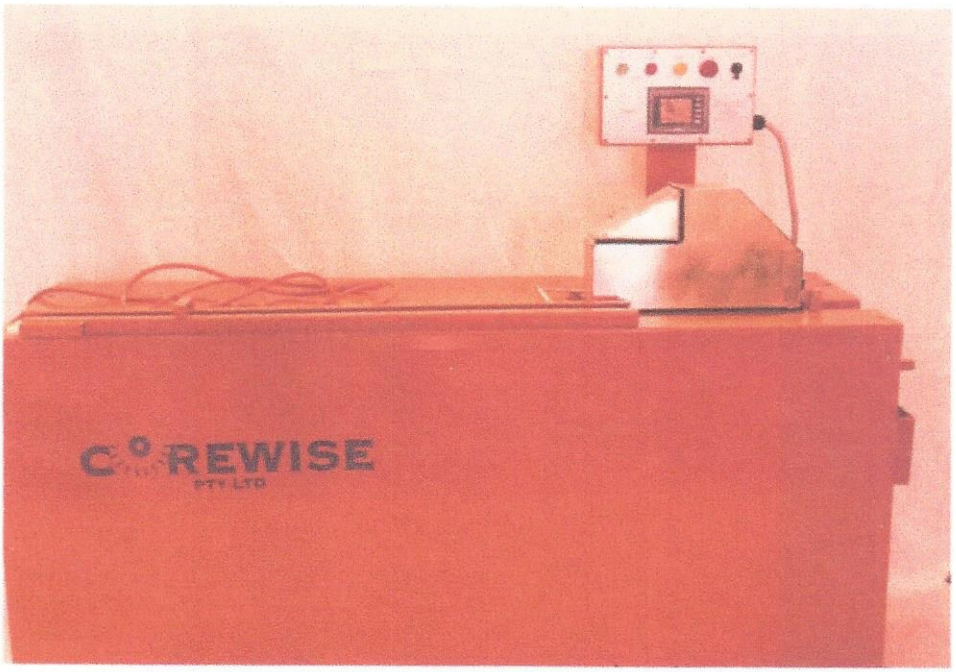
Automatic core saw

operating and safety manual



Contents

1. introduction

This manual has been designed to give operators an understanding of why the drill cores are cut. In this manual we will cover a brief history of drilling, explain about the diamond, the manufacture of the diamond blade, safety on core saws, pre-start checks, cutting procedures and choosing the correct product for your needs.

2. history of drilling

The principle of core drilling comes to us from remote antiquity. The ancient Egyptians used tubular drills for boring short holes in the construction of the pyramids. Examples of early Egyptian cores and drill holes can be examined in museums today. It is thought that the drills were set with gemstones and were undoubtedly hand operated.

The first machine was built in 1862-3. This machine was used for blast hole drilling. Diamond drills were used for blast hole and tunnelling purposes until 1867 when a steam driven machine was patented for coal exploration. This machine is reported to have drilled holes to 750 feet. Today the diamond drill is extensively used wherever a rock sample is desired. The increased demand has stimulated improvements in design and efficiency in drills and associated equipment to the point where many modern operations are multimillion dollar enterprises. Of course without demand for their services no drills would exist and there are numerous applications for the modern diamond drill.

There are four main uses for the diamond drill:

1. Exploration and development of minerals
2. Blast hole drilling
3. Foundation test and grout hole drilling
4. Oil well drilling

For the purposes used here it is primarily for the exploration and development of minerals. The drilling is done for assessment purposes, for blind prospecting through overburden based on "geological bets" for drilling known ore occurrences and extensions obscured by swamps, lakes or overburden. They are also used for "wildcat" exploration in remote unproven areas. In these instances the drills can be an inexpensive way of testing the viability of the ground.

In mining the diamond drill is extensively used for ore body definition, grade control and rock mechanics. In each instance the drilling of small diameter holes proves to be an inexpensive and safe way of obtaining the information when compared to blasting tunnels or excavating the ground.

Diamond drilling is based on the extreme hardness of the diamond enabling it to cut or abrade all rocks, minerals or other materials. Mechanically, the diamond drill consists of a power unit rotating a tubular steel bit in the face of which are set diamonds.

This bit and attached core barrel are rotated at speed under controlled pressure, by means of hollow steel, flush jointed drill pipe through which water is pumped to cool the bit and remove the rock cuttings. With the advance of the bit a cylindrical core of rock passes up into the core barrel where it is held in place by means of a core lifter. This core is periodically removed by means of a wireline and recovery tool (overshot) and the depths recorded. The core is placed into specially made trays and transported to logging areas.

Geologists and engineers plan holes into areas they wish to test and examine. Once the hole has been drilled and the core has been transported to the core yard it is measured, logged, photographed and assayed. In many instances the core is split or cut in half. One half is assayed and the other kept as a record for future reference should any abnormalities arise. This half core is also useful for mine planning and engineering purposes.

