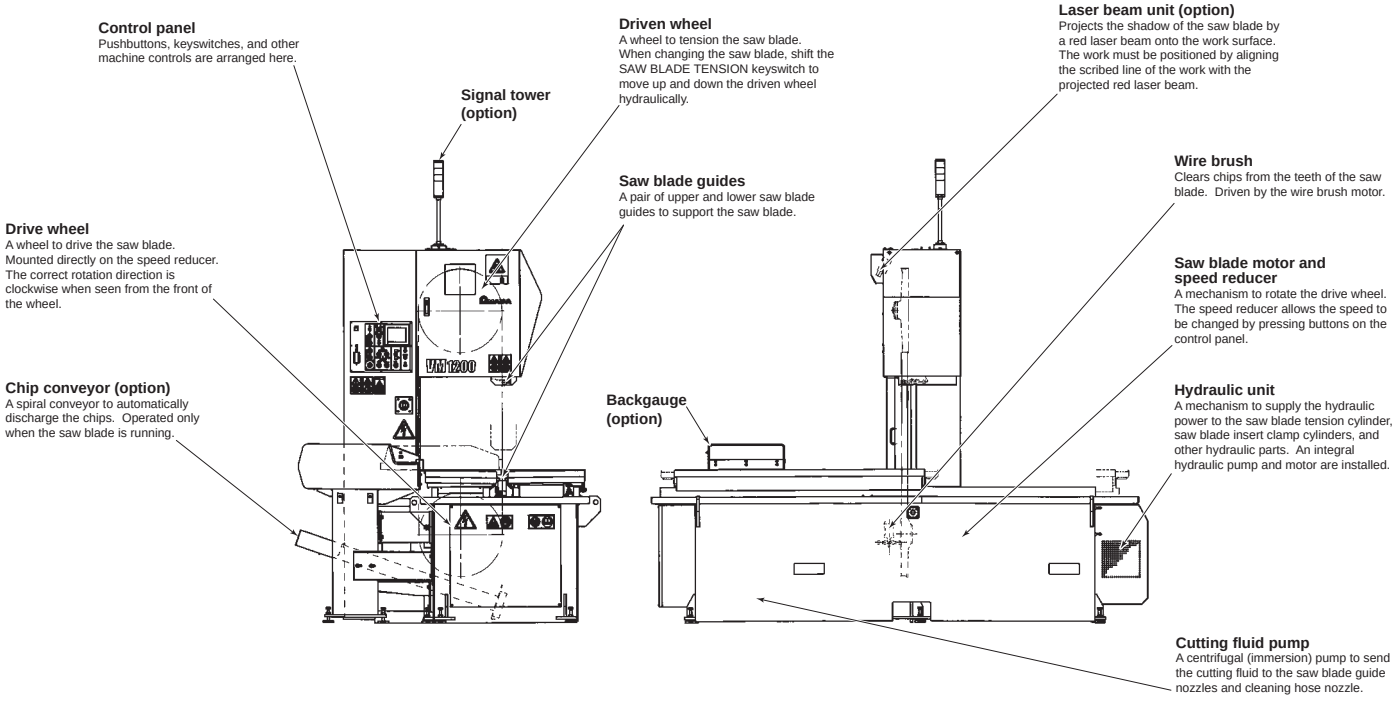
When one of the EMERGENCY STOP buttons is pressed, the machine comes to a total stop immediately. The button locks when pressed and must be pulled out to unlock it.



Part I

Description

NAMES AND FUNCTIONS OF MAIN PARTS

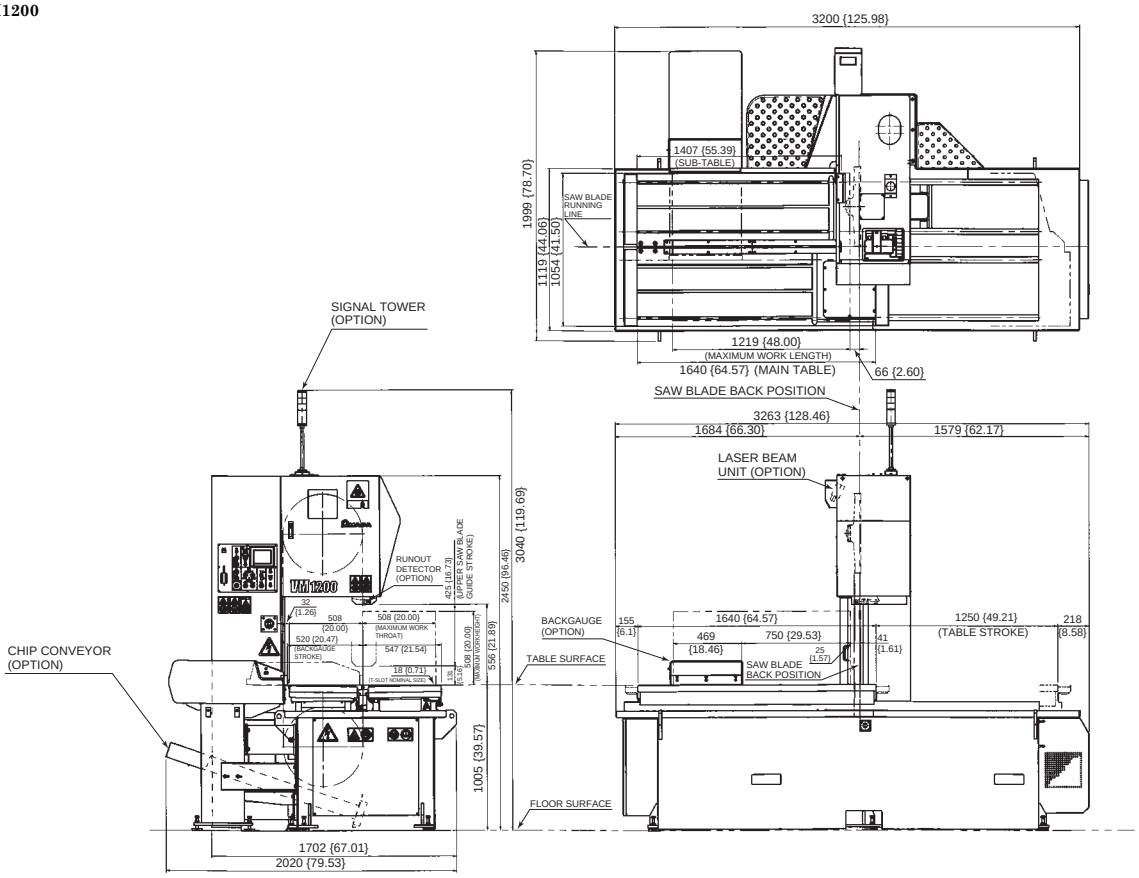


SPECIFICATIONS

Dimensions of main parts

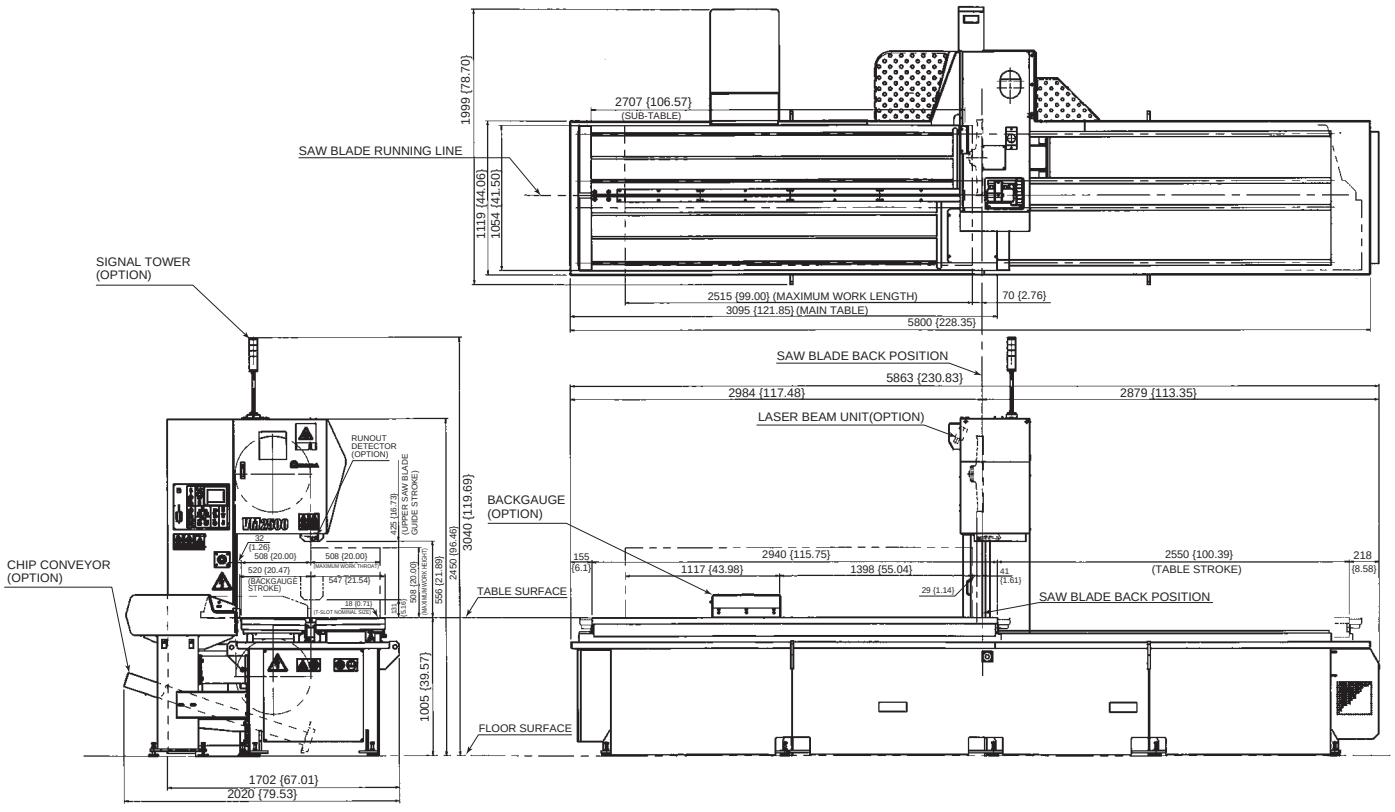
VM1200

Unit: mm {in.}



VM2500

Unit: mm {in.}



Machine

		VM1200	VM2500
Cutting capacity	Throat (width), mm {in.}	508 {20.0}	
	Height, mm {in.}	508 {20.0}	
	Length, mm {in.}	1219 {48.0}	2515 {99.0}
Saw blade	Width, mm {in.}	41 {1.61}	
	Thickness, mm {in.}	1.3 {0.051}	
	Length, mm {in.}	4670 {183.8}	
	Running speed, m/min {fpm}	10 to 90 {32.8 to 295.3}	
	Tension	Automatic hydraulic tension control	
Saw blade guides	Side	Cemented carbide inserts and hydraulic clamps	
	Back	Cemented carbide backup tips	
Table	Main table width, mm {in.}	547 {21.5}	
	Sub-table width, mm {in.}	508 {20.0}	
	Length, mm {in.}	1640 {64.6}	3095 {121.8}
	Stroke, mm {in.}	1250 {49.2}	2550 {100.4}
	Allowable load capacity, kg {lb}	2000 {4410}	5000 {11025}
	Height from floor, mm {in.}	1005 {39.6}	
	T-slot, mm {in.}	18 {0.71} (for M16)	
	Feed control	AC servo motor	

		VM1200	VM2500
Cutting fluid	Tank capacity, L {US gal}	105 {27.7}	
	Pump	Centrifugal immersion type	
Hydraulic unit	Tank capacity, L {US gal}	10 {2.6}	
	Pump capacity	11 L/min {2.9 US gal/min} at 50 Hz	
	Set pressure	3.5 MPa {508 psi}	
Motors	Saw blade motor	5.5 kW {7.38 HP}, 4P, 200 V, 50/60 Hz	
	Hydraulic pump motor	0.75 kW {1.01 HP}, 4P, 200 V, 50/60 Hz	
	Cutting fluid pump motor	0.18 kW {0.24 HP}, 2P, 200 V, 50/60 Hz	
	Table feed motor	0.5 kW {0.67 HP}, 200 V, 50/60 Hz	
	Wire brush motor	0.09 kW {0.12 HP}, 4P, 200 V, 50/60 Hz	
Chip disposal		Use accessory chip rake and chip shovel.	
Control circuit voltage		AC 100 V, DC 24 V	
Machine dimensions	Width, mm {in.}	1702 {67.0}	
	Length, mm {in.}	3263 {128.5}	5863 {230.8}
	Height, mm {in.}	2450 {96.5}	
Machine mass, kg {lb}		3300 {7277}	5500 {12128}

Standard accessories

No.	Name	Specification or type	Quantity
1	Hydraulic oil	Amada A32 (ISO VG 32 equivalent)	18 L
2	Cutting fluid	Amada SD, 4L can	3 cans
3	Leveling plate	1453832	VM1200: 7 VM2500: 11
4	Wire brush	WH1503	2
5	Saw blade	Amada SGLB 2/3P, 41 × 1.3 × 4670 mm {1.61 × 0.051 × 183.8 in.} (W × T × L)	1
6	Chip rake	605565	1
7	Chip shovel	602631	1
8	Saw blade slip detector (motion detector)		1 set
9	Wheel cover open limit switch		1 set
10	Cutting rate display		1 set

Optional accessories

No.	Name	Quantity
1	Runout detector	1 set
2	Chip conveyor	1 set
3	Laser beam unit	1 set
4	Signal tower	1 set
5	Clamping kits	1 set
6	Work stopper	1 set
7	Work clamper	1 set
8	Backgauge	1 set

Part II

Installation

LOCATION

Select such a location that ample space can be provided around the machine for loading workpieces, unloading cut pieces, and performing maintenance on the machine.

NOTICE

- Select a location where the machine will not be exposed to rain and wind. If another machine located nearby produces vibration or dust, take necessary measures against the vibration or dust.

FOUNDATION

Install the machine on a level and flat concrete floor. Execute the foundation work by yourself. The positions of leveling bolts and anchor bolts are as shown in the foundation drawing below.

NOTICE

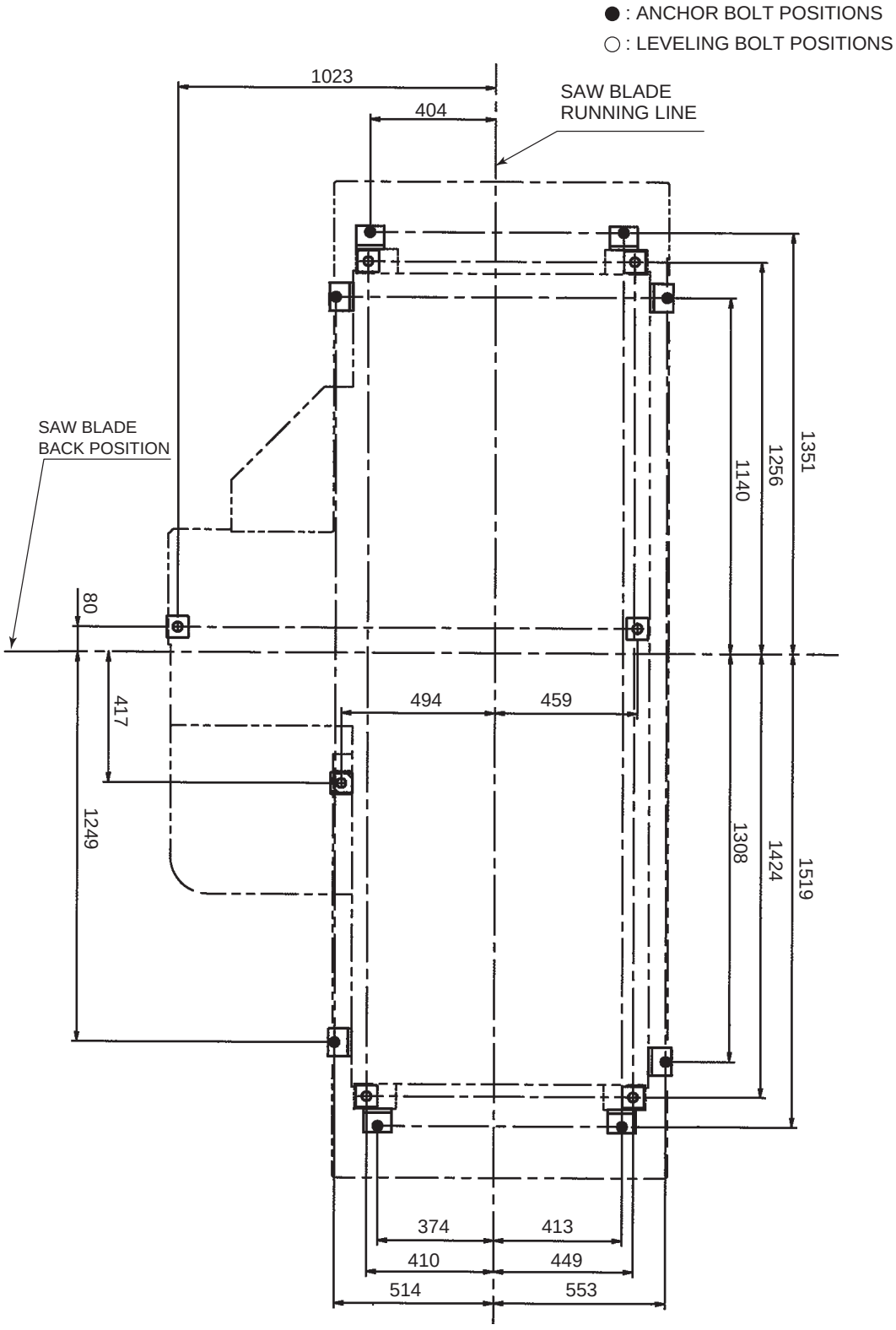
- The load that bears on one leveling bolt is a maximum of 12000 kg {26460 lb}.
- A minimum pressure of 2.9 MPa {421 psi} is applied to the concrete around the leveling bolts.
- Hold the flatness of the concrete floor within 10 mm {0.4 in.}.

NOTE

- The alternate long and two short dashes lines in the foundation drawing show the outline of the machine.

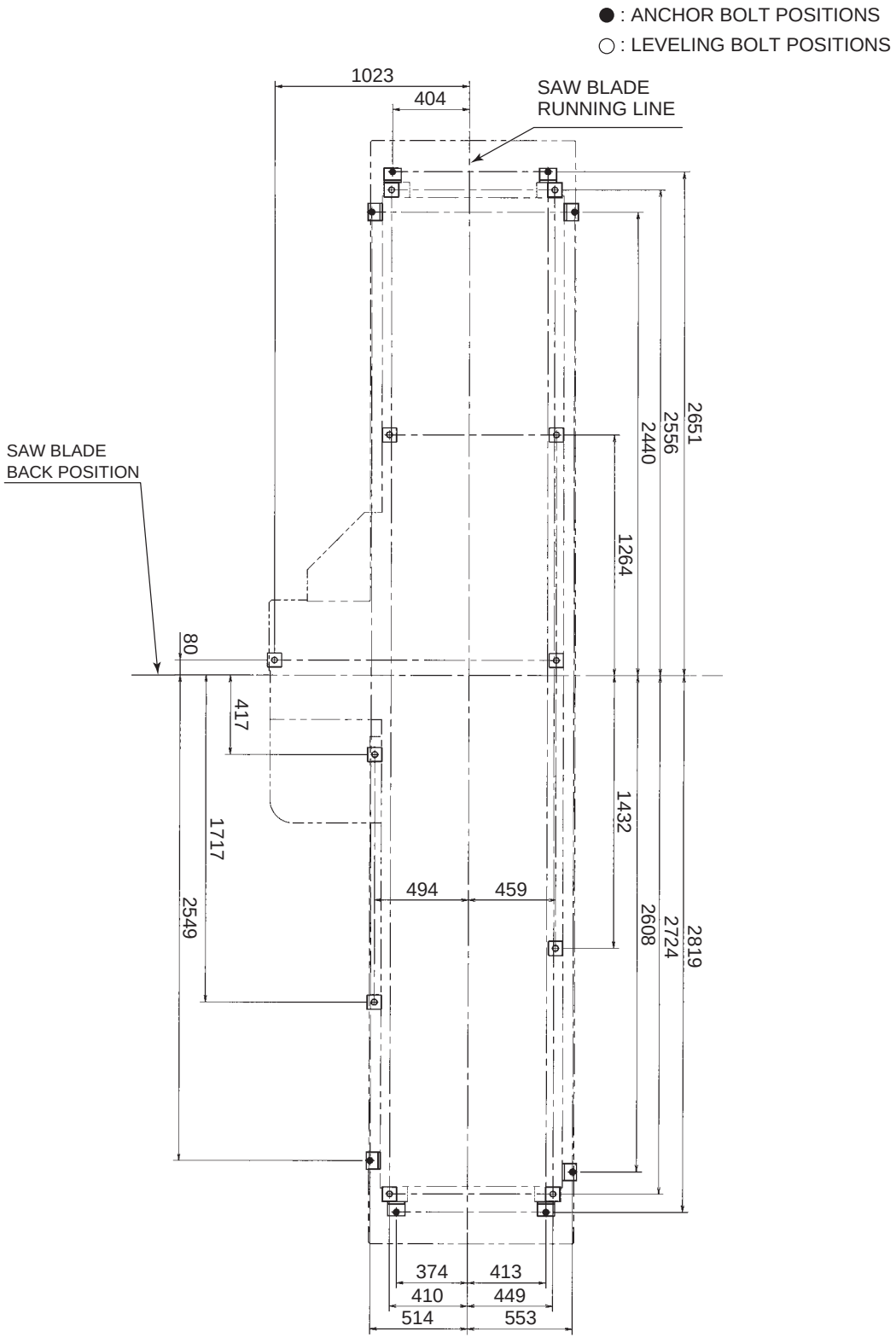
Foundation drawing for VM1200

Unit: mm



Foundation drawing for VM2500

Unit: mm



CARRYING

WARNING

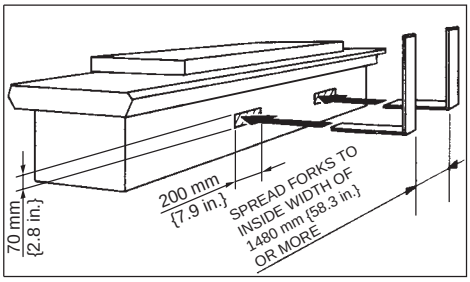
- **It is very dangerous for you to carry and install the machine by yourself. This machine calls for advanced techniques to carry and install it. Be sure to ask a specialized contractor or AMADA to do the work.**

Use a forklift truck or crane to carry the machine to its location.