3. the diamond

Diamonds have long been associated with jewellery the glittering prizes that adorns rings necklaces and earrings. This is not surprising as the gem is truly beautiful. It is also well known that the diamond is the hardest substance in the world, either naturally occurring or manmade.

The oldest definite evidence of the use of diamonds as an ornament is in a Greek statuette which has two small diamonds as eyes and is dated to the fifth century B.C. Diamonds were mined mainly in India and Borneo for nearly two thousand years until they were discovered in Brazil. About 15000000 carats of diamonds were mined in Brazil when the fields became unviable. Then in 1867 diamonds were found in the Orange River in South Africa. This started a rush and in 7870 the first diamond pipe was discovered. The largest of these pipes was discovered at Kimberly, the pipe was mined to 350 feet when floods, landslides and other difficulties made it no longer practical and the workings in the area were consolidated under the name of De Beers Consolidated Mines Ltd. Shafts were sunk, and tunnels bored and the prospector gave way to the engineer, and modern machinery at the pithead. Diamonds for millions to wear and as a by-product, diamonds for industry.

The jewels of industry, incidental to the mining of gemstones there has always been a considerable yield of other stones which because of colour, structure etc, are unsuitable for gem use. These stones are classified as "Bortz" or industrial diamonds.

From a jeweller's viewpoint, these stones are inferior to a gem quality stone but no defect in colour and no speck of uncrystallised carbon can alter the fact that these stones too are composed of the world's hardest substance. They make the finest, most durable and the most economical cutting points known to industry.

The ancients discovered the value of the diamond as a cutting tool thousands of years ago. It was used for cutting other gemstones and engraving. The Greeks called it "Adamas" meaning invincible, and from this word we get the English word Diamond.

Today diamonds are used so widely throughout industry that it is difficult to think of an everyday article which is not improved at some point of its production by the use of the diamond.

Diamonds whether they are of gem or industrial quality are found in nature in two types of deposits.

(a) Kimberlite or pipe formation, from which they are extracted by mining operations

(b) Alluvial deposits, where diamonds occur in gravel beds along riverbeds or ocean terraces and are recovered by strip mining

Then in 1955 General Electric announced they had successfully manufactured diamonds. These diamonds were made in large hydraulic presses by subjecting graphite simultaneously to pressures in excess of 1,500,000 psi and to temperatures up to 5000°F. For sixteen hours. We can clearly see from the above experiments that the key elements in the synthesis of diamond are time, temperature and pressure. Each of these parameters control the size and quality of the diamond produced. The control or adjustments of either of these parameters produces a vast range of synthetic product now available.
It is possible to tailor diamonds for a specific purpose. As already stated diamonds are basically graphite. This simple fact is used in the manufacture of synthetic diamond. In addition to graphite, it has been found necessary to use molten metals as a solvent that dissolves the graphite and deposits diamond crystals. Metals used are nickel, iron and cobalt. The relationship between the controlling parameter is shown in figure (A).

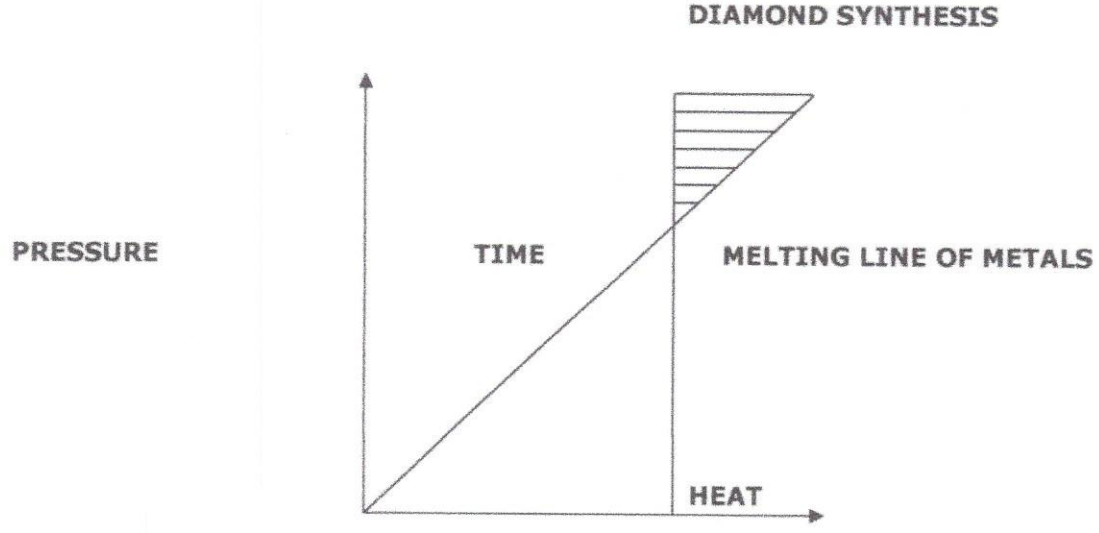


FIG A. SYNTHESIS OF DIAMONDS

(1) Graphite and metals are placed in capsule and placed in high pressure chamber