Carrying with forklift truck

1 Spread the forks of the forklift truck to an inside width of 1480 mm {58.3 in.}.

2 Insert the forks 1000 mm {39.4 in.} or more into the holes in the machine as shown right. Lift the machine.



NOTICE

- Be sure to use the holes shown above and carefully lift the machine while balancing it and taking care not to shock it.

NOTE

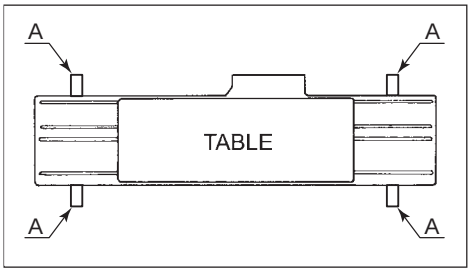
- The mass of the machine is as follows:
  VM1200: 3300 kg {7277 lb}
  VM2500: 5500 kg {12128 lb}

Carrying with crane

WARNING

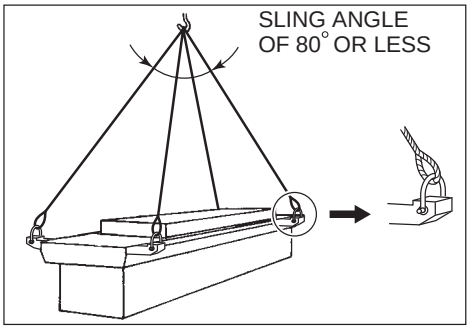
- **Four JIS No. 4, 6×24 wire ropes, 22.4 mm in diameter and 4129 mm or more in length, are required to lift the machine. Take care so that the wire ropes do not touch the table.**
  The mass of the machine is as follows:
  VM1200: 3300 kg {7277 lb}
  VM2500: 5500 kg {12128 lb}
- **Keep the sling angle of the wire ropes at 80° or less.**

1 Attach the shackles to the four lifting lugs (positions A).



2 Pass the wire ropes through the shackles, and secure the shackles.

3 While balancing the machine, slowly lift it with the crane.



CLEANING

When the machine is set in place, wipe off the rust-preventive grease applied to the sliding surfaces of the machine with a soft, kerosene-dampened cloth.

Apply machine oil to the rust-prone surfaces of the machine, such as the table top surface, table guide rail top and side surfaces.

NOTICE

- If the rust-preventive grease is removed with a scraper or the like, or the painted surfaces are wiped with a thinner or other solvent, the machine may be damaged or the paint may be removed.

LEVELING

When the machine is delivered direct from AMADA, the AMADA service engineer will level the machine.

NOTICE

- The machine must be leveled accurately according to a prescribed procedure. You will find it difficult to level the machine by yourself. Here is described not a detailed but an outline procedure. If the machine must be leveled again due to ground subsidence or layout change, for example, be sure to contact AMADA.
- If the machine is not leveled accurately, it cannot perform as intended and may fail. Be sure to check its levelness as item of daily maintenance.

Leveling (reference)

1 Place the accessory leveling plates beneath the leveling bolts.

2 Place a spirit level on the table. Adjust the four corner leveling bolts so that the machine is leveled to within 0.1 mm/m {0.0012 in./ft} front to back and left to right.

3 Lightly seat the remaining leveling bolts on the leveling plates.

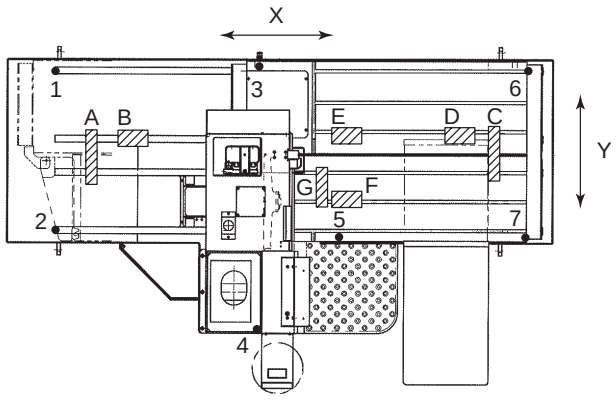
4 Check that all leveling bolts equally support the mass of the machine and are securely seated on the leveling plates.

5 Securely tighten all leveling bolts with the lock nuts.

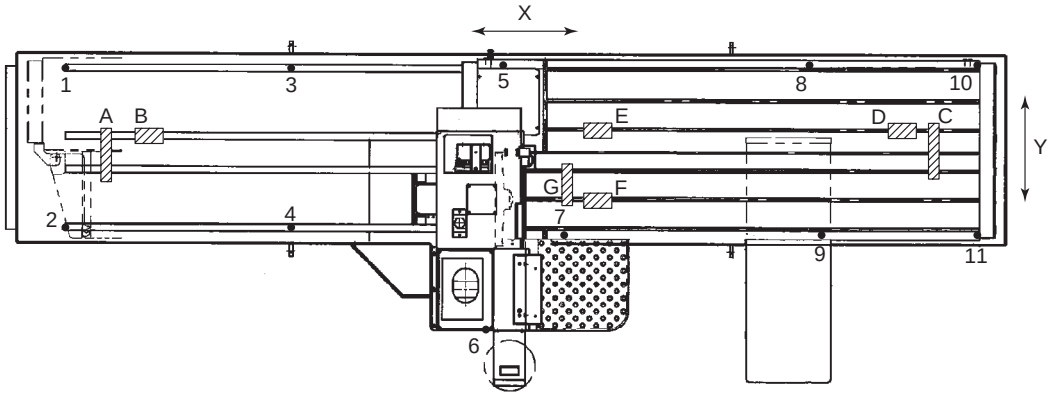
6 Securely tighten the lock nuts of the anchor bolts to complete the leveling procedure.

Positions of leveling bolts (marked •)

● VM1200



● VM2500



REMOVING SHIPPING BRACKETS

To prevent damage to the machine during transportation, the table and the upper sawb lade guide are secured with the shipping brackets. After the machine is installed, remove the bolts securing the shipping brackets, and remove the shipping brackets.

NOTICE

- Store the removed shipping brackets and bolts for future use when relocating the machine.

SUPPLYING HYDRAULIC OIL

Remove the two screws, hydraulic unit cover, and filler cap. Fill the hydraulic oil tank to the middle level of the sight gauge through the filler with one of the hydraulic oils recommended below. When the tank is filled with the specified amount of the hydraulic oil, replace the filler cap. Replace and screw the cover of the hydraulic unit after the electrical connections are completed as described later.

Recommended hydraulic oils: Esso Teresso 32
Mobil DTE 24
Shell Tellus Oil 32
(ISO VG32 equivalent)

Tank capacity: 10 L {2.6 US gal}

NOTICE

- The hydraulic pump may be damaged if its motor is started without the tank filled to the specified level.
- The oil discharge rate of the hydraulic pump is adjusted at the time of factory shipment. Do not tamper with it. If you have a problem, contact AMADA.

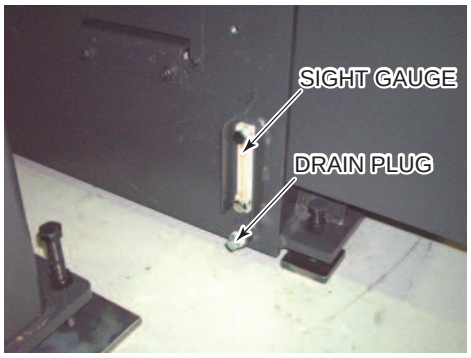
SUPPLYING CUTTING FLUID

WARNING

- **Use a water-soluble cutting fluid on this machine.**
  Oil-based cutting fluids may emit smoke or catch fire, depending on the condition of their use. Never use oil-based cutting fluids on this machine.

Pour the cutting fluid from above its pan to a little above the middle of the sight gauge.

Tank capacity:
105 L {27.7 US gal}



NOTICE

- If the cutting fluid pump motor is started without the cutting fluid tank filled to the specified level, the cutting fluid pump may be damaged. Check that the cutting fluid is at the proper level.

SUPPLYING ELECTRIC POWER

WARNING

- **Have a qualified electrician make the necessary electrical connections.**
- **Before opening the door of the electrical enclosure, be sure to turn off the shop circuit breaker switch.**
- **Ground the machine independently of other equipment.**

NOTICE

- Supply the machine with 3-phase, AC 200V, 50/60 Hz electric power with voltage variations of 10% or less. Prepare a transformer that suits these power supply conditions as required.
- The apparent power of the machine is 11 kVA. Install a shop circuit breaker that suits this power.
- Use a power cable of such a size and type as to suit the power supply voltage, wiring length, and wiring method.
- Supply electric power to the machine from a source different from those for welding or other machines that produce electrical noise. Ground the machine with an independent grounding conductor. If the power cable conductors and grounding conductor are shared by this machine and a noise-producing machine, this machine may be damaged. Additionally, the machine may abruptly stop its operation or may operate improperly. These conditions can lead to a serious accident.

Connect the power cable to the machine as described below.

1 Check that the shop circuit breaker switch is turned off.

2 Turn the POWER switch on the electrical enclosure to OFF.

3 Remove the three screws securing the door of the electrical enclosure, turn the POWER switch to RESET (OPEN), and open the door of the electrical enclosure.

4 Pull the power cable from the shop circuit breaker through the power inlet into the electrical enclosure.

5 Connect the three power cable conductors to the power terminals L1, L2 and L3 and the grounding conductor to the ground terminal PE.

6 Check that the voltage of the power source to the machine is the same as the voltage required for the transformers and motors as shown on the label attached to the electrical enclosure.

If you must use a different source voltage, change the wiring connections of the transformers and motors, and change the thermal relay settings of the motors or replace the thermal relays. If fuses are installed, replace them as well.

Checking electrical connections

When the necessary electrical connections are completed, check that they are correctly made as described below. For the description of the switches, buttons and lights, refer to Part III, Controls.

1 Close and screw the door of the electrical enclosure.

2 Turn on the shop circuit breaker switch, and turn the POWER switch on the electrical enclosure to ON to illuminate the POWER ON light on the control panel.

3 Press and illuminate the HYDRAULIC ON button on the control panel to start the hydraulic pump motor.

4 If the pressure gauge reads the set pressure of 3.5 MPa {508 psi}, go to step 11.

If the pressure gauge does not read the set pressure of 3.5 MPa {508 psi}, immediately press the HYDRAULIC OFF button on the control panel, and go to step 5.

5 Turn the POWER switch to OFF, and turn off the shop circuit breaker switch.

6 Unscrew and open the door of the electrical enclosure, and interchange two of the three power cable conductors.

7 Close and screw the door of the electrical enclosure.

8 Turn on the shop circuit breaker switch, and turn the POWER switch to ON.

9 Press and illuminate the HYDRAULIC ON button.

10 Check again that the pressure gauge reads the set pressure of 3.5 MPa {508 psi}.

11 Press the HYDRAULIC OFF button to stop the hydraulic pump motor.

12 Turn the POWER switch to OFF, and turn off the shop circuit breaker switch.

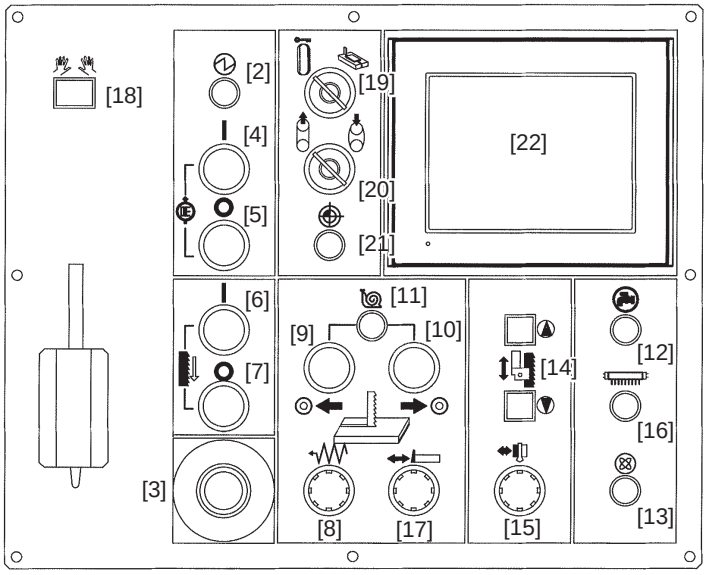
INSTALLING FIRE CONTROL DEVICES

Install a fire extinguisher or other fire control device in the shop to provide against fires.

Part III

Controls

CONTROL PANEL



[1] POWER switch
[2] POWER ON light
[3] EMERGENCY STOP button
[4] HYDRAULIC ON button (with white light)
[5] HYDRAULIC OFF button
[6] BLADE START button (with white light)
[7] BLADE STOP button
[8] TABLE CUTTING FEED button (with white light)
[9] TABLE FORWARD button
[10] TABLE BACKWARD button
[11] TABLE SPEED CHANGE button (with white light)
[12] CUTTING FLUID button
[13] LASER BEAM ON button (option) (with white light)
[14] BLADE GUIDE ▼and ▲ buttons
[15] BLADE INSERT OPEN/CLOSE button (with white light)
[16] WORK LIGHT button (option)
[17] BACKGAUGE button (option)
[18] CONFIRMATION button (option)
[19] MODE keyswitch
[20] BLADE TENSION keyswitch
[21] ZERO-RETURN button (with white light)
[22] Touch screen

[1] POWER switch (Machine circuit breaker switch)

Turned to ON to power on the machine, to OFF to power off the machine, and to RESET (OPEN) to open the electrical enclosure.

Lock the switch with the accessory padlock to prevent unauthorized operation.

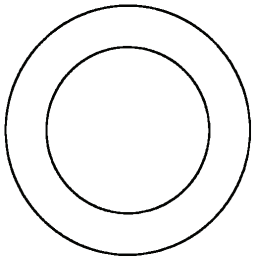
[2] POWER ON light

Illuminated to indicate that the POWER switch is turned to ON.

[3] EMERGENCY STOP button

Used to stop the machine in an emergency and at the end of operation.

Pressed to stop the machine immediately and totally. (The hydraulic pump motor stops, but the machine does not power off.)

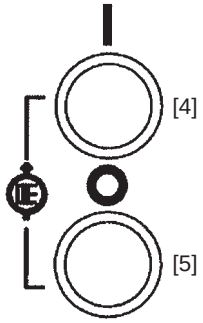


NOTE

- The EMERGENCY STOP button is of the push-to-lock type so that once pressed, it is locked in the pressed condition. To clear the emergency stop condition, pull it out. Unless the emergency stop condition is cleared, the hydraulic pump motor does not start even when the HYDRAULIC ON button is pressed.
- The EMERGENCY STOP button at the rear of the machine base has the same function as this EMERGENCY STOP button. Refer to page III-8.

[4] HYDRAULIC ON button (with white light)

Pressed and illuminated to start the hydraulic pump motor.



NOTICE

- Before pressing the button, check that the hydraulic oil is at the proper level. If the hydraulic pump motor is started without the hydraulic oil tank filled to the specified level, the hydraulic pump may be damaged.

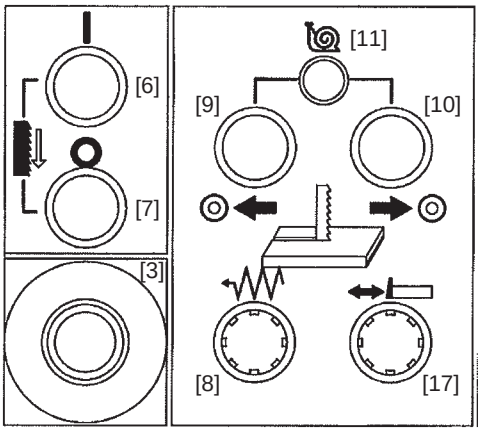
[5] HYDRAULIC OFF button

Pressed to stop the hydraulic pump motor and extinguish the HYDRAULIC ON button.

[6] BLADE START button (with white light)

Pressed to start the saw blade motor and run the saw blade, and wire brush. At the same time, the cutting fluid pump starts, and the cutting fluid is discharged from the upper and lower saw blade inserts.

The button illuminates while the saw blade motor is running.



NOTICE

- Before pressing the button, check that the cutting fluid is at the proper level. Unless the cutting fluid tank is filled to the specified level, the cutting fluid pump may be damaged.

[7] BLADE STOP button

Pressed to stop the saw blade. If the table is feeding the work for cutting, it also is stopped.

[8] TABLE CUTTING FEED button (with white light)

Pressed and illuminated to start the table feeding the work for cutting, after the BLADE START button is pressed to start the saw blade.

When the saw blade is not running, pressing the button does not move the table.

[9] TABLE FORWARD button

Pressed and held to move the table forward.

[10] TABLE BACKWARD button

Pressed and held to move the table backward.

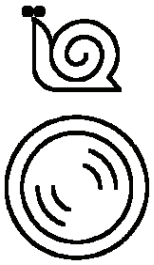
When the table is feeding the work for cutting, press the button to stop the saw blade, and press and hold the button to move the table backward.

[11] TABLE SPEED CHANGE button (with white light)

Used to change the table forward and backward speed to high or low.

Pressed and illuminated to change the table forward and backward speed to low.

Pressed again and extinguished to change the table forward and backward speed to high.



NOTE

- The setting of the table speed with the TABLE SPEED CHANGE button is effective only when the table is moved forward or backward by pressing and holding the TABLE FORWARD or TABLE BACKWARD button.

[12] CUTTING FLUID button

Used to start the cutting fluid pump alone for cleaning the machine.

Pressed to turn on the cutting fluid even when the saw blade is stopped.

Shift the cutting fluid cock lever to discharge the cutting fluid through the cleaning hose nozzle and wash away the chips from the machine. Press the button again to turn off the cutting fluid.

WARNING

- **Normally when the saw blade is started, the cutting fluid pump motor is automatically started as well. It is very dangerous to clean the machine while the saw blade is running. Never do so. When cleaning the machine, be sure to use the CUTTING FLUID button.**

NOTICE

- Before pressing the button, check that the cutting fluid is at the proper level. Unless the cutting fluid tank is filled to the specified level, the cutting fluid pump may be damaged.

[13] LASER BEAM ON button (option) (with white light)

Pressed and illuminated to turn on the laser beam (option) for guiding the work.

After 5 min, the laser beam automatically turns off, and the button extinguishes.

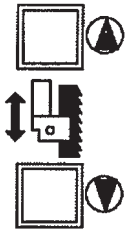
WARNING

- **Never look directly into the source of the laser beam. You may lose your eyesight.**
- **Note that the laser oscillator is not constructed waterproof, dripproof, and dustproof.**
- **The surge current caused by turning on and off the POWER switch may destroy electronic components in the machine. Avoid to continuously turn on and off the switch as much as possible.**
- **When the laser output window is contaminated, the amount of laser beam light is reduced. Wipe off the laser output window with alcohol or the like.**

[14] BLADE GUIDE ▼and ▲ buttons

Used to adjust the position of the upper saw blade guide.

Press and hold the ▼ button to open the saw blade inserts and lower the upper saw blade guide.



[14]

Press and hold the ▲ button to open the saw blade inserts and raise the upper saw blade guide.

When each button is released, the upper saw blade guide stops, and the saw blade inserts close.

NOTICE

- Be sure to set the position of the upper saw blade guide to the height of the work. The machine controls the depth of cut to achieve the target cutting rate based on the position of the upper saw blade guide.

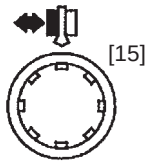
NOTE

- The current position of the upper saw blade guide can be seen on the CNC INPUT or MANUAL INPUT display.

[15] BLADE INSERT OPEN/CLOSE button (with white light)

Pressed to close and open the upper and lower saw blade inserts.

The button illuminates when the upper and lower saw blade inserts are closed.

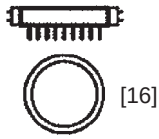

[15]

NOTE

- When the saw blade starts, the saw blade inserts automatically close.
- When the upper saw blade guide moves, the saw blade inserts automatically opens.

[16] WORK LIGHT button (option)

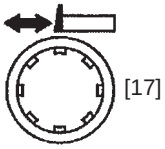
Used to turn on and off the work light (option) to light around the operator's feet.

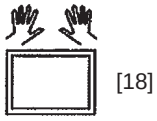

[16]

[17] BACKGAUGE button (option)

[18] CONFIRMATION button (option)

Used together when the machine is equipped with the backgauge (option). Enter the target position on the BACKGAUGE display on the touch screen, and simultaneously press the CONFIRMATION button and the BACKGAUGE button to start the positioning of the backgauge.


[17]


[18]

NOTE

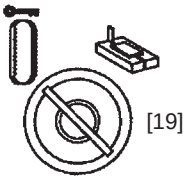
- The BACKGAUGE button and the CONFIRMATION button are disabled when the saw blade is running.

[19] MODE keyswitch

Used to select an operating mode of the machine.

Turned to "  " to perform the cutting operation of the machine.

Turned to "  " to lock the table and the saw blade motor.


[19]

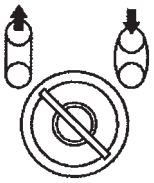
WARNING

- **When changing the saw blade, set the MODE keyswitch at "  ", remove the key from the keyswitch, and keep the key by yourself to prevent other workers from starting the machine by mistake.**

[20] BLADE TENSION keyswitch

Used when changing the saw blade.

Turned to the " " position to tension the saw blade and to the " " position to slacken the saw blade.



[20]

NOTE

- The BLADE TENSION keyswitch is disabled when the saw blade is running.

[21] ZERO-RETURN button (with white light)

Used to zero-return the upper saw blade guide and backgauge (option).

The button flashes when the hydraulic motor is started for the first time after power-on of the machine.

Pressed to start the zero-return of the upper saw blade guide and backgauge (option). The button illuminates when the zero-return of the upper saw blade guide and backgauge (option) is completed.

[21]

[22] Touch screen

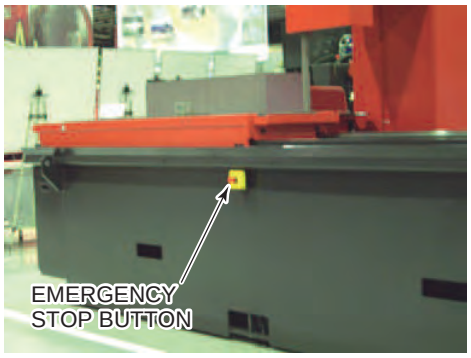
Shows cutting data, error messages, and other data.

MACHINE BASE REAR

EMERGENCY STOP BUTTON

The EMERGENCY button located at the rear of the machine base has the same function as the EMERGENCY STOP button on the control panel.

Pressed to stop the machine immediately and totally. (The hydraulic pump motor stops, but the machine does not power off.)



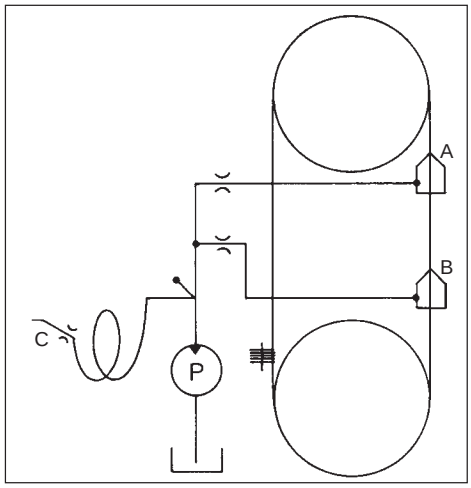
NOTE

- An EMERGENCY STOP button is of the push-to-lock type so that once pressed, it is locked in the pressed condition. To clear the emergency stop condition, pull it out. Unless the emergency stop condition is cleared, the hydraulic pump motor does not start even when the HYDRAULIC ON button on the control panel is pressed.

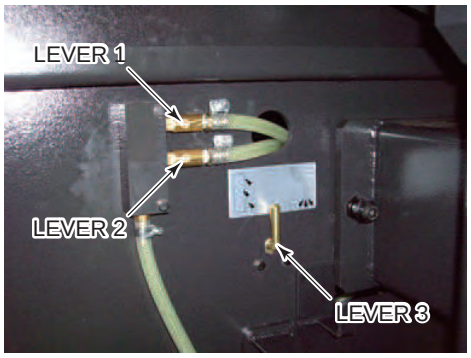
CUTTING FLUID SUPPLY SYSTEM

The cutting fluid delivered from its pump is discharged through the upper saw blade guide nozzle A, lower saw blade guide nozzle B, and cleaning hose nozzle C.

Adjust the flow rate through the nozzles with the three cock levers near the stairway of the bed.



The lever 1 adjusts the flow rate through the nozzle A. This is designed to cool and lubricate the saw blade. Adjust the flow rate to suit the work material type and cutting rate.



The lever 2 adjusts the flow rate through the nozzle B.

This is designed to clear the saw blade and wire brush of chips. Discharge as much cutting fluid as possible.

The lever 3 adjusts the flow rate through the nozzle C. Turn the lever to the left to supply the cutting fluid to the nozzles A and B and to the right to supply the cutting fluid to the nozzle C.

PROTECTIVE DEVICES

The machine is fitted with the following protective devices in addition to the EMERGENCY STOP buttons.

Wheel cover open limit switches

When either the drive or driven wheel cover is opened during cutting, its open limit switch operates to display an error and stop the saw blade.

When the BLADE START button on the control panel is pressed with either or both of the covers opened, the saw blade does not start either, resulting in an error condition.

Saw blade slip detector (Motion detector)

When the saw blade slips on the drive wheel during cutting, an error occurs, and the machine automatically stops.

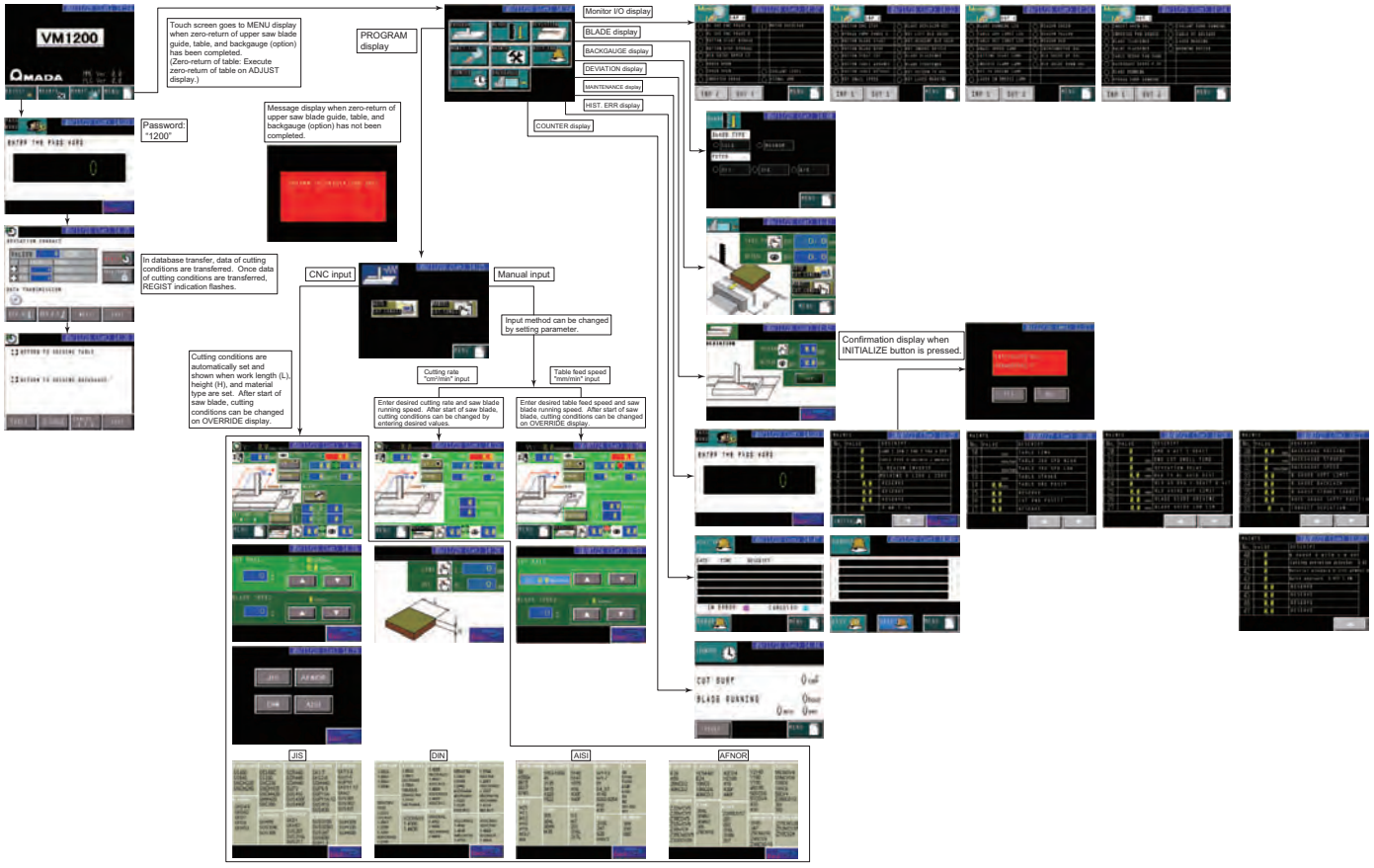
This error condition occurs when the cutting rate is too high or when the saw blade is worn or chipped. Thoroughly check for these causes and remove them before restarting the machine.

NOTE

- When an error occurs, its number and message are shown on the HIST. ERR display. Remove the cause of the error by referring to “Error list” in Part IV, and restart the machine.

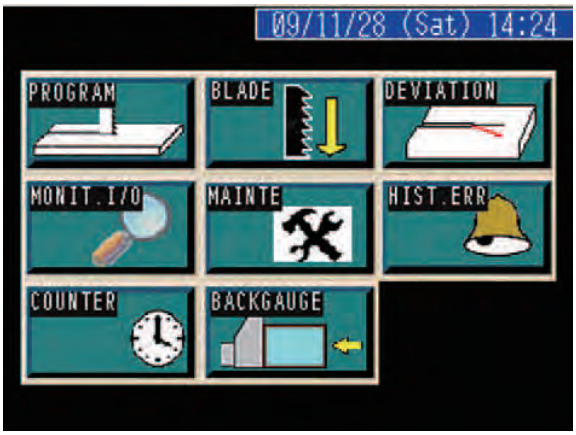
DISPLAYS

Schematic diagram of displays



MENU display

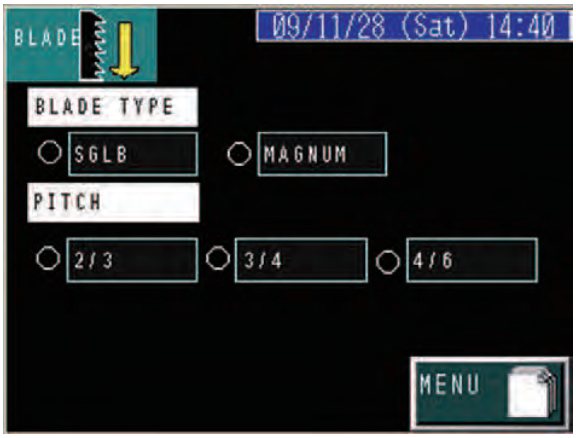
Appears when the zero-return of the upper saw blade guide, table, and backgauge (option) has been completed.



BLADE display

Press the BLADE button on the MENU display to go to the BLADE display.

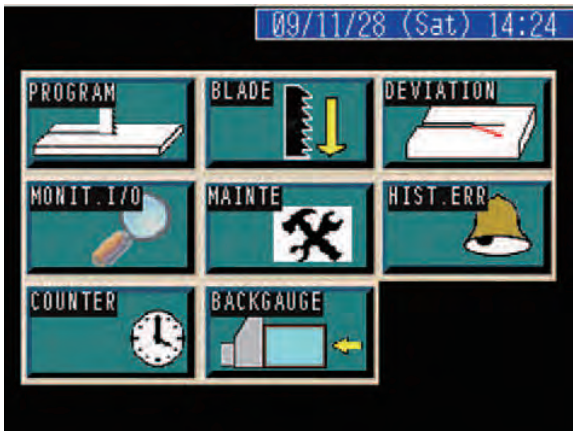
Select the saw blade type and the tooth pitch of the saw blade.



The lights at the left of the selected saw blade type and tooth pitch illuminate.

PROGRAM display

Press the PROGRAM button on the MENU display to go to the PROGRAM display.



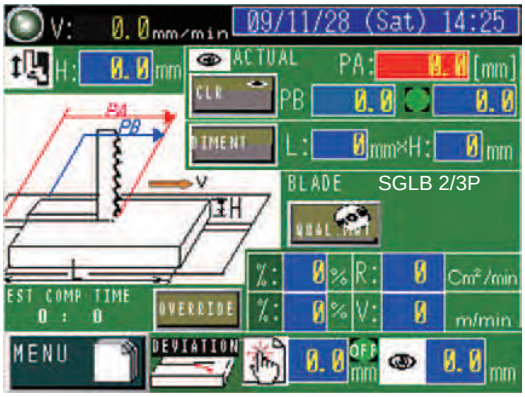
When automatically setting the cutting conditions, press the AUTO CUT CONDIT button to open the CNC INPUT display.

When manually setting the cutting conditions, press the MANUAL CUT CONDIT button to open the MANUAL INPUT display.

CNC INPUT display

Press the AUTO CUT CONDIT button on the PROGRAM display to go to the CNC INPUT display.

On the CNC INPUT display, the cutting conditions are automatically set when the material type of the work is selected from the registered standards and the length and height of the work are entered.



DIMENT button: Pressed to go to the DIMENT display to enter the work length (L) and height (H).

QUAL. MAT button: Pressed to show the standards by countries. Select the standard and material type of the work to be cut. The cutting conditions are automatically set according to the selected standard and material type.

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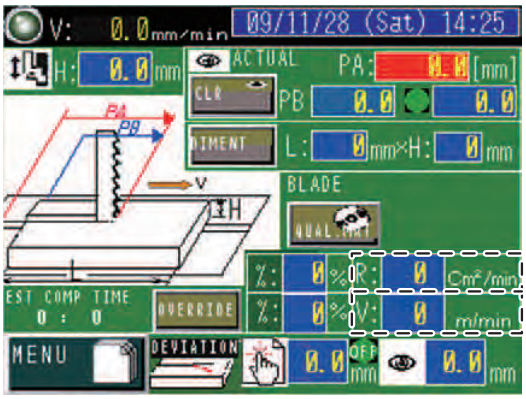
When the work length (L) and height (H) and the work material type are set, the cutting rate (cm^2/min or in^2/min) and the saw blade running speed (m/min or ft/min) are automatically set and shown in the R and V fields respectively.



MANUAL INPUT display

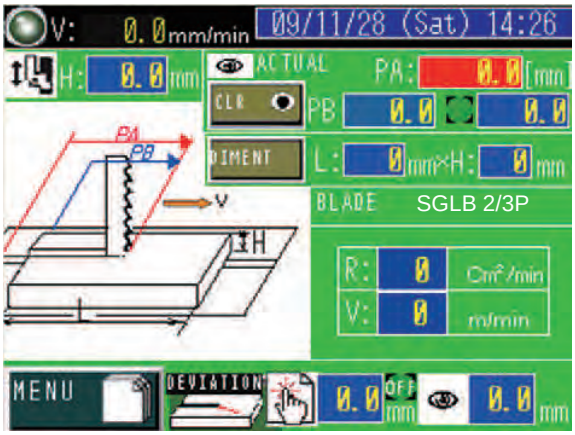
Press the MANUAL CUT CONDIT button on the PROGRAM display to go to the MANUAL INPUT display.

NOTE

- The input method of the MANUAL INPUT display can be selected between the cutting rate "cm^2/min" input and the table feed speed "mm/min" input by setting parameter No. 2 "TABLE FEED" on the MAINTENANCE display.

MANUAL INPUT display (1) (cutting rate "cm^2/min" input)

Enter the desired cutting rate and saw blade running speed.



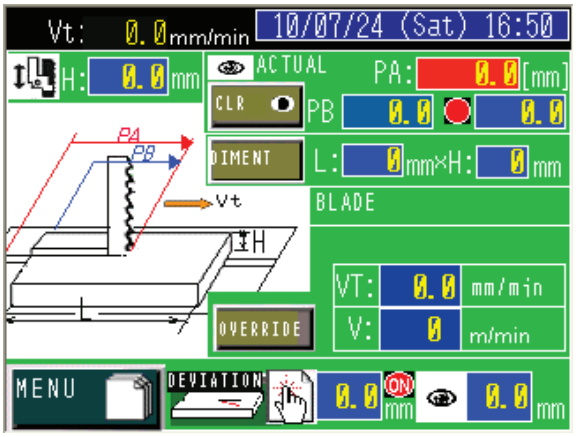
DIMENT button: Pressed to go to the DIMENT display to enter the work length (L) and height (H).

R field: Enters the desired cutting rate (cm^2/min or in^2/min).

V field: Enters the desired saw blade running speed (m/min or ft/min).

MANUAL INPUT display (2) (table feed speed “mm/min” input)

Enter the desired table feed speed and saw blade running speed.



DIMENT button: Pressed to go to the DIMENT display to enter the work length (L) and height (H).

VT field: Enters the desired table feed speed (mm/min or in./min).

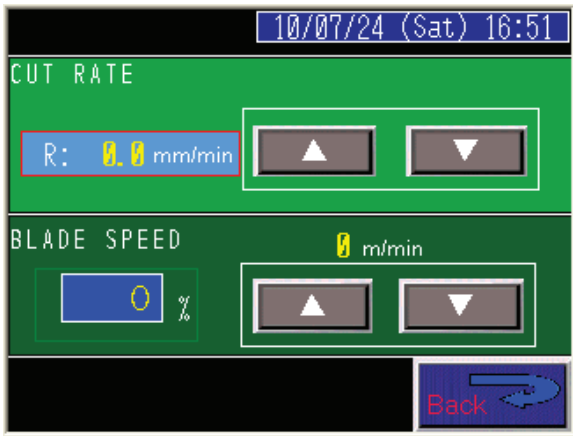
V field: Enters the desired saw blade running speed (m/min or ft/min).

OVERRIDE button:

Pressed to open the OVERRIDE display. Used when adjusting the table feed speed and saw blade running speed after the start of the saw blade.

NOTE

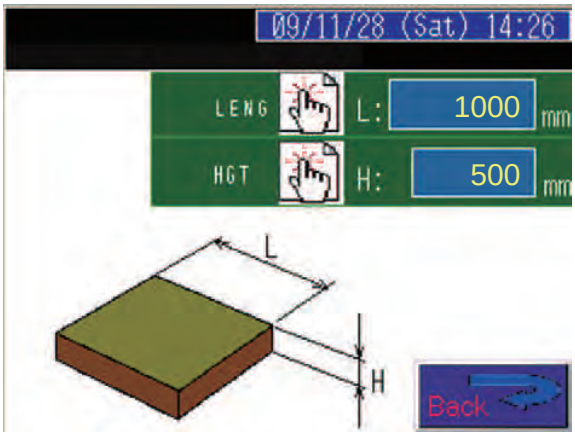
- Before the start of the saw blade, the table feed speed and the saw blade running speed can be directly entered in the VT and V fields. To adjust the table feed speed and saw blade running speed after the start of the saw blade, press the OVERRIDE button to open the OVERRIDE display, and press the ▲ or ▼ button to adjust them.



DIMENT display

Press the DIMENT button to go to the DIMENT display.

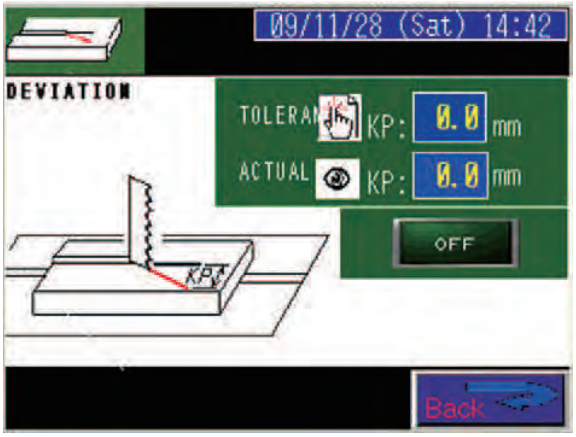
Enter the work length (L) and height (H).