(2) The capsule is subject to extreme pressure

(3) The capsule is heated, the metal melts and the diamonds are formed

In today's modern drill bits and core cutting blades, the vast majority of diamonds used are synthetic. We use these diamonds for two specific reasons:

(a) Synthetic diamonds have no faults or flaws, they are perfect. This perfect crystal is much stronger than a natural industrial diamond. It also has many more sharp points than a natural diamond making it a better cutting medium.

(b) The synthetic diamond can be made to the exact same shape and size every time. This means that the product manufactured can be made to strict formulas and that one core cutting blade is the same as the next.

4. blade manufacture

Traditionally diamond cutting equipment has been made by setting individual diamonds on the face of a bit, blade etc. Then in the 1950's a process called impregnation was discovered where numerous small diamonds are mixed and set in a metal powder which is then melted together and bonded to the bit or blade. This powder is called the matrix and consists of diamonds and various alloys mixed together so as the distribution of the diamond is even.

Once this is melted together and bonded it gives the cutting medium (bit, blade etc.) a much extended life. As the top row of diamonds becomes blunt the metal matrix wears away exposing a fresh row of diamonds. This continues until the matrix is worn completely away, and is many times the life of a single set article.

For blade manufacture the matrix is mixed much like mixing a fruitcake and like a recipe the amount of diamonds and matrix powder are pre-weighed to give a pre-determined ratio of diamond articles per cubic volume of matrix. This is referred to as the diamond concentration and is based on a 100% being 72 carats per cubic inch of matrix.

Diamond concentration and matrix alloys are varied to suit various types of rocks to be cut and as a general rule the harder the rock the softer the matrix. This means when cutting very hard rocks that the diamond blunts very quickly requiring fresh and sharp diamond be exposed on a much more regular basis. If fresh diamond is not exposed the blade will become polished and will not cut. This is explained in a latter chapter. To enable the matrix to abrade more readily the composition of the matrix is much softer than a matrix designed for soft rock.

The matrix recipe is then individually weighed and placed in separate carbon moulds ready for furnacing. Mixed in with the matrix is a binding material which is mainly copper, a flux is used to prevent oxidization. The mould assembly is then heated to approximately 900°C at which point the binder materials melt and by capillary action is absorbed into the matrix powder. This forms what is called the segment. These segments are now ready to be braised onto the blade blank. The blank is made of extremely high quality steel which is laser cut and ground to make it perfectly balanced. This is called the tension of the blade. It is very important that the blade runs true as any vibration can cause the blade not to cut properly and severely shortens the life of the blade or if extremely bad, the segments can vibrate off. This will be covered in the use of the blade section. The segments are then braised onto the blank using a specifically designed machine that ensures the segment is perfectly true on the blank. The blank is then again tested for its tension before it is finished to make it cosmetically attractive.

There is obviously a lot more involved in the engineering design of the blades and this is just a simplified version to give you a basic understanding of the process

5. the core cutting blade

The core cutting blade is made to strict engineering design and is of very high quality. It is specifically designed for the purpose of cutting rock and will not tolerate any misuse or improper operation. It is perfectly balanced which is paramount in its performance but because of the need to be perfect in this regard it is very fragile. These following rules must be strictly adhered to.

(a) Never under any circumstances cut anything without a continuous flow of water onto the blade and into the cut. Failure to observe this will cause the blade to overheat (blue) lose tension (become wobbly) and possibly fail risking severe personal injury.

(b) Never under any circumstances cut anything that the blade has not been designed to cut.

(c) Never slam core into the blade, always have a smooth entry.

(d) Never stall the blade into the rock.

(e) Never hit the blade sideways.

Observing these simple rules regarding the use of the blade will help keep the job safe and greatly extend the life of the blade.

The life of the blade can be greatly increased by ensuring the proper conditions exist for the blade. These conditions include, proper operator training, correct water flows, correct blade speed, and the correct selection of the blade to suit the ground being cut. Sandvik manufacture blades to strict formulas and are designed to perform at within specific parameters. These include water flows, 8 - 11 litres/minute and peripheral blade speed. Sandvik's blades are designed to have optimum performance at a peripheral blade speed of 3,000 metres (9,900 feet) per minute.

6. safety

Safety is paramount in any operation and is unfortunately often overlooked in core cutting operations. At this point I will stress that flesh and bone are no match for a high powered core cutting machine spinning at high speed a blade containing the hardest known cutting material

There are general safety rules that should be observed whilst using any power tool:

(1) No person shall operate a diamond cutting saw without proper instruction and authorisation on the use of and the procedures involved with the operation of the saw.

(2) Under no circumstances should a diamond core cutting machine be operated whilst under the influence of alcohol or drugs, including prescription drugs.

(3) Personal Protective Equipment - personal protective safety equipment must be worn whilst using a diamond core cutting machine. This includes safety goggles, ear muffs/plugs, tight fitting waterproof apron, steel toe rubber boots, plus any other relative site safety equipment. Gloves can be worn but must be the tight fitting pink house hold type. All other types of gloves can easily be caught in the blade.

(4) Pre-start Checks - as in the safe operation of any machine it is imperative that the responsible operator performs a pre-start check. Failure to observe this simple safety procedure represents a serious breach of mine regulations and will lead to disciplinary action. Never assume that a pre-start check has been performed, it is a simple task that takes only a few minutes. If you are not sure then re-do the pre-start check. Remember that it designed to protect you.

7. potential hazards

Electrical

Cease operation immediately, tag machine and report fault. Repairs are too carried out by qualified personal.

High speed rotating saw blade

Do not lift the primary/secondary blade cover whilst the machine is in operation.

Crushing and cutting

Do not place hands or fingers between the cutting block and blade housing

Hearing Loss

Always wear hearing protection

Airborne fragments

Always wear eye protection

Falling Core

Appropriate feet protection to be worn.

Back injury

Ensure safe lifting practises are adhered to at all times

8. safety features

Blade guard

Designed to contain fragments or broken blade at no risk to the operator

Spray/splash guard

Ensures no airborne vapour

Emergency stop

As well as stopping the machine the emergency stop has a braking effect rather than freewheeling to a stop

Cut out switch on blade cover

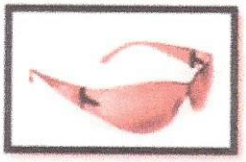
Stops the machine if the primary cover is raised whilst the machine is in operation. *This switch must be checked in the daily pre-start check*

Noise reduction

While the machine has been designed with minimal noise emissions, ensure hearing protection is worn.

9. personal protective equipment

Personal protective equipment must be worn whilst using or in the vicinity of a diamond core cutting machine. Special attention should be made to hearing and eye protection.



Diamond core cutting machines are extremely loud and failure to use approved hearing protection will result in hearing loss. Eye protection must also be worn in the vicinity of a diamond core cutting machine. The blade of the machine is spinning at nearly 3000 rpm and any small chip of rock flying at this speed can cause serious damage to unprotected eyes.

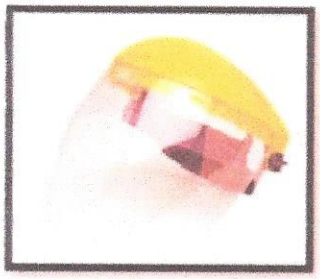
It is also important that the operator is protected from the spray of the water. The light mist that is present can easily cause an operator to become chilled; extra attention should be paid to this during the winter months.

Mine regulations state that on any mine or exploration site, that steel toe safety boots, must be worn. During core cutting operations it is recommended that rubber steel toe boots be worn to prevent the operators feet becoming wet. The type of boots worn should also have good tread to prevent the operator slipping in the wet conditions. Gloves can also be worn, but it must be stressed that only the tight fitting house hold type glove should be worn. Loose fitting gloves can easily be caught in the blade.

10. minimum personal protective equipment

Hearing protection	Earmuffs
Eye protection	Safety glasses
Hand protection	Vinyl gloves
Foot protection	Steel caps
Clothing	No loose sleeves

additional recommendations



Rubber boots	Ensures dry feet
Rubber apron	Prevents wet clothing
Face Shield	Extra protection

11.detailed procedure prestart

Ensure work area is clean

Lubricate pusher chain belt if fitted

Inspect blade for wear

Turn water on

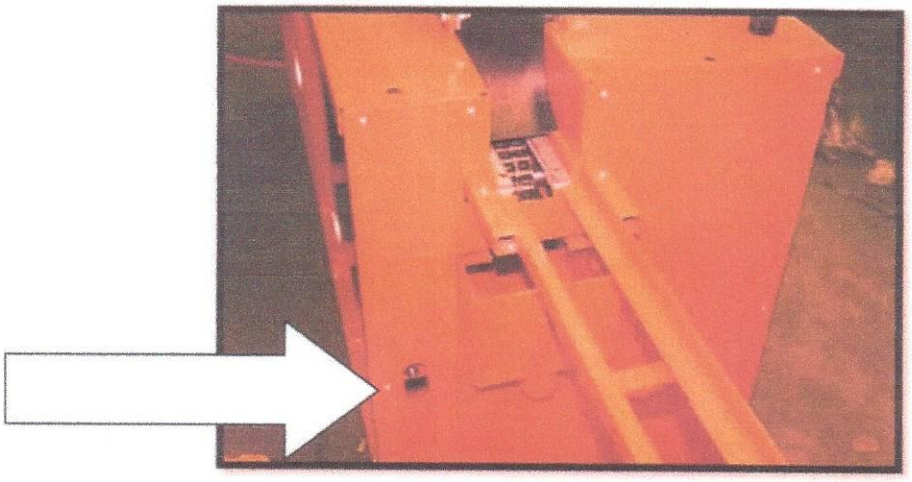
Drain pipe securely fitted and waste is directed away from work area