DEVIATION display

Press the DEVIATION button to go to the DEVIATION display.

Select whether to enable or disable the runout detector (option) and set the runout tolerance of the saw blade.



MONITOR I/O display

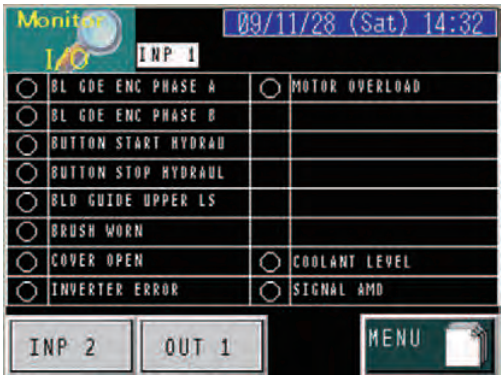
Press the Monitor I/O button on the MENU display to go to the Monitor I/O display.

The Monitor I/O display is used to monitor the sequencer inputs and outputs.

NOTE

- The Monitor I/O display is provided for maintenance and requires no data entry for cutting the work.

INPUT MONITOR 1



INPUT MONITOR 2

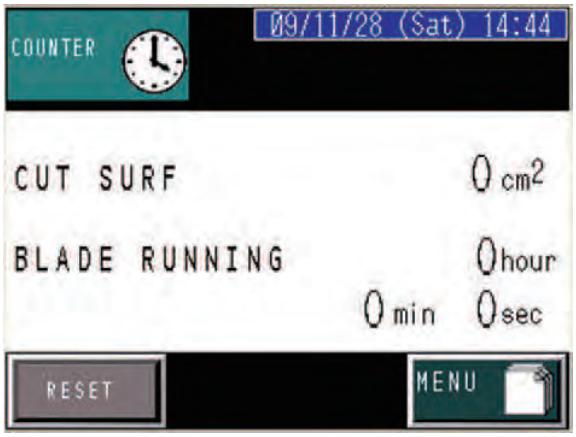
OUTPUT MONITOR 1

OUTPUT MONITOR 2

COUNTER display

Press the COUNTER button on the MENU display to go to the COUNTER display.

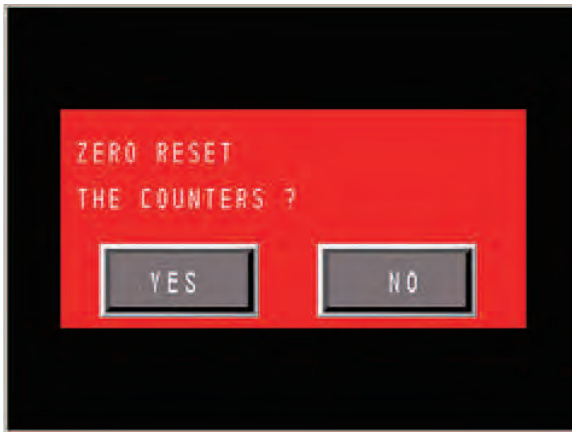
The COUNTER display shows the total cut area and total running time of the saw blade up to the current time.



CUT SURF field: Shows the total cut area up to the current time.

BLADE RUNNING field: Shows the total running time of the saw blade up to the current time.

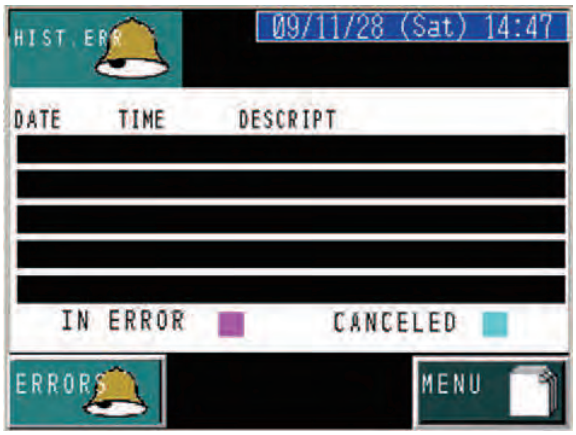
RESET button: Clears the total cut area in the CUT SURF field and the total running time of the saw blade in the BLADE RUNNING field. Press the YES button for confirmation after having pressed the RESET button.



HIST. ERR display

Press the HIST. ERR button on the MENU display to go to the HIST. ERR display.

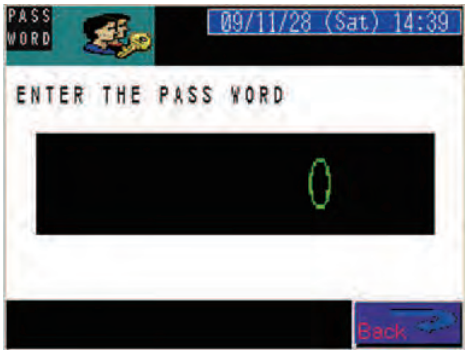
The HIST. ERR display lists the history of errors that has occurred. The newest error is listed first. The display can be scrolled.

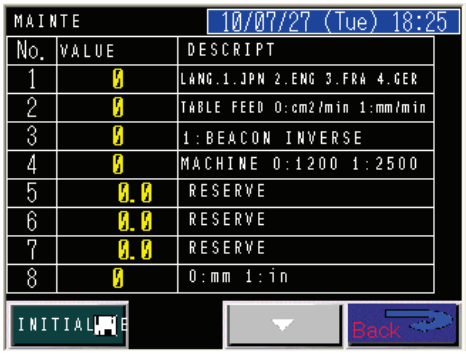


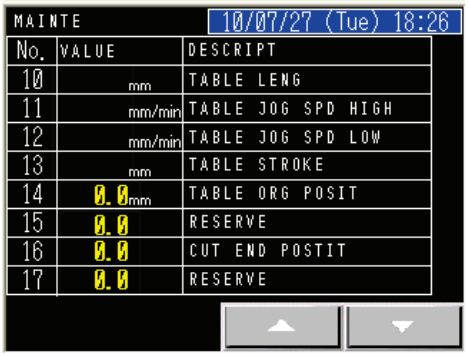
MAINTENANCE display

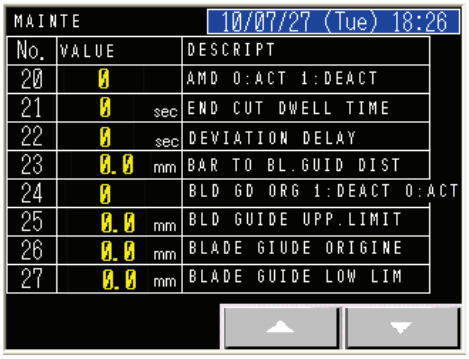
Press the MAINTE button to go to the PASSWORD display, and enter the password “1200” to go to the MAINTENANCE display.

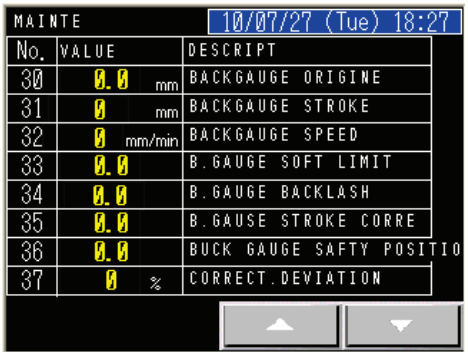
The parameters can be set on the MAINTENANCE display.

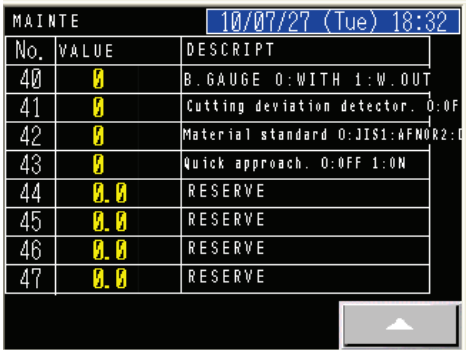




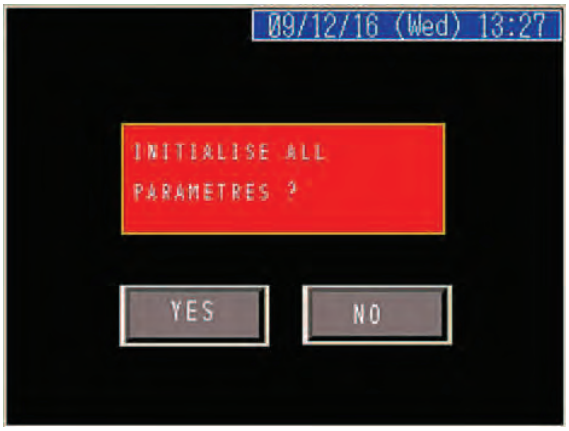








INITIALIZE button: Resets the setting values to their default values. Press the YES button for confirmation with utmost care.



Part IV

Operation

(Continued on next page.)

PREPARING FOR OPERATION

Turning on power

1 Turn on the shop circuit breaker switch.

2 Turn the POWER switch to ON to illuminate the POWER ON light and power on the machine.

The initial display appears on the touch screen of the control panel.

3 Press and illuminate the HYDRAULIC ON button to start the hydraulic pump motor.

4 Zero-return the upper saw blade guide as described below.

Zero-returning upper saw blade guide

When the hydraulic pump motor is started for the first time after the machine is powered on, zero-return the upper saw blade guide as described below.

NOTICE

- The upper saw blade guide must be zero-returned to store the actual position of the upper saw blade guide into the memory of the control unit. Be sure to perform this zero-return. Unless the upper saw blade guide is zero-returned, the machine cannot be operated.

1 Power on the machine, and start the hydraulic pump motor.

2 Press the ZERO-RETURN button.
The upper saw blade guide rises to the upper end.
The MENU display appears on the touch screen.

Selecting saw blade

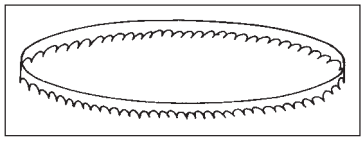
Select an appropriate saw blade to suit the material type, shape, and size of work to be cut.

Dedicated saw blades are available for difficult-to-cut workpieces and irregular-shaped workpieces. Contact AMADA.

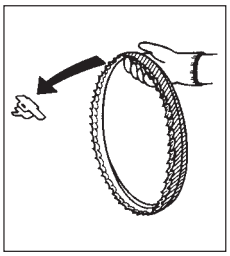
Unfolding saw blade

NOTICE

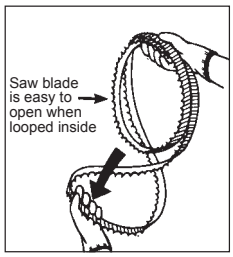
- Unpack the saw blade, hold it with its teeth facing down, and check that the teeth are oriented lower right. If its teeth are oriented lower left, the saw blade cannot be used. Contact AMADA.



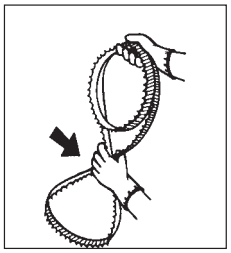
1 Remove the band securing the saw blade, and hold the saw blade with the right hand.



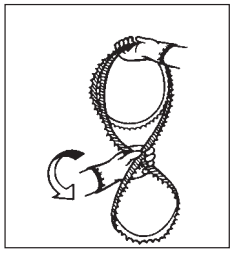
2 Open the first loop with the left hand.



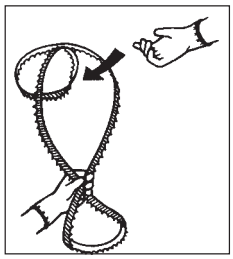
3 Grasp the crossed portion of the saw blade with the left hand.



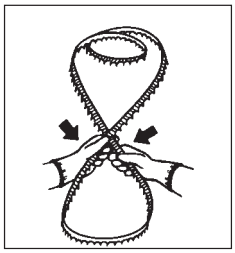
4 Turn back the left hand, and turn the right hand away from the body.



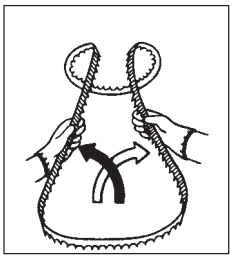
5 Slowly release the right-hand loop away from the body.



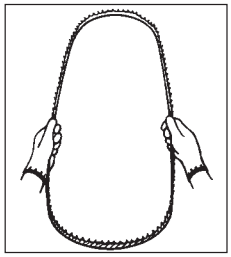
6 Rehold the crossed portion of the saw blade with both hands.



7 Twist the saw blade to the left and right to unfold it.



8 The saw blade is now completely unfolded.

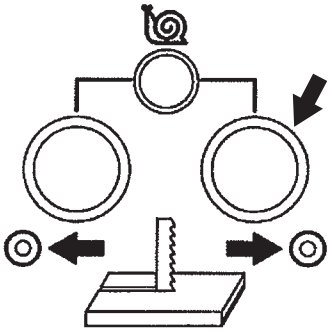


Installing saw blade

Install the saw blade as described below.

1 Turn the POWER switch to ON to power on the machine, press and illuminate the HYDRAULIC ON button to start the hydraulic pump motor, and zero-return the upper saw blade guide. (Refer to “Turning on power” and “Zero-returning upper saw blade guide” earlier in this Part.)

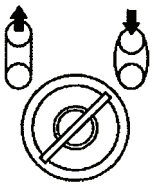
2 Press and hold the TABLE BACKWARD button to move the table to the backward end.



3 Turn the MODE keyswitch to “ ” to lock the table.

4 Open the driven wheel cover.

5 Turn the BLADE TENSION keyswitch to the “ ” position to move the driven wheel down to the lower end.

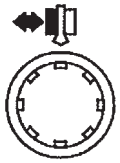


6 Open the drive wheel cover.

The wire brush is located at the left side of the drive wheel.

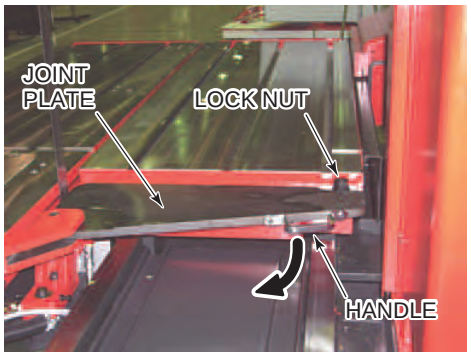
7 Pull the handle of the wire brush, move the wire brush away from the drive wheel.

8 Press the BLADE INSERT OPEN/CLOSE button to open the upper and lower saw blade inserts.



9 Loosen the lock NUT at the forward end of the table.

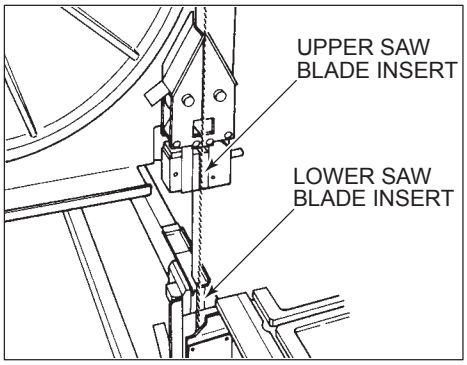
10 Hold the HANDLE of the joint plate, and turn the joint plate to leave an opening for the saw blade.



11 Hold the saw blade with both hands so that its teeth face forward, and put the saw blade into the opening in the bed.

12 Install the saw blade on the driven wheel and then on the drive wheel.

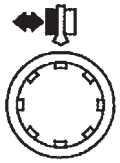
13 Push the saw blade into the lower saw blade insert opening and then into the upper saw blade insert opening.



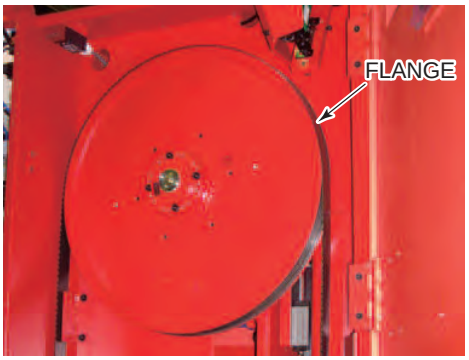
CAUTION

- **Push in the saw blade until its back is securely pressed against the backup tips of the saw blade inserts.**

14 Press the BLADE INSERT OPEN/CLOSE button to close the upper and lower saw blade inserts and clamp the saw blade.



15 Check that the saw blade does not ride on the flanges of the drive and driven wheels.

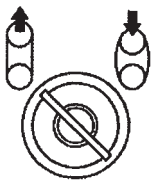


16 Push the handle of the wire brush to return the wire brush to the original position.

17 Close the drive wheel cover.

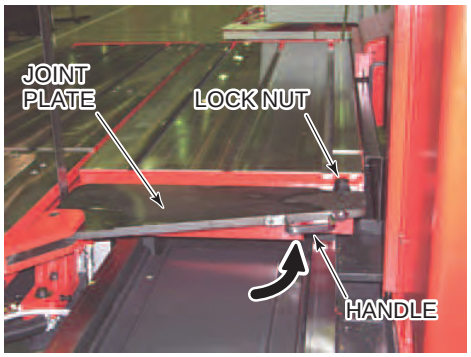
18 Close the driven wheel cover.

19 Turn the BLADE TENSION keyswitch to the “ ” position to raise the driven wheel and tension the saw blade.

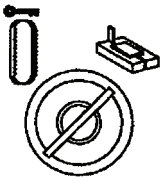


Check through the window on the driven wheel cover that the saw blade does not come off.

20 Return the joint plate to the original position, and tighten the lock nut.

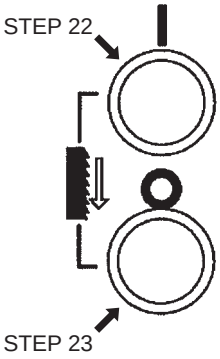


21 Turn the MODE keyswitch to “ ” to unlock the table.



22 Press the BLADE START button to start the saw blade. Check that the saw blade runs smoothly.

23 Press the BLADE STOP button to stop the saw blade.



NOTICE

- When using a new saw blade, be sure to break it in as described in “Breaking in new saw blade” later in this Part.

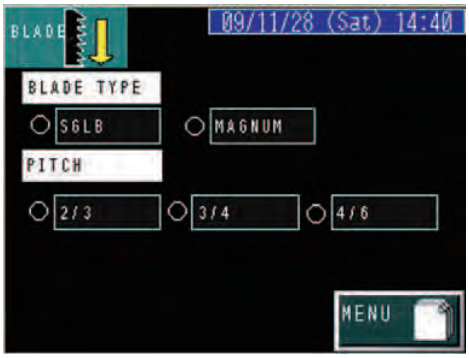
Registering saw blade

Set the saw blade type and the pitch of the saw blade as described below.

1 Press the BLADE button on the MENU display to go to the BLADE display.

2 Select the saw blade type and the tooth pitch of the saw blade.

The lights at the left of the selected saw blade type and tooth pitch illuminate.



Adjusting flow rate of cutting fluid

When the BLADE START button or CUTTING FLUID button is pressed, the cutting fluid pump starts, and the cutting fluid discharges through each nozzle.

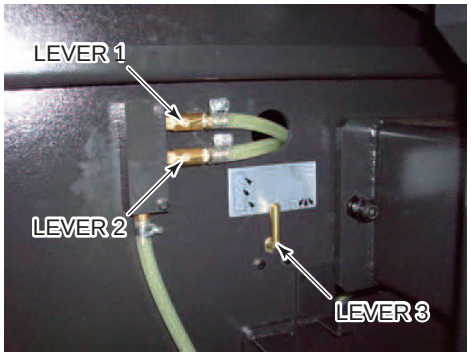
Adjust the flow rate of the cutting fluid to suit the material type and size of work to be cut and the cutting rate.

Three cock levers for adjusting the flow rate are located near the stairway of the bed.

The lever 1 adjusts the flow rate through the upper saw blade guide nozzle.

The lever 2 adjusts the flow rate through the lower saw blade guide nozzle.

Turn the lever 3 to the left to supply the cutting fluid to the upper and lower saw blade guide nozzles. Turn the lever 3 the right to supply the cutting fluid to the cleaning hose nozzle.



Loading work

Lift the work with a crane or forklift truck, and gently place it on the table while taking care not to shock the machine.

When the machine is equipped with the laser beam unit (option), press the LASER BEAM ON button (option) to turn on the laser beam for positioning the work at a scribed line. (The laser beam automatically turns off 5 min later.)

After positioning the work, clamp the work with the optional clamping kits or other fixtures.