Turn power on at mains

Blade guards to be down and locked

PPE to be worn

With a grease Gun, apply grease to the nipples located on the left and right sides of the machine



start up

1. Pull emergency stop button on control panel out
2. Press start button on control panel
3. Press emergency stop button to ensure machine stops

4. With a foreign object trip the proximity switch
5. **If machine fails to stop cease operation immediately, tag machine and report fault. Repairs are to be carried out by qualified personal.**

cutting core

1. Load core into V core holder, the machine will hold all 3 V core holders.
2. Place V core holder into automatic feed slot, ensure the lugs are furtherest away from the blade
3. Remove V core holder from right side of machine, and repeat steps 1 and 2

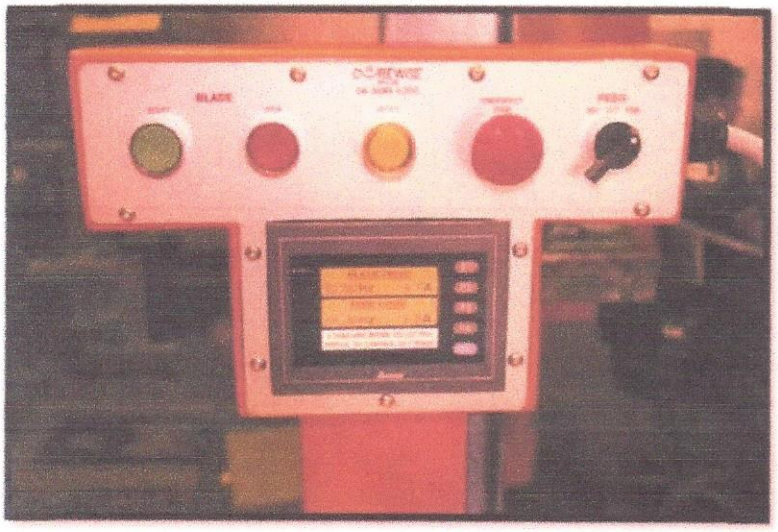
shutting down

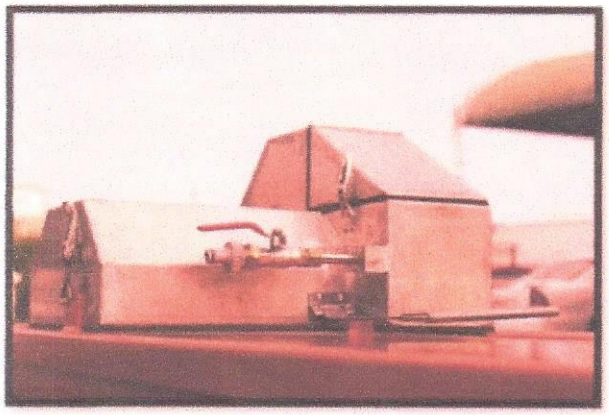
1. Check all core and V core holders are removed from the machine.
2. Turn the feed switch to the off position
3. Push the stop button in
4. Turn off mains
5. Turn water off

end of shift

1. Wash down machine with a broom or brush
2. Wash out V core holders
3. Clean all debris from floor area
4. *If your machine is fitted with a chain belt*, start saw, turn feed switch to forward, allow feed chain one complete revolution, spraying the chain with a suitable lubricant.

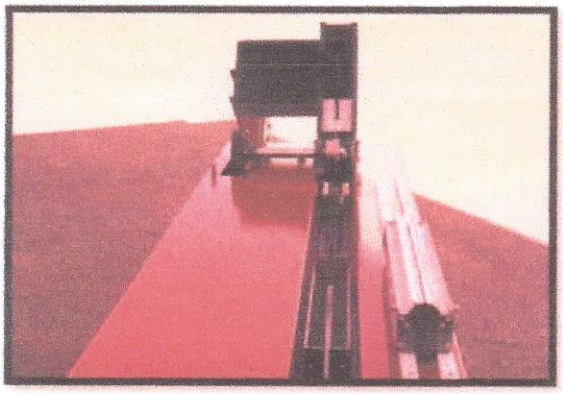
5. Turn feed switch to off and shut the saw down





Blade cover housing with lock down latches and water tap

V core holder



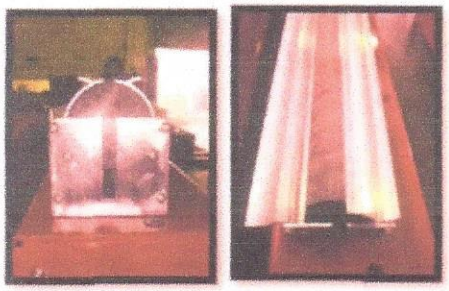
V core holder in automatic feed slot

12.options and spare parts

Water recycling tank

water recycling tank

part no	description
GSBA26	water recycling tank



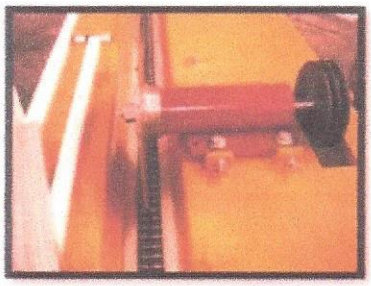
broken core guide

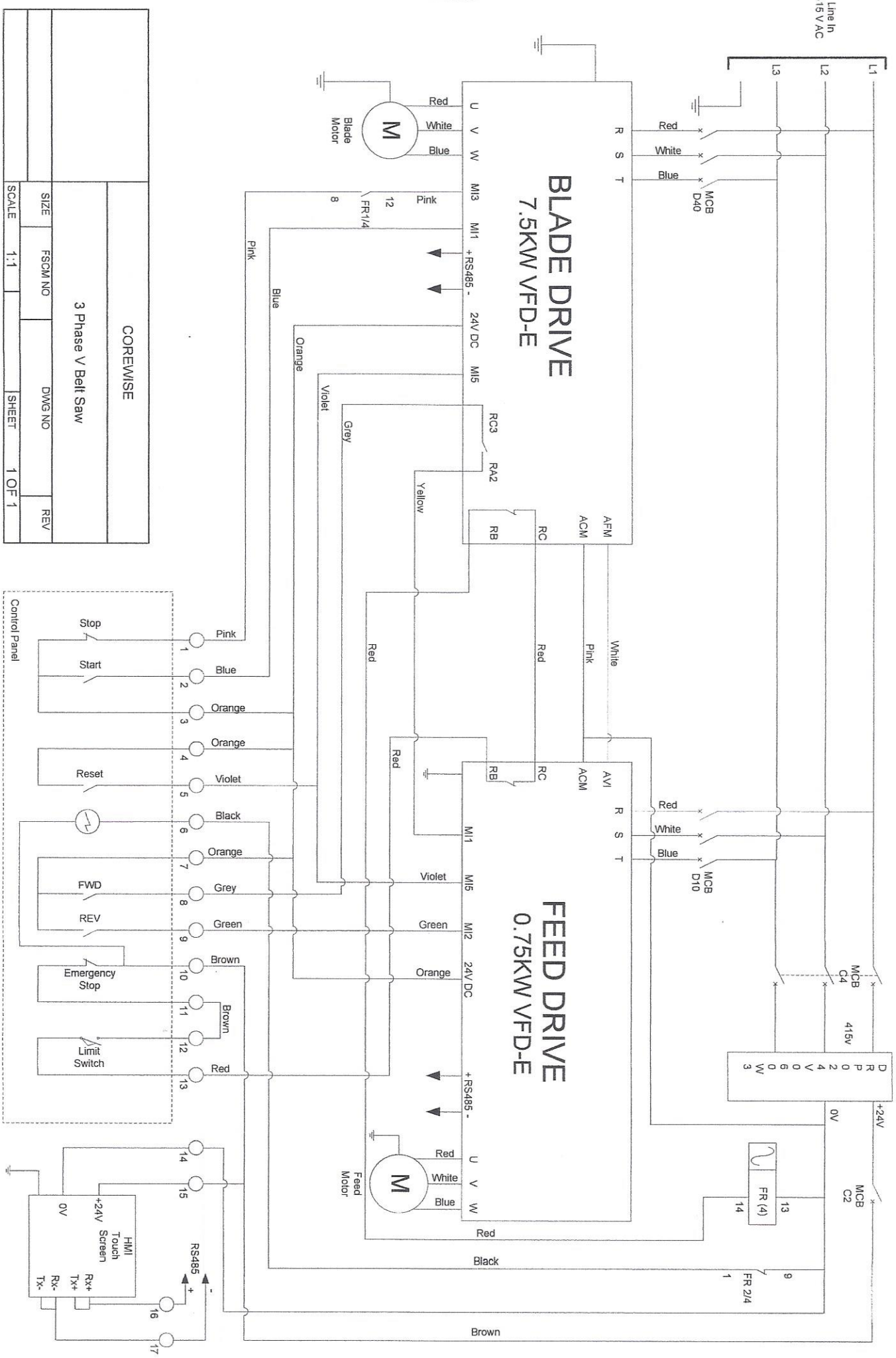
core holders

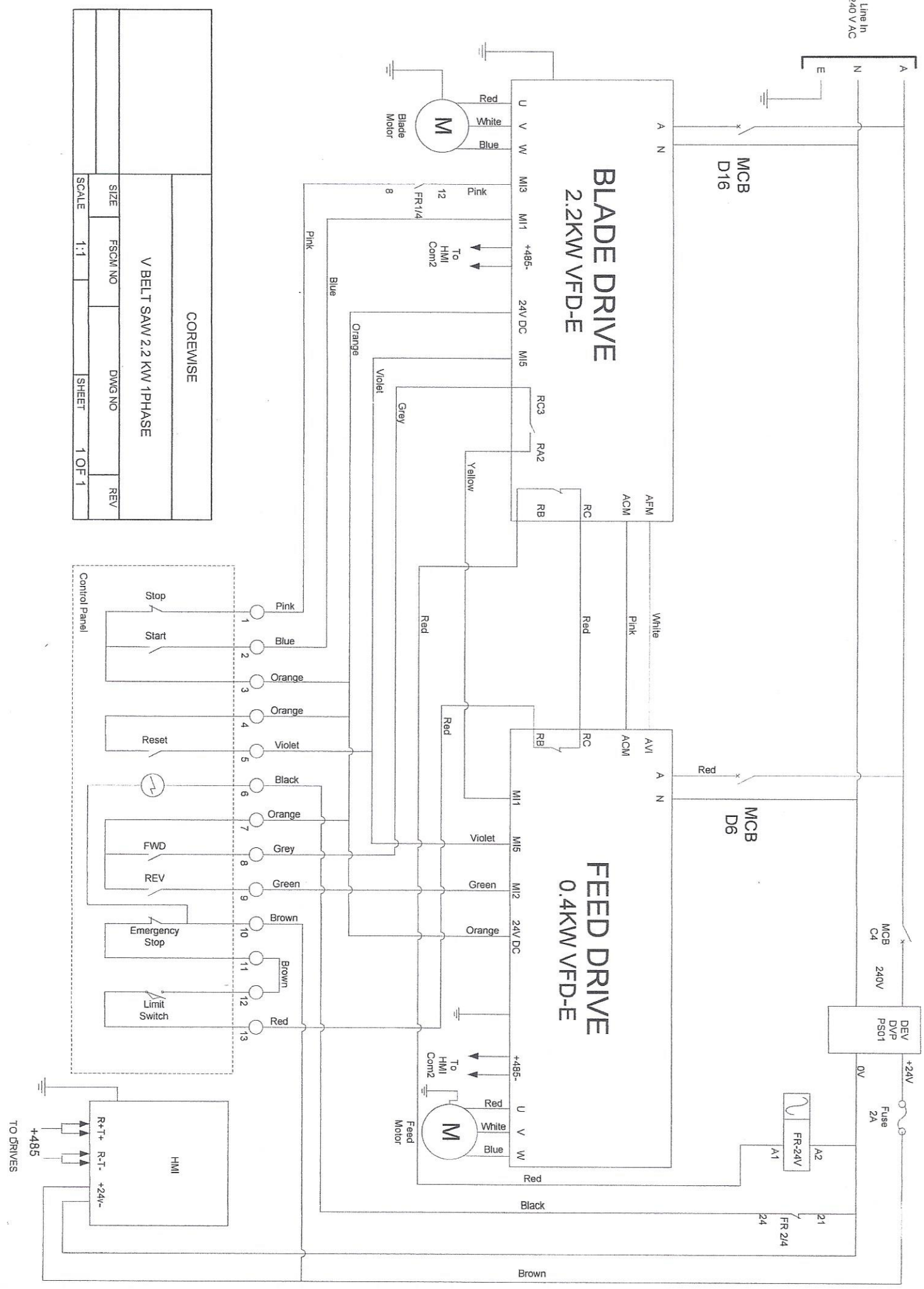
part no	description
GSBA5	Automatic Core Saw, "V" Core Holder
GSBA5B	B Size Broken Core Guide
GSBA5H	H Size Broken Core Guide
GSBA5N	N Size Broken Core Guide
GSBA5N2	N2 Size Broken Core Guide
GSBA5P	P Size Broken Core Guide

spare parts

part no	description
GSBA27	Spare Belt for the 3 Phase Automatic Coresaw Unit
GSBA28	Spare Belt for the Single Phase Automatic Coresaw Unit
GSBA20	Blade Shaft Assembly for all Automatic Coresaw Units
GSBA210	Spare Chain for the Single Phase Automatic Coresaw Unit
GSBA29	Spare Chain for the 3 Phase Automatic Coresaw Unit