WARNING

- **When positioning or clamping the work on the table, use a work stand. Never step onto the table.**
- **When using the optional laser beam unit, take full care so that the laser beam does not enter the eyes.**

NOTICE

- Unless securely clamped, the work may vibrate during cutting or may not be cut straight. Be sure to securely clamp the work.
- If the fixtures are higher than the work, fully check that they do not touch the machine (e.g., driven wheel cover or upper saw blade guide).

Setting work dimensions

Set the work length and height as described below.

1 Press the PROGRAM button on the MENU display to go to the PROGRAM display.

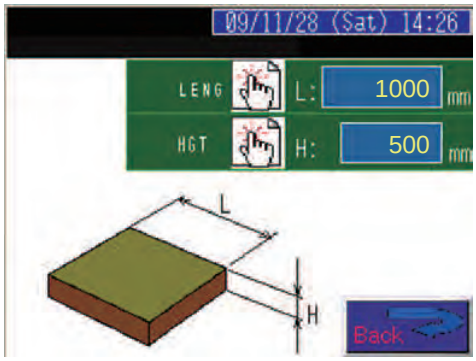
2 Press the AUTO CUT CONDIT button or MANUAL CUT CONDIT button to go to the CNC INPUT display or MANUAL INPUT display.

3 Press the DIMENT button to go to the DIMENT display.

4 Press the L field to open the numeric keypad.

5 Enter the work length, and press the ENT key.

6 Press the H field to open the numeric keypad.



7 Enter the work height, and press the ENT key.

Setting running speed of saw blade

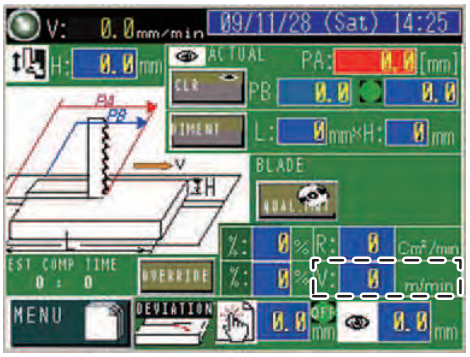
Set the saw blade running speed to suit the material type and size of work to be cut as described below.

NOTICE

- If the running speed is improper, the cutting efficiency and economy both suffer. Be sure to cut the work with a proper running speed. When using a new saw blade, be sure to break it in as described in “Breaking in new saw blade” later in this Part.

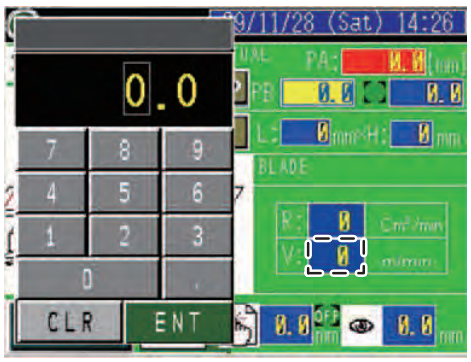
CNC INPUT display

On the CNC INPUT display, the proper saw blade running speed (m/min or ft/min) is automatically set and shown in the V field when the work length (L) and height (H) are entered in the L and H fields and the standard and material type of the work to be cut are selected.



MANUAL INPUT display

1 Press the V field to open the numeric keypad.



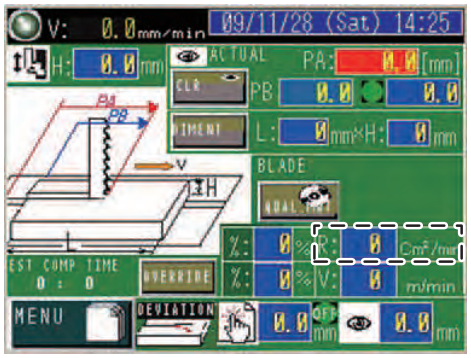
2 Enter the desired value with the 0 to 9 and • keys to set the saw blade running speed (m/min or ft/min).

3 Press the ENT key.

Setting cutting rate

CNC INPUT display

On the CNC INPUT display, the proper cutting rate (cm^2/min or in^2/min) is automatically set and shown in the R field when the work length (L) and height (H) are entered in the L and H fields and the standard and material type of the work to be cut are selected.



MANUAL INPUT display

Set the cutting rate to suit the material type and size of work to be cut as described below.

NOTE

● The cutting rate is given by

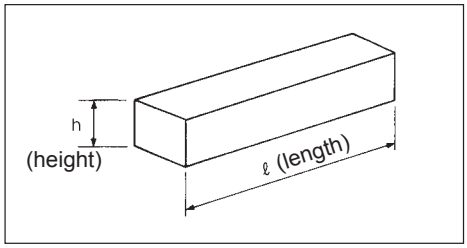
$$\text{Cutting rate (cm}^2\text{/min)} = \frac{\text{Cutting area (cm}^2\text{)}}{\text{Cutting time (min)}}$$

$$\text{Cutting rate (cm}^2\text{/min) for rectangle} = \frac{h \times \ell}{\text{Cutting time (min)}}$$

or

$$\text{Cutting rate (in.}^2\text{/min)} = \frac{\text{Cutting area (in.}^2\text{)}}{\text{Cutting time (min)}}$$

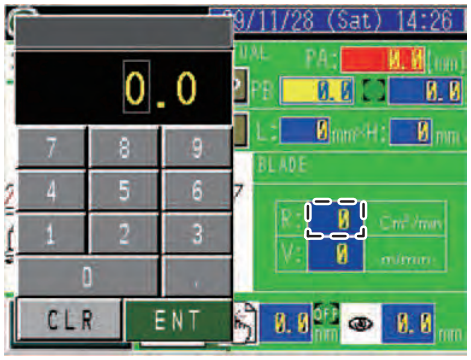
$$\text{Cutting rate (in.}^2\text{/min) for rectangle} = \frac{h \times \ell}{\text{Cutting time (min)}}$$



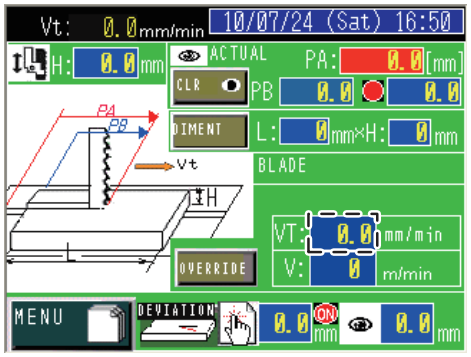
1 Press the R field to open the numeric keypad.

2 Enter the desired value with the 0 to 9 and • keys to set the cutting rate (cm^2/min or in^2/min).

3 Press the ENT key.

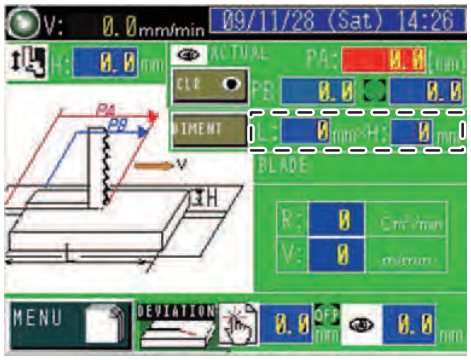


When the parameter No.2 “TABLE FEED” on the MAINTENANCE display is set to “1: mm/min”, enter the table feed speed (mm/min or in./min) in the VT field.



Adjusting position of upper saw blade guide

The upper saw blade guide is automatically positioned about 30 mm {1.2 in.} plus the work height at the start of the saw blade running, if the work length (L) and height (H) are entered in the L and H fields.



WARNING

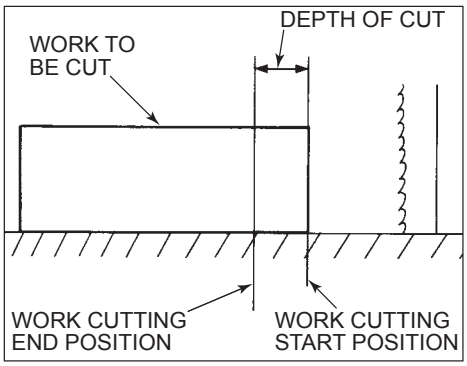
- **Do not reach between the work and upper saw blade guide. You may get your hands pinched and injured. It is particularly dangerous when the work height is not properly set.**

Setting cutting length

Set the cutting length to suit the work length or depth of cut as described below.

When the table moves over the set length, the machine automatically stops.

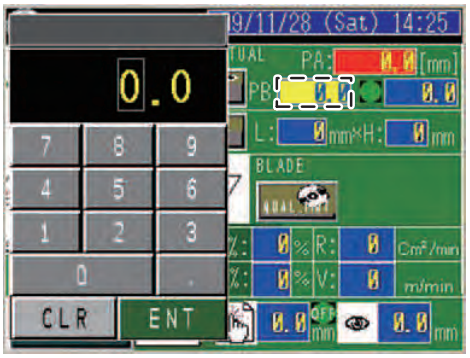
When the table moves over its stroke length, the machine stops.



Relative coordinate system

Set in the PB field the cutting length to suit the depth of cut.

1. Press the PB field to open the numeric keypad.
2. Press the 0 to 9 and • keys to set the cutting length.
3. Press the ENT key.



When the work contacts the saw blade after the start of cutting feed, press the CLR button to illuminate the RELATIVE COORDINATE light. The field at the right of the PB field shows zero and then shows the table move distance.
When cutting proceeds and the value shown in the field at the right of the PB field reaches the value shown in the PB field, the cutting feed stops.

Absolute coordinate system

When cutting the work completely, check that the work length (L) is set in the L field.

After the start of cutting feed, the cutting feed stops when the table move distance reaches the work length (L) shown in the L field.

Setting runout detector (option)

When using the optional runout detector, set the runout tolerance before starting the cutting operation of the machine.

NOTICE

- Just after the start of the machine, the runout detector is turned off, and OFF is shown in the ON/OFF field at the right of the DEVIATION button on the CNC INPUT or MANUAL INPUT display. Press the RUNOUT DETECTOR ON/OFF button to show ON on the DEVIATION display.

Breaking in new saw blade

Breaking in a new saw blade is basic to the correct use of the machine. Each time when you use the new saw blade, be sure to break it in as described below.

Unless properly broken in, the saw blade may become unable to cut any more in the middle of its life, may run out early, or may prematurely come to the end of its life.

1 Set the broken-in running speed to 20 to 30% lower than the normal speed.

For CNC input, set the override rate (%) to adjust the broken-in speed to 20 to 30 % lower than the normal speed.

2 Decrease the cutting rate to about 1/2 to 2/3 of the standard cutting rate.

For CNC input, set the override rate (%) to decrease the cutting rate to about 1/2 to 2/3 of the standard cutting rate.

Cut an appropriate workpiece with the new saw blade to an area approximately equal to “standard cutting rate × 80 (min)” under the following conditions.

Example: Cut a 200 mm high workpiece at a standard cutting rate of 60 cm^2/min.

Broken-in cutting area = 60 cm^2/min × 80 min = 4800 cm^2

Broken-in cutting length = 4800 × 100 ÷ 200 = 2400 mm

Or cut a 7.874 in. high workpiece at a standard cutting rate of 9.3 $in.^2$/min.

Broken-in cutting area = 9.3 $in.^2$/min × 80 min = 744 $in.^2$

Broken-in cutting length = 744 $in.^2$ ÷ 7.874 in. = 94.488 in.

When the broken-in cutting operation is completed, slowly return the saw blade running speed and cutting rate to the normal, and cut more work with the new saw blade.

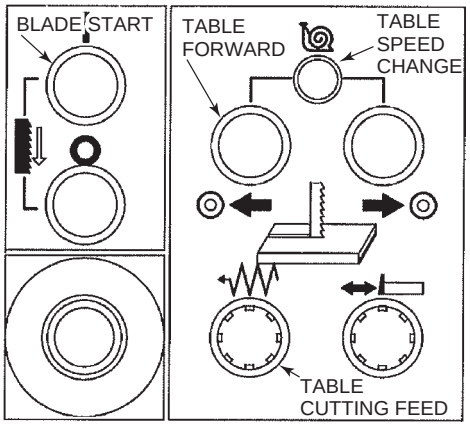
If the saw blade vibrates during cutting before normal cutting conditions are achieved, it is not properly broken in. In this case, lower the saw blade running speed and cutting rate again, and gradually bring them back to the normal cutting conditions while checking for vibration.

OPERATION

Starting cutting

After setting the work and cutting conditions, start cutting the work as described below.

1 Press and hold the TABLE FORWARD button to bring the work close to the saw blade.



NOTICE

- Take care not to bring the work into contact with the saw blade. It is safe to move the table forward at low speed by pressing and illuminating the TABLE SPEED CHANGE button.

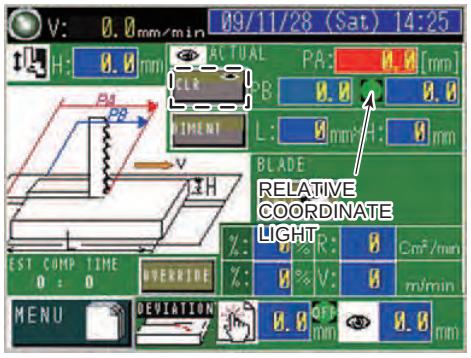
2 Press the BLADE START button to start the saw blade and turn on the cutting fluid.

3 Press the TABLE CUTTING FEED button to start the table feeding the work for cutting.

Relative coordinate system

Press the CLR button to illuminate the RELATIVE COORDINATE light when the work contacts the saw blade.

The field at the right of the PB field shows zero and then shows the table move distance.



Absolute coordinate system

After the start of cutting feed, the cutting feed stops when the table move distance reaches the work length (L) shown in the L field.

NOTICE

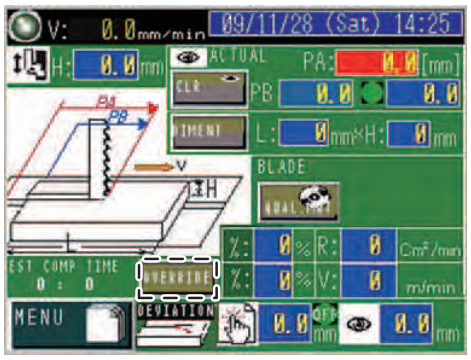
- If the saw blade vibrates, the cutting rate and saw blade running speed may be improperly set. Adjust the cutting rate and saw blade running speed as described in “Operation during cutting” on the next page.

Operation during cutting

ADJUSTING CUTTING RATE

CNC INPUT display

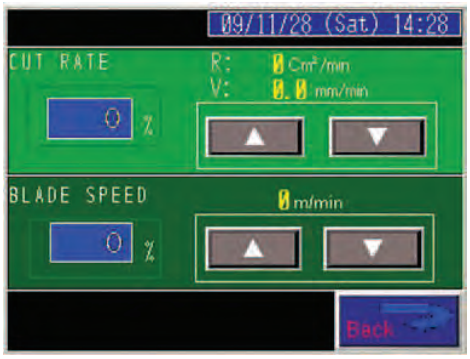
1 Press the OVERRIDE button to go to the OVERRIDE display.



2 Press the CUT RATE ▲ or ▼ button to adjust the cutting rate.

3 Each time the ▲ or ▼ button is pressed, the cutting rate increases or decreases by 1 %.

The settable range of the override rate (%) is 50 to 150%.

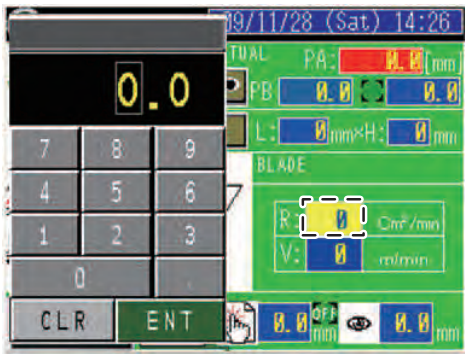


MANUAL INPUT display (cutting rate "cm²/min" input)

1 Press the R field to open the numeric keypad.

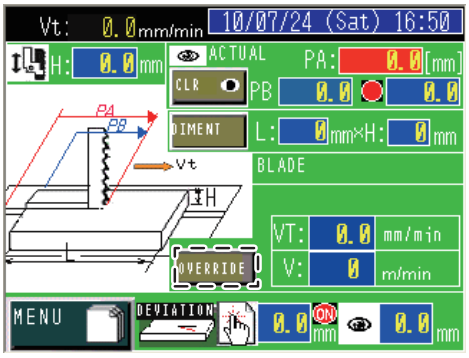
2 Enter the desired value with the 0 to 9 and • keys to adjust the cutting rate.

3 Press the ENT key.

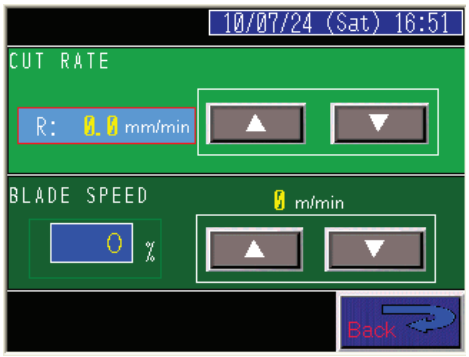


MANUAL INPUT display (table feed speed “mm/min” input)

1 Press the OVERRIDE button to go to the OVERRIDE display.



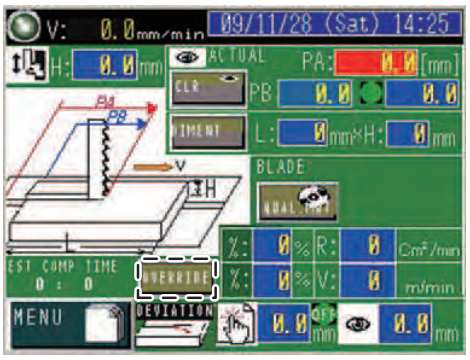
2 Press the CUT RATE ▲ or ▼ button to adjust the table feed speed.



ADJUSTING RUNNING SPEED OF SAW BLADE

CNC INPUT display

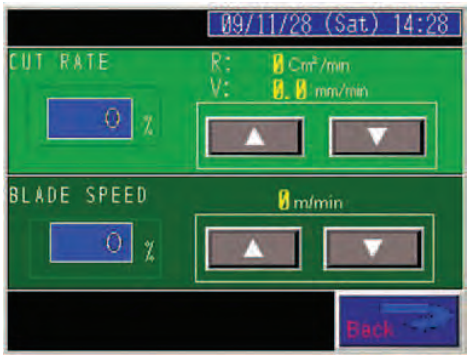
1 Press the OVERRIDE button to go to the OVERRIDE display.



2 Press the BLADE SPEED ▲ or ▼ button to adjust the running speed of the saw blade.

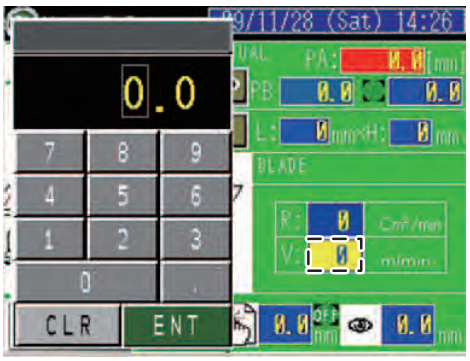
3 Each time the ▲ or ▼ button is pressed, the cutting rate increases or decreases by 1 %.

The settable range of the override rate (%) is 50 to 150%.



MANUAL INPUT display (cutting rate "cm²/min" input)

1 Press V field to open the numeric keypad.

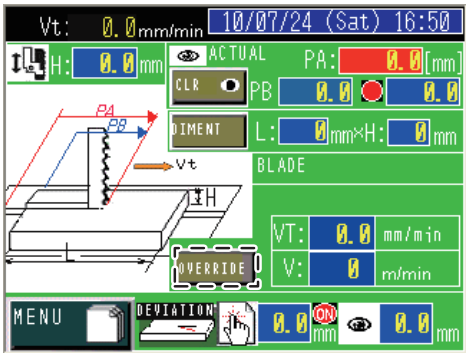


2 Enter the desired value with the 0 to 9 and • keys to adjust the saw blade running speed.

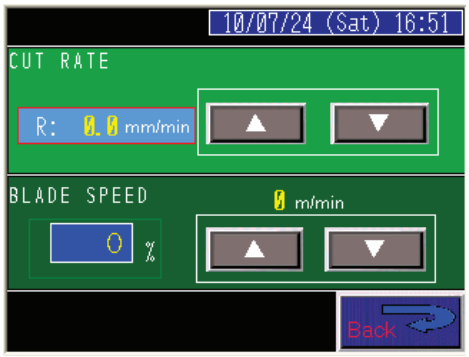
3 Press the ENT key.

MANUAL INPUT display (table feed speed “mm/min” input)

1 Press the OVERRIDE button to go to the OVERRIDE display.



2 Press the BLADE SPEED ▲ or ▼ button to adjust the saw blade running speed.



UPPER SAW BLADE GUIDE POSITION

Cannot be changed during cutting.

RESETTING RUNOUT TOLERANCE (OPTION)

The runout tolerance can be changed during cutting.

For the procedure for setting the runout tolerance, refer to Appendix A, Options.

Ending cutting

AUTOMATIC STOP

Relative coordinate system

When cutting proceeds and the value shown in the field at the right of the PB field reaches the value shown in the PB field, the cutting feed stops. After 30 sec, the machine totally stops.

Absolute coordinate system

The cutting feed stops when the table move distance reaches the work length (L) shown in the L field. After 30 sec, the machine totally stops.

RETURNING TABLE

Return the table to near the cutting start position or to the backward end by either of the following procedures.

Rapidly moving table backward

1 Press and hold the TABLE BACKWARD button.

The table moves backward rapidly.

Moving table backward at low speed

1 As required, press and illuminate the TABLE SPEED CHANGE button to change to low speed.

2 Press and hold the TABLE BACKWARD button to move the table fully backward.

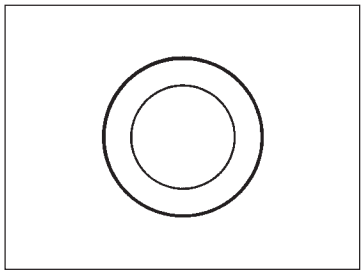
CAUTION	● **Depending on the clamp condition or internal stress of the work, the cut slot may be narrowed or bent. When moving the table backward, check that the saw blade is not subjected to undue force. After the work is completely cut off, it is safe to remove the cut piece first.**

Stopping machine

EMERGENCY STOP

As soon as an abnormal condition occurs to interrupt the continuous operation of the machine, press an EMERGENCY STOP button.

The machine stops totally and immediately, resulting in an emergency stop error. Remove the cause of the emergency stop, pull out the EMERGENCY STOP button.



Turning off power

NOTE

- Before turning off the power of the machine at the end of the day's work, press and illuminate the CUTTING FLUID button to discharge the cutting fluid and clean the machine.

1 Press the HYDRAULIC OFF button to stop the hydraulic pump motor and extinguish the HYDRAULIC ON button.

2 Turn the POWER switch to OFF.

3 Lock out the POWER switch with the accessory padlock, and hand the key to the chief operator for safekeeping.

4 Turn off the shop circuit breaker switch.

LIST OF CUTTING OPERATIONS

General flow of cutting operations

1 Turn POWER switch to ON

····· Turn POWER switch to ON to illuminate POWER ON light.

When error occurs, error message is shown on touch screen

····· Remove cause of error.

Refer to “Error list” later in this Part.

2 Press HYDRAULIC ON button

····· Press and illuminate HYDRAULIC ON button to start hydraulic pump motor.

3 Zero-return upper saw blade guide and backgauge (option)

····· Press ZERO-RETURN button.

Upper saw blade guide rises to upper end, and backgauge (option) zero-returns.

MENU display is shown on touch screen.

4 Register saw blade type and tooth pitch

····· Press BLADE button on MENU display to go to BLADE display.

Select saw blade type and tooth pitch of saw blade.

5 MENU display → PROGRAM display

Select CNC input or manual input

····· Press AUTO CUT CONDIT button (CNC input) or MANUAL CUT CONDIT button (manual input).

6 Set work data, saw blade running speed, and cutting rate

CNC INPUT display

Press DIMENT button to enter work length (L) and height (H) in L and H fields.

Press QUAL. MAT button to show standards by countries, and select standard and material type of work to be cut. Saw blade running speed and cutting rate are automatically set and shown in V and R fields respectively.

MANUAL INPUT display

Press V field to open numeric keypad, and enter desired saw blade running speed.

Press R (or VT) field to open numeric keypad, and enter desired cutting rate (or table feed speed).

7 Set runout tolerance (when using optional runout detector)

Press DEVIATION button to go to DEVIATION display, and press RUNOUT DETECTOR ON/OFF button to show ON on button.

Press TOLERANCE field to open numeric keypad, and enter runout tolerance.

8 Position work

Laser beam unit (option)

Press LASER BEAM ON button (option) to turn on laser beam. (Laser beam automatically turns off 5 min later.)

Position work by aligning scribed line of work with laser beam.

Backgauge (option)

Enter target position on BACKGAUGE display, and simultaneously press BACKGAUGE button and CONFIRMATION button.

Backgauge starts to move to target position.

Gently push work against backgauge by using crane or forklift. After work positioning, zero-return backgauge.

Cut-to-width stoppers (option)

Install stoppers on table.

Push work against stoppers to position it.

9 Clamp work

Clamp work with fixtures.

10 Approach

Press and hold TABLE FORWARD button to bring work close to saw blade.

11 Start saw blade

Press BLADE START button to start saw blade and turn on cutting fluid.

12 Adjust saw blade running speed and cutting rate

CNC INPUT display

Press OVERRIDE button to go to OVERRIDE display.

Adjust saw blade running speed with BLADE SPEED ▲ and ▼ buttons.

Adjust cutting rate with CUT RATE ▲ and ▼ buttons.

MANUAL INPUT display

Press V field to open numeric keypad, and enter desired value to adjust speed of saw blade.

Press R field to open numeric keypad, and enter desired value to adjust cutting rate.

(When the input method is table feed speed “mm/min” input, press OVERRIDE button to open OVERRIDE display, and adjust saw blade running speed and table feed speed on OVERRIDE display.)

13 Start cutting feed ····· Press the TABLE CUTTING FEED button to start table cutting feed.

14 Cutting end and automatic stop ····· When table move distance reaches cutting length, table cutting feed stops. After 30 sec, machine totally stops.

Repeat same cutting operation ····· Repeat steps 8 to 11, and 13 and 14.

Perform different cutting operation ····· Repeat steps 4 to 14.

15 Turn off power ····· Turn POWER switch to OFF.

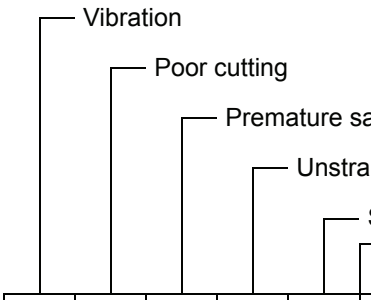
POWER ON light extinguishes.

TROUBLESHOOTING

Troubles during cutting

The saw blade is consumable and is certain to reach the end of its service life after cutting a sufficient amount of work. If it prematurely comes to the end of its service life, one of the causes described below may be responsible. Remove the cause, and perform a correct cutting operation. Do similarly for other symptoms.

Vibration	Poor cutting	Premature saw blade life	Unstraight cut	Saw blade breakage	Cause	Remedy
○	○	○	○	○	Improper saw blade pitch for height of work being cut.	Change to saw blade with proper pitch for height of work to be cut.
○	○	○	○	○	Saw blade not broken in.	Break in saw blade.
○	○	○	○		Saw blade running speed too fast.	Decrease saw blade running speed.
			○	○	Saw blade running speed too slow.	Increase saw blade running speed.
		○	○		Saw blade tension too low.	Check hydraulic oil.
○		○	○	○	Wire brush worn or not in proper contact with saw blade.	Change wire brush or adjust it to proper position.
○		○	○		Saw blade not properly clamped in saw blade inserts.	Clean and check saw blade inserts.
○	○	○	○	○	Work not properly clamped.	Reclamp work.
	○	○	○		Work surface too hard.	Remove hardened surface.
		○	○	○	Cutting rate too high.	Reduce cutting rate to proper level.
○		○	○	○	Cutting fluid flow insufficient or cutting fluid degraded.	Increase cutting fluid flow or change cutting fluid.
○	○	○	○	○	Supply voltage not stable.	Use voltage stabilized power source.
		○		○	Chips colored blue or purple.	Decrease cutting rate and saw blade running speed.
○		○		○	Chips built up in saw blade inserts.	Clean saw blade inserts.



					Cause	Remedy
○	○	○	○	○	Backup tips worn or cracked.	Change backup tips.
	○				Saw blade running in improper position.	Adjust saw blade to proper running position.
○		○		○	Saw blade in contact with flange of wheel.	Adjust clearance to proper degree.
	○	○	○		Saw blade teeth worn.	Change saw blade.

Saw blade binds or its teeth chip

When the saw blade has bound and stopped in the cut, press the TABLE BACKWARD button. The saw blade motor stops, and the table moves backward.

Check the saw blade teeth in the binding and adjacent portions for chipping.

If there is tooth chipping, the chipped teeth may be left in the cut. Slowly cut the rest of the work with the tooth-chipped saw blade to remove the chipped teeth. Change to a new saw blade, and cut off another piece from the work.

ERROR LIST

When an error is detected, the error message appears on the touch screen.

To clear the error condition, do as described below.

Error message	Error description	Remedy	Remarks
E001 EMERGENCY STOP	EMERGENCY STOP button is pressed.	Remove cause of error, and pull out EMERGENCY STOP button.	Hydraulic pump motor stops.
E002 BLADE SLIPPED	Saw blade slipped on drive wheel.	Check saw blade and cutting conditions.	
E003 INVERTER ERROR	Saw blade inverter is in abnormal condition.	Contact AMADA.	
E004 COVER OPEN	Wheel cover is open.	Close wheel covers.	Saw blade stops.
E005 MOTOR OVERLOAD	Motor is overloaded.	Restore motor to normal load condition, and check motor.	Hydraulic pump motor stops.
E006 BACKGAUGE OVERLOAD	Backgauge (option) is overloaded.	Restore backgauge to normal load condition, and check backgauge.	
E011 TABLE ADVANCE LIMIT	Table reached forward limit.	Contact AMADA.	
E012 TABLE RECOIL LIMIT	Table reached backward limit.	Contact AMADA.	
E013 TABLE SERVO DRIVER	Table servo amplifier detected error.	Turn off power and back on. If error recurs, contact AMADA.	
E014 BK.GAUGE SERVO DRIV	Backgauge servo amplifier detected error.	Turn off power and back on. If error recurs, contact AMADA.	
E015 COOLANT LEVEL	Cutting fluid level is low.	Add cutting fluid.	Warning
E016 PLC BATTERY	Sequencer memory backup battery is exhausted.	Contact AMADA.	Hydraulic pump motor stops.
E017 DEVIATION	Runout detector sensed saw blade runout.	Reduce cutting rate or change saw blade.	
E018 BLD GUIDE POSITION	Upper saw blade guide became misaligned.	Check upper saw blade guide for abnormal condition. (If abnormal condition is found, contact AMADA.)	
E019 BRUSH WORN	Wire brush is worn.	Replace wire brush with new one.	Warning

Part V

Maintenance

Maintenance is particularly important in ensuring the safety of the operator and the performance of the machine. Be sure to perform maintenance on the machine as described below.

CLEANING

WARNING

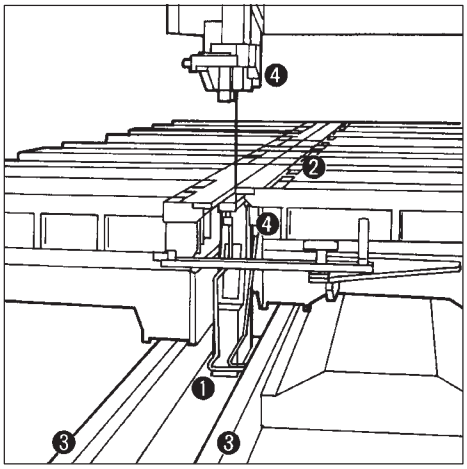
- **Before cleaning the machine, be sure to stop the saw blade.**
- **When cleaning the machine by discharging the cutting fluid from the cleaning hose nozzle, wear protective goggles.**

At the end of the day's work, clean the machine.

Be sure to stop the saw blade. Press and illuminate the CUTTING FLUID button to discharge the cutting fluid through the cleaning hose nozzle, and wash away chips from the parts of the machine.

Pay particular attention to the following parts:

① Below cutting area
② Top surface of table
③ Guide rails
④ Saw blade guides



NOTICE

- Never clean the upper saw blade guide and table with compressed air. Doing so may force the chips onto the slides and gears to cause the upper saw blade guide position detector to malfunction and the moving parts to be damaged.

After washing away the chips, wipe off the moisture from rust-prone surfaces like the table top surface and slide surfaces, and apply machine oil to them for rust protection.

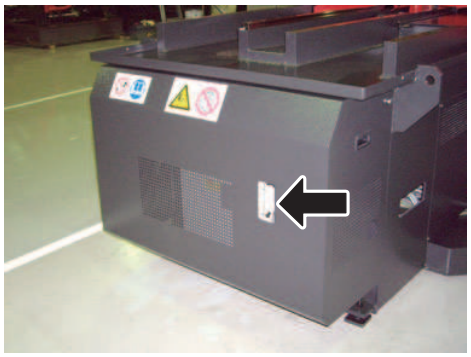
CHECKING BEFORE START OF DAY'S WORK

Before starting the machine every day, check it for the following items:

HYDRAULIC OIL LEVEL

Check the hydraulic oil level with the sight gauge.

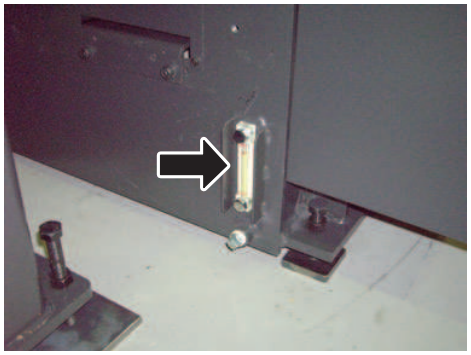
If it is low, add the same hydraulic oil. For the recommended hydraulic oils and other details, refer to page V-6.



CUTTING FLUID LEVEL

Check the cutting fluid level with the sight gauge.

If it is low, add the cutting fluid. If the cutting fluid is deteriorated, change all of it. For the other details, refer to page V-6.



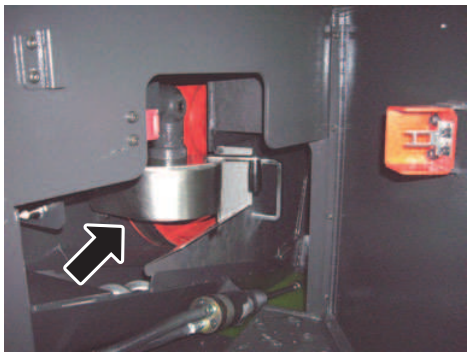
SAW BLADE

Check that the saw blade is properly installed on the drive and driven wheels and that its teeth are not chipped or worn.

WIRE BRUSH

Check that the wire brush properly touches the gullets of the saw blade.

If the wire brush is worn or the error message E019 is shown on the touch screen, change it. When the wing nut securing the wire brush is turned clockwise and loosened, the wire brush can be removed.



NOTICE

- When loosening the wing nut securing the wire brush, be sure to turn it clockwise.
- When tightening the wing nut securing the wire brush, be sure to turn it counterclockwise.
- Turning the wing nut in the wrong direction may result in wire brush breakage.

PERIODIC MAINTENANCE

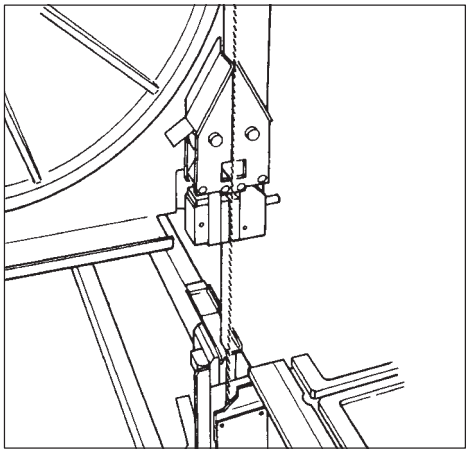
Check the following parts of the machine every month.

If any part is worn or damaged, it must be changed. Contact AMADA.

Saw blade guides

- Press the BLADE INSERT OPEN/CLOSE button to check that the saw blade inserts properly open and close.
- Check the sides and back of the saw blade for damage.

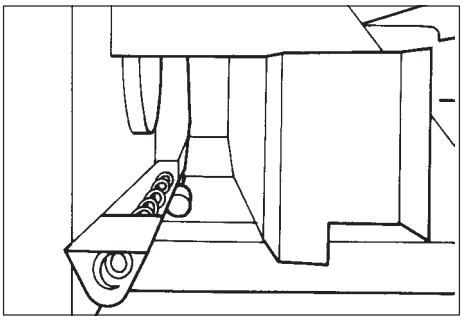
  If they are damaged, check the insert tips and backup tips.



- Check that the roller of the optional runout detector properly rotates.

Spiral of chip conveyor (option)

- Check that the spiral of the chip conveyor (option) is not worn.
- Check that the U-shaped groove below the spiral is not worn.



NOTE

- The chip conveyor (option) operates only when the saw blade is running.

CHANGING FLUID AND OIL

Cutting fluid

The cutting fluid will be discolored by the contaminants and rust of the workpieces and will be degraded and subject to bacterial growth when used for a long period of time.

At least once per year, especially before the summer vacation, change the entire cutting fluid. At the same time as the fluid change, clean the cutting fluid tank and pan.

Tank capacity: 105 L {27.7 US gal}

NOTE

- Dispose of the used cutting fluid as specified by the manufacturer and by the applicable government regulations in your country.

Hydraulic oil

Change the hydraulic oil every six months of machine operation.

Change the entire hydraulic oil despite any additions made in the process. At the same time as the oil change, clean the hydraulic tank and suction filter.

Recommended hydraulic oils: Esso Teresso 32
Mobil DTE 24
Shell Tellus Oil 32
(ISO VG32 equivalent)

Tank capacity: 10 L {2.6 US gal}

NOTE

- Dispose of the used hydraulic oil as specified by the manufacturer and by the applicable government regulations in your country.

Saw blade speed reducer oil

Change the entire oil every two years or 10000 hours of operation thereafter.

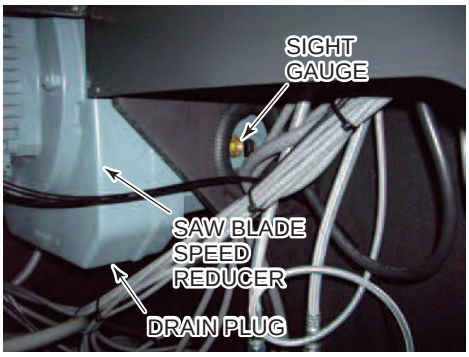
Drain the old oil from the speed reducer by removing the plug of the drain hose.

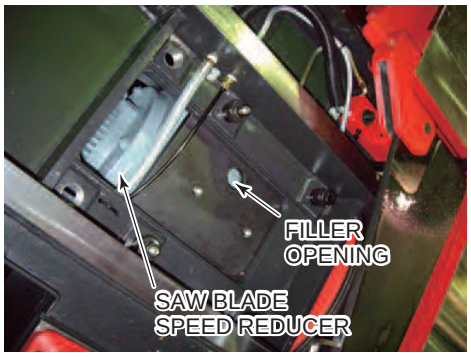
Recommended oil: Shell Omala Oil 220
(ISO VG220 equivalent)

Required amount of oil: 5.1 L {172 fl.oz.}

NOTE

- Dispose of the used speed reducer oil as specified by the manufacturer and by the applicable government regulations in your country.





GREASE LUBRICATION

WARNING

- **Before lubricating the machine, be sure to set the MODE keyswitch at "0" to lock the table.**
- **When stepping onto the table for performing maintenance, wear a helmet and safety shoes, and take care not to slip.**

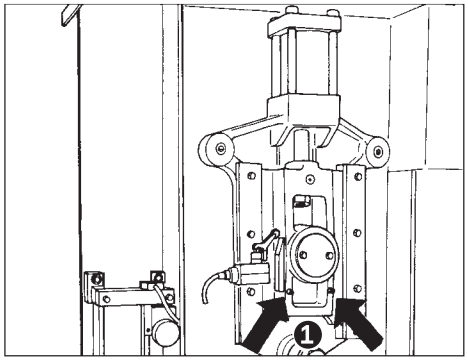
Check the grease lubrication condition of the following parts every month, and add grease to them as required.

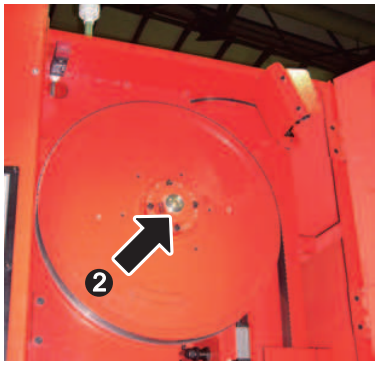
Recommended greases: Esso Lithtan 2
Mobil Mobilux 2
Shell Alvania Grease 2

NOTICE

- Apply grease to the grease nipples with a grease gun. Take care not to apply grease in an excessive amount.

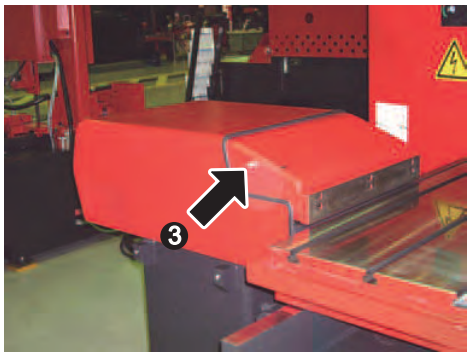
① Saw blade tension slides
② Driven wheel bearing
③ Backgauge screw (option)





NOTE

- Remove the driven wheel rear cover to check and lubricate the saw blade tension slides. The cover is secured with eight screws.

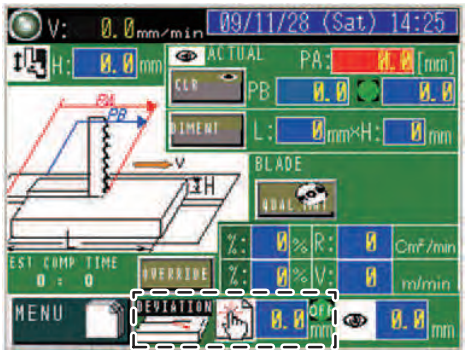


Appendix A

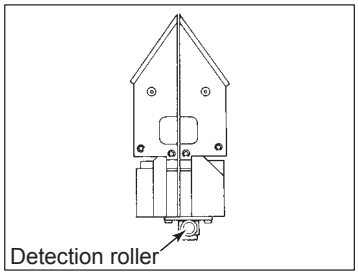
Options

RUNOUT DETECTOR

The runout detector senses the runout of the saw blade during cutting and automatically stops the machine when the actual runout of the saw blade exceeds the preset runout tolerance.



A roller that detects the runout of the saw blade is installed in the upper saw blade guide.

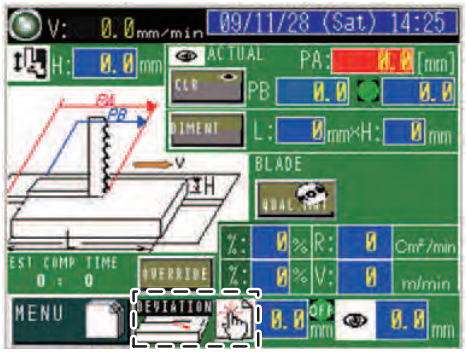


Setting runout tolerance

Set the runout tolerance on the DEVIATION display as described below.

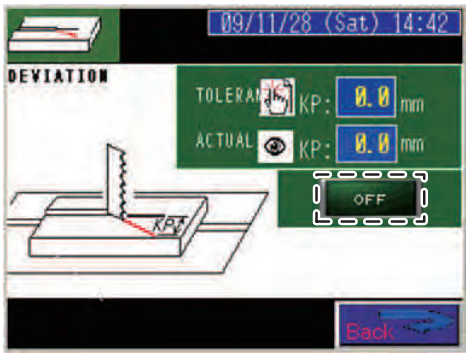
At a certain time after the runout of the saw blade exceeds the preset tolerance, the machine automatically stops. The setting range is 0.0 to ±9.9 mm {0.0 to ±0.389 in.}.

1 Press the DEVIATION button to go to the DEVIATION display.



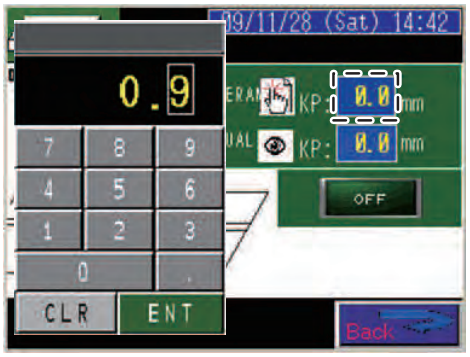
2 Press the RUNOUT DETECTOR ON/OFF button to show ON on the button.

(The ON/OFF field at the right of the DEVIATION button on the CNC INPUT or MANUAL INPUT display shows ON.)



3 Press the TOLERANCE field to open the numeric keypad.

4 Press the CLR key on the numeric keypad to reset the TOLERANCE field to zero.



5 Press the 0 to 9 and • keys to enter the runout tolerance.

(If the entered value is incorrect, press the CLR key to delete it, and enter the correct value.)

6 After checking its value, press the ENT key to register the runout tolerance in the control unit.

Operation at start of cutting and during cutting

Press the RUNOUT DETECTOR ON/OFF button on the DEVIATION display to show ON on the button and turn on the runout detector. (The ON/OFF field at the right of the DEVIATION button on the CNC INPUT or MANUAL INPUT display shows ON.)

If the machine is started with OFF shown on the RUNOUT DETECTOR ON/OFF button by pressing again the button, it does not stop even when the saw blade runs out.

The RUNOUT DETECTOR ON/OFF button can be operated and the runout tolerance can be set or changed even after the start of cutting.

Automatic stop at detection of excessive saw blade runout

When the actual runout of the saw blade exceeds the runout tolerance, the error message E017 is shown on the touch screen. When this condition continues for a certain time (standard timer-set time of 60 sec), the machine stops automatically and totally.

Resetting after automatic stop

When the machine automatically stops as the runout tolerance is exceeded, it is locked in the error condition. Restart the machine as described below.

1. Press the RUNOUT DETECTOR ON/OFF button on the DEVIATION display to show OFF on the button.
2. Press and illuminate the HYDRAULIC ON button to start the hydraulic pump motor.
3. To discontinue the cutting operation, press the TABLE BACKWARD button to move the table backward, and remove the work.
4. To continue the cutting operation with the runout of the saw blade permitted, restart the machine with the runout detector turned off, or restart the machine after setting a larger runout tolerance. (If the machine is restarted after turning on the runout detector and without changing the runout tolerance, the same error occurs again.)

The above procedure allows the machine to be reoperated. Check and remove the cause of the runout error (premature saw blade life, improper cutting conditions, improper clamping, or internal stress), and restart the machine.

SIGNAL TOWER

The signal tower illuminates to indicate that the machine enters the conditions described below.

Even when working apart from the machine, the operator can know from the lights to see if the machine is operating or not.

Red light: Illuminated to indicate that the machine has stopped at the occurrence of an error. A buzzer also sounds.

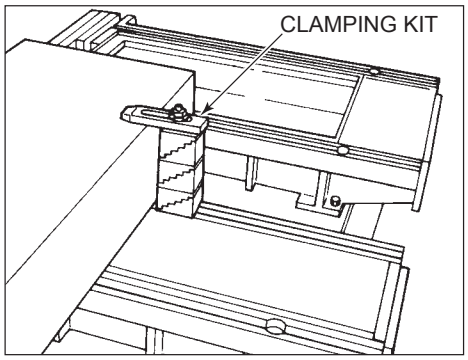
Green light: Illuminated to indicate that cutting is under way.

Yellow light: Illuminated to indicate that the machine has stopped at the end of cutting operation.

CLAMPING KITS

Clamping kits are dedicated fixtures to fix the work to the table. Change the number of blocks to suit the height of the work.

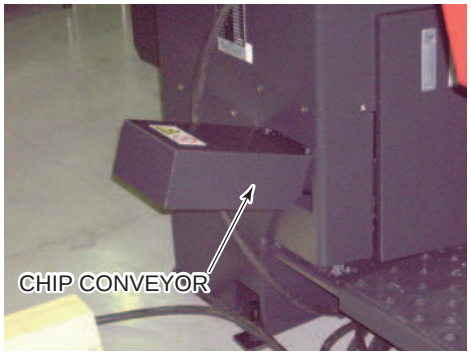
Machine speed clamps with a clamp height of 0 to 240 mm {0 to 9.4 in.} are also available to fix the work by one touch.



CHIP CONVEYOR

Automatically discharges the chips from the machine.

The chip conveyor automatically starts when the saw blade starts running.



WARNING

- **The chip conveyor is very dangerous. Never reach into the running chip conveyor.**

NOTICE

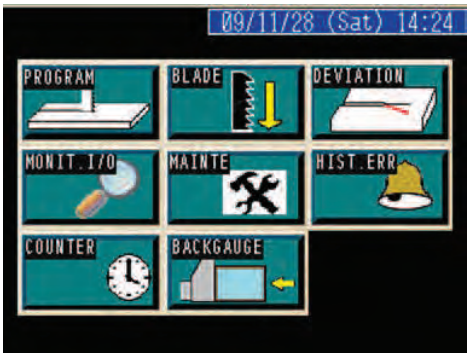
- When a trimming or solid material other than chips enters the chip conveyor, it may eat into and damage the spiral. Take care not to drop such foreign matter into the chip conveyor.

BACKGAUGE

The backgauge is used when positioning the work to the cutting position.

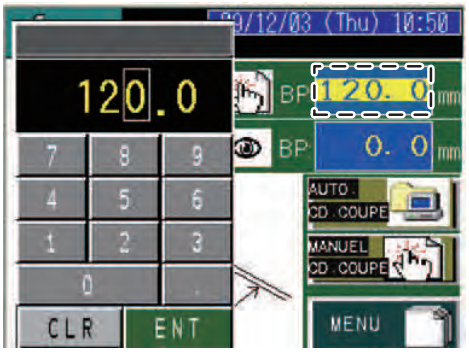
Operating procedure

1 Press the BACKGAUGE button on the MENU display to go to the BACKGAUGE display.



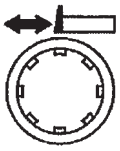
2 Press the TARG. POSITION field to open the numeric keypad.

3 Press the 0 to 9 and • keys to enter the target position.



4 Press the ENT key.

5 Simultaneously press the BACKGAUGE button and the CONFIRMATION button on the control panel to start the positioning of the backgauge. The backgauge starts to move to the target position.


[17]


[18]

6 Gently push the work against the backgauge by using a crane or forklift.

WARNING

- **Keep away from the table while the backgauge is moving. You may get injured.**
- **Depending on the position and shape of the work, you may get your hands pinched and injured between the work and upper frame or between the work and backgauge.**

NOTICE

- Press the ZERO-RETURN button to zero-return the backgauge before starting the cutting operation or moving the table.
- Never use the backgauge to push and move the work to the cutting position. Gently push the work against the backgauge by using a crane or forklift when positioning the work.

NOTE

- The backgauge stroke is 520 mm {20.47 in.}
- The backgauge cannot be operated during cutting.
- The table does not move unless the backgauge is positioned at 500 mm {19.69 in.} or more from the saw blade running line.

Appendix B
Material Safety Data Sheets

MATERIAL SAFETY DATA SHEET

Review Date: 12/06/2005

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: **ALVANIA® Grease 2**

MSDS NUMBER: 56110E - 11
PRODUCT CODE(S): 71012, 7101202120, 7101202400, 7101235203

SECTION 2 PRODUCT/INGREDIENTS

INGREDIENTS	CAS#	CONCENTRATION
Lubricating Grease		
Highly refined petroleum oils	Mixture	65 - 90 %weight
Hydrogenated castor oil	8001-78-3	5 - 30 %weight
Lithium grease thickener	Mixture	1 - 5 %weight
Additives (containes Sodium Nitrite)	Mixture	1 - 5 %weight

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Appearance & Odor: Amber semi-solid. Hydrocarbon odor.
Health Hazards: No known immediate health hazards. High-pressure injection under the skin may cause serious damage.
Physical Hazards: No known physical hazards.
NFPA Rating (Health, Fire, Reactivity): 0, 1, 0
Hazard Rating: Least - 0 Slight - 1 Moderate - 2 High - 3 Extreme - 4

Inhalation:
Inhalation of vapors (generated at high temperatures only) or oil mist may cause mild irritation of the nose, throat, and respiratory tract.

Eye Irritation:
May be irritating to the eyes causing a burning sensation, redness, swelling and/or blurred vision.

Skin Contact:
May be irritating to the skin causing a burning sensation, redness and/or swelling. Release of the material during high-pressure applications may result in injection under the skin causing possible extensive tissue damage which is

difficult to heal. Other adverse effects not expected from brief skin contact.

Ingestion:
Generally considered to have a low order of acute oral toxicity.

Signs and Symptoms:
Irritation as noted above. Local necrosis is evidenced by delayed onset of pain and tissue damage a few hours following injection.

Aggravated Medical Conditions:
Pre-existing eye, skin and respiratory disorders may be aggravated by exposure to this product.

For additional health information, refer to section 11.

SECTION 4 FIRST AID MEASURES

Inhalation:
If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting or unresponsive, give 100% oxygen with rescue breathing or CPR as required and transport to the nearest medical facility.

Skin:
Remove contaminated clothing and shoes and wipe excess from skin. Flush skin with water, then wash with soap and water. If irritation occurs, get medical attention. Do not reuse clothing until cleaned. Wipe off excess material from exposed area. If material is injected under the skin, transport to the nearest medical facility for additional treatment. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.

Eye:
Flush eyes with large amounts of water for at least 15 minutes. If redness, burning, blurred vision or swelling persist, transport to nearest medical facility for additional treatment.

Ingestion:
Do not induce vomiting. In general, no treatment is necessary unless large quantities of product are ingested. However, get medical attention. Have victim rinse mouth out with water, then drink sips of water to remove taste from mouth. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.

Note to Physician:
In general, emesis induction is unnecessary in high viscosity, low volatility products such as oils and greases.

SECTION 5 FIRE FIGHTING MEASURES

Flash Point [Method]: >400 ºF/>204.44 ºC [Pensky-Martens Closed Cup]

Extinguishing Media:
Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Fire Fighting Instructions:
Do not enter confined fire space without full bunker gear (helmet with face shield, bunker coats, gloves and rubber boots), including a positive pressure, NIOSH approved, self-contained breathing apparatus. This material is non-flammable.

Unusual Fire Hazards:
Material may ignite when preheated.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures:
May burn although not readily ignitable.

Spill Management:
Scoop up excess grease. Clean area with appropriate cleaner.

Reporting:
U.S. regulations require reporting releases of this material to the environment which exceed the reportable quantity to the National Response Center at (800)424-8802.
CERCLA: Product is covered by EPA's Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) petroleum exclusion. Releases to air, land, or water are not reportable under CERCLA (Superfund).

CWA: This product is an oil as defined under Section 311 of EPA's Clean Water Act (CWA). Spills into or leading to surface waters that cause a sheen must be reported to the National Response Center, 1-800-424-8802.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures:
Avoid heat, open flames, including pilot lights, and strong oxidizing agents. Use explosion-proof ventilation to prevent vapor accumulation. Ground all handling equipment to prevent sparking. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Handling:
Wash with soap and water before eating, drinking, smoking, applying cosmetics, or using toilet. Launder contaminated clothing before reuse. Properly dispose of contaminated leather articles such as shoes or belts that cannot be decontaminated. Contaminated leather articles including shoes cannot be decontaminated and should be destroyed to prevent reuse.

Storage:
Do not store in open or unlabeled containers. Store in a cool, dry place with adequate ventilation. Keep away from open flames and high temperatures.

Container Warnings:
Keep containers closed when not in use. Containers, even those that have been emptied, can contain explosive vapors. Do not cut, drill, grind, weld or perform similar operations on or near containers.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Chemical	Limit	TWA	STEL	Ceiling	Notation
Li-Hydroxystearate	ACGIH TLV	10 mg/m3			
Oil mist, mineral	ACGIH TLV	5 mg/m3	10 mg/m3		
Oil mist, mineral	OSHA PEL	5 mg/m3			

Exposure Controls

Adequate ventilation to control airborne concentrations.

Personal Protection

Personal protective equipment (PPE) selections vary based on potential exposure conditions such as handling practices, concentration and ventilation. Information on the selection of eye, skin and respiratory protection for use with this material is provided below.

Eye Protection:
Chemical Goggles, or Safety glasses with side shields

Skin Protection:
Use protective clothing which is chemically resistant to this material. Selection of protective clothing depends on potential exposure conditions and may include gloves, boots, suits and other items. The selection(s) should take into account such factors as job task, type of exposure and durability requirements.

Published literature, test data and/or glove and clothing manufacturers indicate the best protection is provided by:
Neoprene, or Nitrile Rubber

Respiratory Protection:
If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, an approved respirator must be worn. Respirator selection, use and maintenance should be in accordance with the requirements of the OSHA Respiratory Protection Standard, 29 CFR 1910.134.

Types of respirator(s) to be considered in the selection process include:
For Vapors: Air Purifying, R or P style prefilter & organic cartridge, NIOSH approved respirator. Self-contained breathing apparatus for use in environments with unknown concentrations or emergency situations.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Odor: Amber semi-solid. Hydrocarbon odor.
Substance Chemical Family: Lubricants

Drop Point	> 350 °F	**Flash Point**	> 400 °F [Pensky-Martens Closed Cup]
Solubility (in Water)	Insoluble	**Specific Gravity**	> 1.07

SECTION 10 REACTIVITY AND STABILITY

Stability:
Material is stable under normal conditions.

Conditions to Avoid:
Avoid heat and open flames.

Materials to Avoid:
Avoid contact with strong oxidizing agents.

Hazardous Decomposition Products:

Thermal decomposition products are highly dependent on combustion conditions. A complex mixture of airborne solids, liquids and gases will evolve when this material undergoes pyrolysis or combustion. Carbon Monoxide, Carbon Dioxideand other unidentified organic compounds may be formed upon combustion.

SECTION 11 TOXICOLOGICAL INFORMATION

Acute Toxicity

TEST	Result	OSHA Classification	Material Tested
Dermal LD50	>2 g/kg(Rabbit)	Non-Toxic	Based on components(s)
Oral LD50	>5 g/kg(Rat)	Non-Toxic	Based on components(s)

Carcinogenicity Classification

Chemical Name	NTP	IARC	ACGIH	OSHA
Lubricating Grease	No	No	No	No

SECTION 12 ECOLOGICAL INFORMATION

Environmental Impact Summary:
There is no ecological data available for this product. However, this product is an oil. It is persistent and does not readily biodegrade. However, it does not bioaccumulate.

SECTION 13 DISPOSAL CONSIDERATIONS

RCRA Information:

Under RCRA, it is the responsibility of the user of the material to determine, at the time of the disposal, whether the material meets RCRA criteria for hazardous waste. This is because material uses, transformations, mixtures, processes, etc. may affect the classification. Refer to the latest EPA, state and local regulations regarding proper disposal.

SECTION 14 TRANSPORT INFORMATION

US Department of Transportation Classification
This material is not subject to DOT regulations under 49 CFR Parts 171-180.

Oil: This product is an oil under 49CFR (DOT) Part 130. If shipped by rail or highway in a tank with a capacity of 3500 gallons or more, it is subject to these requirements. Mixtures or solutions containing 10% or more of this product may also be subject to this rule.

International Air Transport Association
Not regulated under IATA rules.

International Maritime Organization Classification
Not regulated under International Maritime Organization rules.

SECTION 15 REGULATORY INFORMATION

Federal Regulatory Status

OSHA Classification:
Product is hazardous according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Comprehensive Environmental Release, Compensation & Liability Act (CERCLA):

sodium nitrite	RQ 100 lbs	Reportable Spill => 6993.006993 lbs or 838.79 gal

Ozone Depleting Substances (40 CFR 82 Clean Air Act):
This material does not contain nor was it directly manufactured with any Class I or Class II ozone depleting substances.

Superfund Amendment & Reauthorization Act (SARA) Title III:
There are no components in this product on the SARA 302 list.

SARA Hazard Categories (311/312):

Immediate Health	Delayed Health	Fire	Pressure	Reactivity
YES	NO	NO	NO	NO

SARA Toxic Release Inventory (TRI) (313):
There are no components in this product on the SARA 313 list.

Toxic Substances Control Act (TSCA) Status:
All component(s) of this material is(are) listed on the EPA/TSCA Inventory of Chemical Substances.

Other Chemical Inventories:
Component(s) of this material is (are) listed on the Australian AICS, Canadian DSL, Chinese Inventory, European EINECS, Korean Inventory, Philippines PICCS,

State Regulation

This material is not regulated by California Prop 65, New Jersey Right-to-Know Chemical List or Pennsylvania Right-To-Know Chemical List. However for details on your regulation requirements you should contact the appropriate agency in your state.

SECTION 16 OTHER INFORMATION

Revision#: 11
Review Date: 12/06/2005
Revision Date: 12/06/2005
Revisions since last change (discussion): This Material Safety Data Sheet has changed because Equiva Services LLC. has implemented new software to generate the sheet. There will be slight differences in the hazard and precautionary language as we incorporate the guidance contained in the ANSI MSDS standard (ANSI Z400.1-1998). There are no significant changes to the health, safety or precautionary messages. We

encourage you to take the opportunity to reread the sheet and review the information contained.

SECTION 17 LABEL INFORMATION

READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET BEFORE HANDLING OR DISPOSING OF PRODUCT. THIS LABEL COMPLIES WITH THE REQUIREMENTS OF THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200) FOR USE IN THE WORKPLACE. THIS LABEL IS NOT INTENDED TO BE USED WITH PACKAGING INTENDED FOR SALE TO CONSUMERS AND MAY NOT CONFORM WITH THE REQUIREMENTS OF THE CONSUMER PRODUCT SAFETY ACT OR OTHER RELATED REGULATORY REQUIREMENTS.

PRODUCT CODE(S): 71012, 7101202120, 7101202400, 7101235203

ALVANIA® Grease 2

CAUTION!

MAY CAUSE SKIN AND EYE IRRITATION. PROLONGED OR REPEATED SKIN CONTACT MAY CAUSE OIL ACNE OR DERMATITIS. HIGH-PRESSURE INJECTION UNDER SKIN MAY CAUSE SERIOUS DAMAGE.

Precautionary Measures:
Avoid prolonged or repeated contact with eyes, skin and clothing. Avoid breathing of vapors, fumes, or mist. Use only with adequate ventilation. Wash thoroughly after handling.

FIRST AID

Inhalation: If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting or unresponsive, give 100% oxygen with rescue breathing or CPR as required and transport to the nearest medical facility.
Skin Contact: Wipe off excess material from exposed area. Remove contaminated clothing and shoes and wipe excess from skin. Flush skin with water, then wash with soap and water. If irritation occurs, get medical attention. Do not reuse clothing until cleaned. If material is injected under the skin, transport to the nearest medical facility for additional treatment. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact: Flush eyes with large amounts of water for at least 15 minutes. If redness, burning, blurred vision or swelling persist, transport to nearest medical facility for additional treatment.
Ingestion: Do not induce vomiting. In general, no treatment is necessary unless large quantities of product are ingested. However, get medical attention. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Have victim rinse mouth out with water, then drink sips of water to remove taste from mouth.

FIRE

In case of fire, Use water fog, 'alcohol foam', dry chemical or carbon dioxide (CO_2) to extinguish flames. Do not use a direct stream of water.

SPILL OR LEAK

Scoop up excess grease. Clean area with appropriate cleaner.

CONTAINS: Highly refined petroleum oils, Mixture; Hydrogenated castor oil, 8001-78-3; Lithium grease thickener, Mixture; Additives (containes Sodium Nitrite), Mixture

NFPA Rating (Health, Fire, Reactivity): 0, 1, 0

TRANSPORTATION

US Department of Transportation Classification
This material is not subject to DOT regulations under 49 CFR Parts 171-180.

Oil: This product is an oil under 49CFR (DOT) Part 130. If shipped by rail or highway in a tank with a capacity of 3500 gallons or more, it is subject to these requirements. Mixtures or solutions containing 10% or more of this product may also be subject to this rule.

CAUTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or toxic fumes from residues. Do not pressurize or expose to open flames or heat. Keep container closed and drum bungs in place.

Name and Address

SOPUS Products
P.O. Box 4427
Houston, TX 77210-4427

ADMINISTRATIVE INFORMATION	
MANUFACTURER ADDRESS:	SOPUS Products, P.O. Box 4427, Houston, TX. 77210-4427

THE INFORMATION CONTAINED IN THIS DATA SHEET IS BASED ON THE DATA AVAILABLE TO US AT THIS TIME, AND IS BELIEVED TO BE ACCURATE BASED UPON THAT : IT IS PROVIDED INDEPENDENTLY OF ANY SALE OF THE PRODUCT, FOR PURPOSE OF HAZARD COMMUNICATION. IT IS NOT INTENDED TO CONSTITUTE PRODUCT PERFORMANCE INFORMATION, AND NO EXPRESS OR IMPLIED WARRANTY OF ANY KIND IS MADE WITH RESPECT TO THE PRODUCT, UNDERLYING DATA OR THE INFORMATION CONTAINED HEREIN. YOU ARE URGED TO OBTAIN DATA SHEETS FOR ALL PRODUCTS YOU BUY, PROCESS, USE OR DISTRIBUTE, AND ARE ENCOURAGED TO ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

TO DETERMINE THE APPLICABILITY OR EFFECT OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, YOU SHOULD CONSULT WITH YOUR LEGAL ADVISOR OR THE APPROPRIATE GOVERNMENT AGENCY. WE WILL NOT PROVIDE ADVICE ON SUCH MATTERS, OR BE RESPONSIBLE FOR ANY INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN. THE UNDERLYING DATA, AND THE INFORMATION PROVIDED HEREIN AS A RESULT OF THAT DATA, IS THE PROPERTY OF SOPUS PRODUCTS AND IS NOT TO BE THE SUBJECT OF SALE OR EXCHANGE WITHOUT THE EXPRESS WRITTEN CONSENT OF SOPUS PRODUCTS.

44532-11973-100R-12/06/2005

Material Safety Data Sheet

1. MATERIAL AND COMPANY IDENTIFICATION

Material Name	:	**Omala Oil 220**
Uses	:	Gear lubricant.

2. COMPOSITION/INFORMATION ON INGREDIENTS

The highly refined mineral oil contains <3% (w/w) DMSO-extract, according to IP346.
Highly refined mineral oils and additives.

3. HAZARDS IDENTIFICATION

Emergency Overview

Appearance and Odour	:	Brown. Clear pale yellow. Liquid. Liquid at room temperature. Slight hydrocarbon.
Health Hazards	:	Not classified as dangerous for supply or conveyance.
Safety Hazards	:	Not classified as flammable but will burn.
Environmental Hazards	:	Not classified as dangerous for the environment.

Health Hazards	:	Not expected to be a health hazard when used under normal conditions.
Health Hazards		
Inhalation	:	Under normal conditions of use, this is not expected to be a primary route of exposure.
Skin Contact	:	Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin resulting in disorders such as oil acne/folliculitis.
Eye Contact	:	May cause slight irritation to eyes.
Ingestion	:	Low toxicity if swallowed.
Other Information	:	Used oil may contain harmful impurities.
Signs and Symptoms	:	Oil acne/folliculitis signs and symptoms may include formation of black pustules and spots on the skin of exposed areas. Ingestion may result in nausea, vomiting and/or diarrhoea.
Aggravated Medical Condition	:	Pre-existing medical conditions of the following organ(s) or organ system(s) may be aggravated by exposure to this material: Skin.
Environmental Hazards	:	Not classified as dangerous for the environment.

Additional Information	:	Under normal conditions of use or in a foreseeable emergency, this product does not meet the definition of a hazardous chemical when evaluated according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

4. FIRST AID MEASURES

General Information	:	Not expected to be a health hazard when used under normal conditions.
Inhalation	:	No treatment necessary under normal conditions of use. If symptoms persist, obtain medical advice.
Skin Contact	:	Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available. If persistent irritation occurs, obtain medical attention.
Eye Contact	:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion	:	In general no treatment is necessary unless large quantities are swallowed, however, get medical advice.
Advice to Physician	:	Treat symptomatically.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Flash point	:	Typical 200 °C / 392 °F (COC) >= 225 °C / 437 °F (Cleveland Open Cup)
Upper / lower Flammability or Explosion limits	:	Typical 1 - 10 %(V)(based on mineral oil)
Auto ignition temperature	:	> 320 °C / 608 °F
Specific Hazards	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Unidentified organic and inorganic compounds.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use water in a jet.
Protective Equipment for Firefighters	:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe all relevant local and international regulations.

Protective measures	:	Avoid contact with skin and eyes. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Clean Up Methods	:	Slippery when spilt. Avoid accidents, clean up immediately.

Prevent from spreading by making a barrier with sand, earth or other containment material. Reclaim liquid directly or in an absorbent. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly.

Additional Advice : Local authorities should be advised if significant spillages cannot be contained.

7. HANDLING AND STORAGE

General Precautions : Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.

Handling : Avoid prolonged or repeated contact with skin. Avoid inhaling vapour and/or mists. When handling product in drums, safety footwear should be worn and proper handling equipment should be used.

Storage : Keep container tightly closed and in a cool, well-ventilated place. Use properly labelled and closeable containers. Storage Temperature: 0 - 50 °C / 32 - 122 °F

Recommended Materials : For containers or container linings, use mild steel or high density polyethylene.

Unsuitable Materials : PVC.

Additional Information : Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
Oil mist, mineral	ACGIH	TWA(Mist.)		5 mg/m3	
Oil mist, mineral	ACGIH	STEL(Mist.)		10 mg/m3	

Exposure Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Adequate ventilation to control airborne concentrations. Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.

Personal Protective Equipment : Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.

Respiratory Protection : No respiratory protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene

		practices, precautions should be taken to avoid breathing of material. If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65 °C (149 °F)].
Hand Protection	:	Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC, neoprene or nitrile rubber gloves. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.
Eye Protection	:	Wear safety glasses or full face shield if splashes are likely to occur.
Protective Clothing	:	Skin protection not ordinarily required beyond standard issue work clothes.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Environmental Exposure Controls	:	Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Brown. Clear pale yellow. Liquid. Liquid at room temperature.
Odour	:	Slight hydrocarbon.
pH	:	Not applicable.
Initial Boiling Point and Boiling Range	:	> 280 °C / 536 °F estimated value(s)
Pour point	:	Typical -18 °C / 0 °F
Freezing Point		Typical -50 °C / -58 °F
Flash point	:	Typical 200 °C / 392 °F (COC) >= 225 °C / 437 °F (Cleveland Open Cup)
Upper / lower Flammability or Explosion limits	:	Typical 1 - 10 %(V) (based on mineral oil)
Auto-ignition temperature	:	> 320 °C / 608 °F
Vapour pressure	:	< 0.5 Pa at 20 °C / 68 °F (estimated value(s))
Density	:	Typical 899 kg/m3 at 15 °C / 59 °F
Water solubility	:	Negligible.

n-octanol/water partition coefficient (log Pow)	:	> 6 (based on information on similar products)
Kinematic viscosity	:	Typical 220 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	> 1 (estimated value(s))
Evaporation rate (nBuAc=1)	:	Data not available

10. STABILITY AND REACTIVITY

Stability	:	Stable.
Conditions to Avoid	:	Extremes of temperature and direct sunlight.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on data on the components and the toxicology of similar products.
Acute Oral Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rat
Acute Dermal Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Not considered to be an inhalation hazard under normal conditions of use.
Skin Irritation	:	Expected to be slightly irritating. Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin resulting in disorders such as oil acne/folliculitis.
Eye Irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Inhalation of vapours or mists may cause irritation.
Sensitisation	:	Not expected to be a skin sensitiser.
Repeated Dose Toxicity	:	Not expected to be a hazard.
Mutagenicity	:	Not considered a mutagenic hazard.
Carcinogenicity	:	Product contains mineral oils of types shown to be non-carcinogenic in animal skin-painting studies. Highly refined mineral oils are not classified as carcinogenic by the International Agency for Research on Cancer (IARC). Other components are not known to be associated with carcinogenic effects.
Reproductive and Developmental Toxicity	:	Not expected to be a hazard.
Additional Information	:	Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal. ALL used oil should be handled with caution and skin contact avoided as far as possible.

12. ECOLOGICAL INFORMATION

Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity	:	Poorly soluble mixture. May cause physical fouling of aquatic organisms. Expected to be practically non toxic: LL/EL/IL50 >

100 mg/l (to aquatic organisms) (LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract). Mineral oil is not expected to cause any chronic effects to aquatic organisms at concentrations less than 1 mg/l.

Mobility	:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence/degradability	:	Expected to be not readily biodegradable. Major constituents are expected to be inherently biodegradable, but the product contains components that may persist in the environment.
Bioaccumulation	:	Contains components with the potential to bioaccumulate.
Other Adverse Effects	:	Product is a mixture of non-volatile components, which are not expected to be released to air in any significant quantities. Not expected to have ozone depletion potential, photochemical ozone creation potential or global warming potential.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses.
Container Disposal	:	Dispose in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations.

14. TRANSPORT INFORMATION

US Department of Transportation Classification (49CFR)
This material is not subject to DOT regulations under 49 CFR Parts 171-180.

IMDG
This material is not classified as dangerous under IMDG regulations.

IATA (Country variations may apply)
This material is not classified as dangerous under IATA regulations.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Federal Regulatory Status

Notification Status

EINECS	All components listed or polymer exempt.
TSCA	All components listed.
DSL	All components listed.

SARA Hazard Categories (311/312)
No SARA 311/312 Hazards.

State Regulatory Status

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)

This material does not contain any chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

16. OTHER INFORMATION

NFPA Rating (Health, Fire, Reactivity)	:	0, 1, 0
MSDS Version Number	:	13.0
MSDS Effective Date	:	07/08/2008
MSDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
MSDS Regulation	:	The content and format of this MSDS is in accordance with the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
MSDS Distribution	:	The information in this document should be made available to all who may handle the product.
Disclaimer	:	The information contained herein is based on our current knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.

Material Safety Data Sheet

1. MATERIAL AND COMPANY IDENTIFICATION

Material Name	:	**Shell TELLUS OIL 32**
Uses	:	Hydraulic oil

2. COMPOSITION/INFORMATION ON INGREDIENTS

Highly refined mineral oils and additives.
The highly refined mineral oil contains <3% (w/w) DMSO-extract, according to IP346.

3. HAZARDS IDENTIFICATION

Emergency Overview

Appearance and Odour	:	Brown. Liquid. Slight hydrocarbon.
Health Hazards	:	High-pressure injection under the skin may cause serious damage including local necrosis.
Safety Hazards	:	Not classified as flammable but will burn.
Environmental Hazards	:	Not classified as dangerous for the environment.

Health Hazards	:	Not expected to be a health hazard when used under normal conditions.
Health Hazards		
Inhalation	:	Under normal conditions of use, this is not expected to be a primary route of exposure.
Skin Contact	:	Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin resulting in disorders such as oil acne/folliculitis.
Eye Contact	:	May cause slight irritation to eyes.
Ingestion	:	Low toxicity if swallowed.
Other Information	:	High-pressure injection under the skin may cause serious damage including local necrosis. Used oil may contain harmful impurities.
Signs and Symptoms	:	Oil acne/folliculitis signs and symptoms may include formation of black pustules and spots on the skin of exposed areas. Local necrosis is evidenced by delayed onset of pain and tissue damage a few hours following injection. Ingestion may result in nausea, vomiting and/or diarrhoea.

Aggravated Medical Condition	:	Pre-existing medical conditions of the following organ(s) or organ system(s) may be aggravated by exposure to this material: Skin.
Environmental Hazards	:	Not classified as dangerous for the environment.
Additional Information	:	Under normal conditions of use or in a foreseeable emergency, this product does not meet the definition of a hazardous chemical when evaluated according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

4. FIRST AID MEASURES

General Information	:	Not expected to be a health hazard when used under normal conditions.
Inhalation	:	No treatment necessary under normal conditions of use. If symptoms persist, obtain medical advice.
Skin Contact	:	Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available. If persistent irritation occurs, obtain medical attention. When using high pressure equipment, injection of product under the skin can occur. If high pressure injuries occur, the casualty should be sent immediately to a hospital. Do not wait for symptoms to develop. Obtain medical attention even in the absence of apparent wounds.
Eye Contact	:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion	:	In general no treatment is necessary unless large quantities are swallowed, however, get medical advice.
Advice to Physician	:	Treat symptomatically. High pressure injection injuries require prompt surgical intervention and possibly steroid therapy, to minimise tissue damage and loss of function. Because entry wounds are small and do not reflect the seriousness of the underlying damage, surgical exploration to determine the extent of involvement may be necessary. Local anaesthetics or hot soaks should be avoided because they can contribute to swelling, vasospasm and ischaemia. Prompt surgical decompression, debridement and evacuation of foreign material should be performed under general anaesthetics, and wide exploration is essential.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Flash point	:	Typical 209 °C / 408 °F (PMCC / ASTM D93)
Upper / lower Flammability or Explosion limits	:	Typical 1 - 10 %(V)(based on mineral oil)
Auto ignition temperature	:	> 320 °C / 608 °F
Specific Hazards	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Unidentified organic and inorganic compounds.

Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use water in a jet.
Protective Equipment for Firefighters	:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe all relevant local and international regulations.

Protective measures	:	Avoid contact with skin and eyes. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Clean Up Methods	:	Slippery when spilt. Avoid accidents, clean up immediately. Prevent from spreading by making a barrier with sand, earth or other containment material. Reclaim liquid directly or in an absorbent. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly.
Additional Advice	:	Local authorities should be advised if significant spillages cannot be contained.

7. HANDLING AND STORAGE

General Precautions	:	Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
Handling	:	Avoid prolonged or repeated contact with skin. Avoid inhaling vapour and/or mists. When handling product in drums, safety footwear should be worn and proper handling equipment should be used.
Storage	:	Keep container tightly closed and in a cool, well-ventilated place. Use properly labelled and closeable containers. Storage Temperature: 0 - 50 °C / 32 - 122 °F
Recommended Materials	:	For containers or container linings, use mild steel or high density polyethylene.
Unsuitable Materials	:	PVC.
Additional Information	:	Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation

Oil mist, mineral	ACGIH	TWA(Mist.)		5 mg/m3	
Oil mist, mineral	ACGIH	STEL(Mist.)		10 mg/m3	

Exposure Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Adequate ventilation to control airborne concentrations. Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.

Personal Protective Equipment : Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.

Respiratory Protection : No respiratory protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid breathing of material. If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65 °C (149 °F)].

Hand Protection : Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC, neoprene or nitrile rubber gloves. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.

Eye Protection : Wear safety glasses or full face shield if splashes are likely to occur.

Protective Clothing : Skin protection not ordinarily required beyond standard issue work clothes.

Monitoring Methods : Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.

Environmental Exposure Controls : Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Brown. Liquid.
Odour	:	Slight hydrocarbon.
pH	:	Not applicable.
Initial Boiling Point and Boiling Range	:	> 280 °C / 536 °F estimated value(s)
Pour point	:	Typical -30 °C / -22 °F
Flash point	:	Typical 209 °C / 408 °F (PMCC / ASTM D93)
Upper / lower Flammability or Explosion limits	:	Typical 1 - 10 %(V) (based on mineral oil)
Auto-ignition temperature	:	> 320 °C / 608 °F
Vapour pressure	:	< 0.5 Pa at 20 °C / 68 °F (estimated value(s))
Density	:	Typical 875 kg/m3 at 15 °C / 59 °F
Water solubility	:	Negligible.
n-octanol/water partition coefficient (log Pow)	:	> 6 (based on information on similar products)
Kinematic viscosity	:	Typical 32 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	> 1 (estimated value(s))
Evaporation rate (nBuAc=1)	:	Data not available

10. STABILITY AND REACTIVITY

Stability	:	Stable.
Conditions to Avoid	:	Extremes of temperature and direct sunlight.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on data on the components and the toxicology of similar products.
Acute Oral Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rat
Acute Dermal Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Not considered to be an inhalation hazard under normal conditions of use.
Skin Irritation	:	Expected to be slightly irritating. Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin resulting in disorders such as oil acne/folliculitis.
Eye Irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Inhalation of vapours or mists may cause irritation.
Sensitisation	:	Not expected to be a skin sensitiser.
Repeated Dose Toxicity	:	Not expected to be a hazard.
Mutagenicity	:	Not considered a mutagenic hazard.
Carcinogenicity	:	Product contains mineral oils of types shown to be non-carcinogenic in animal skin-painting studies. Highly refined mineral oils are not classified as carcinogenic by the International Agency for Research on Cancer (IARC). Other components are not known to be associated with carcinogenic effects.

Reproductive and Developmental Toxicity	:	Not expected to be a hazard.
Additional Information	:	Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal. ALL used oil should be handled with caution and skin contact avoided as far as possible. High pressure injection of product into the skin may lead to local necrosis if the product is not surgically removed.

12. ECOLOGICAL INFORMATION

Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity	:	Poorly soluble mixture. May cause physical fouling of aquatic organisms. Expected to be practically non toxic: LL/EL/IL50 > 100 mg/l (to aquatic organisms) (LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract). Mineral oil is not expected to cause any chronic effects to aquatic organisms at concentrations less than 1 mg/l.
Mobility	:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence/degradability	:	Expected to be not readily biodegradable. Major constituents are expected to be inherently biodegradable, but the product contains components that may persist in the environment.
Bioaccumulation	:	Contains components with the potential to bioaccumulate.
Other Adverse Effects	:	Product is a mixture of non-volatile components, which are not expected to be released to air in any significant quantities. Not expected to have ozone depletion potential, photochemical ozone creation potential or global warming potential.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses.
Container Disposal	:	Dispose in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations.

14. TRANSPORT INFORMATION

US Department of Transportation Classification (49CFR)
This material is not subject to DOT regulations under 49 CFR Parts 171-180.

IMDG
This material is not classified as dangerous under IMDG regulations.

IATA (Country variations may apply)
This material is not classified as dangerous under IATA regulations.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Federal Regulatory Status

Notification Status

EINECS	All components listed or polymer exempt.
TSCA	All components listed.
DSL	All components listed.

SARA Hazard Categories (311/312)
No SARA 311/312 Hazards.

State Regulatory Status

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)

This material does not contain any chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

16. OTHER INFORMATION

NFPA Rating (Health, Fire, Reactivity)	:	0, 1, 0
MSDS Version Number	:	2.0
MSDS Effective Date	:	07/03/2008
MSDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
MSDS Regulation	:	The content and format of this MSDS is in accordance with the

MSDS Distribution	:	OSHA Hazard Communication Standard, 29 CFR 1910.1200. The information in this document should be made available to all who may handle the product.
Disclaimer	:	The information contained herein is based on our current knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.

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