COREWISE
3 Phase V Belt Saw
SIZE
FSCM NO
DWG NO
REV
SCALE 1:1
SHEET 1 OF 1
Line In 415 V AC
L1
L2
L3
MCB D40
MCB D10
MCB C4
MCB C2
415v
BLADE DRIVE 7.5KW VFD-E
FEED DRIVE 0.75KW VFD-E
Blade Motor
Feed Motor
FR1/4
FR (4)
FR 2/4
RC3
RA2
RB
RC
AFM
ACM
AVI
+RS485 -
24V DC
MI1
MI2
MI3
MI5
Control Panel
Stop
Start
Reset
FWD
REV
Emergency Stop
Limit Switch
HMI Touch Screen
RS485
0V
+24V
Rx-
Tx-
Rx+
Tx+
Red
White
Blue
Pink
Orange
Violet
Grey
Yellow
Green
Brown
Black


COREWISE
V BELT SAW 2.2 KW 1PHASE
SIZE
FSCM NO
DWG NO
REV
SCALE 1:1
SHEET 1 OF 1
Line In 240 V AC
E
N
A
MCB D16
MCB C4 240V
MCB D6
BLADE DRIVE 2.2KW VFD-E
FEED DRIVE 0.4KW VFD-E
Blade Motor
Feed Motor
U V W
MI3 MI1 +485- 24V DC MI5
A N
AFM ACM
RC RB RA2 RC3
AVI ACM
MI1 MI5 MI2 24V DC
To HMI Com2
FR1/4
Red White Blue Pink
Blue Orange Violet Grey Yellow
Red Pink White
Control Panel
Stop Start Reset FWD REV Emergency Stop Limit Switch
Pink Blue Orange Orange Violet Black Orange Grey Green Brown Brown Red
1 2 3 4 5 6 7 8 9 10 11 12 13
DEV DVP PS01
+24V 0V
Fuse 2A
FR-24V
A1 A2
FR 2/4
21 24
HMI
R+ T+ R- T- +24v-
+485
TO DRIVES
Black
Brown

saw application chart

MATRIX — HARDER / SEGMENT / SOFTER

SOFTER / FORMATION / HARDER — MORE ABRASIVE / LESS ABRASIVE

SERIES	CONDITION
CORECUT 3	SOFT CORE
	ABRASIVE, COARSE
	GRAINED SEDIMENTARY
	FORMATION
CORECUT 2	MEDIUM CORE
	MEDIUM TO FINE
	GRAIN GRANITE, BASALT
	GABRO & PORPHYRY
CORECUT 1	2 - 3 H.P. MACHINE
	EXTREMELY HARD CORE
	EXTREMELY FINE GRAIN
	CHERT & IRON STONE

RECOMMENDED PERIPHERAL SPEED

3,000 metres / 9,900 feet per minute

AUTOMATIC CORE SAW PRE-START CHECK

PERSONAL PROTECTIVE EQUIPMENT		CHECK		CHECK
EYE PROTECTION	CLEAN		SECURE	
EAR PROTECTION	CLEAN		SECURE	
RUBBER APRON	NOT TORN		SECURE	
RUBBER SAFETY BOOTS	NOT LEAKING		GOOD TREAD	
GLOVES	CORRECT TYPE		GOOD FIT	

HOUSEKEEPING		CHECK		CHECK
AREA CLEAR OF TRIPPING HAZARDS	NO DEBRIS		NO HOSES ETC	
MACHINE CLEAN	NO DEBRIS		CLEAN	
TRAYS POSITIONED CORRECTLY	CLEARLY MARKED		ORIANTATION	
LOG SHEET READY	CLEARLY MARKED		CORRECTLY MARKED	

MACHINE CHECKS		CHECK		CHECK
BLADE GUARD	DOWN		LOCKED	
PROXIMITY SWITCH	TRIP LEVER		STOPS MACHINE	
ELECTRICAL CABLE	NOT EXPOSED		NOT FRAYED	
GREASE NIPPLES	APLLY GREASE		SPLASH SHIELD	
WATER HOSES	SECURE		WORKING	
CHAIN LUBRICATED	CHAIN		SHAFT	
EMERGENCY STOP BUTON	PULLED OUT		WORKS	
DRAIN PIPE SECURELY FITTED AND WASTE IS DIRECTED AWAY FROM WORK AREA	SECURE		DIRECTION	

BLADE		CHECK		CHECK
BLADE	RUNS TRUE		NOT DISCOLOURED	
BLADE	NO CRACKS		VISUAL CHECK	
FLANGE	CORRECT SIZE		TIGHT	
SEGMENTS	NONE MISSING		SHARP	
WATER FLOW	ONTO BLADE		CORRECT VOLUME	

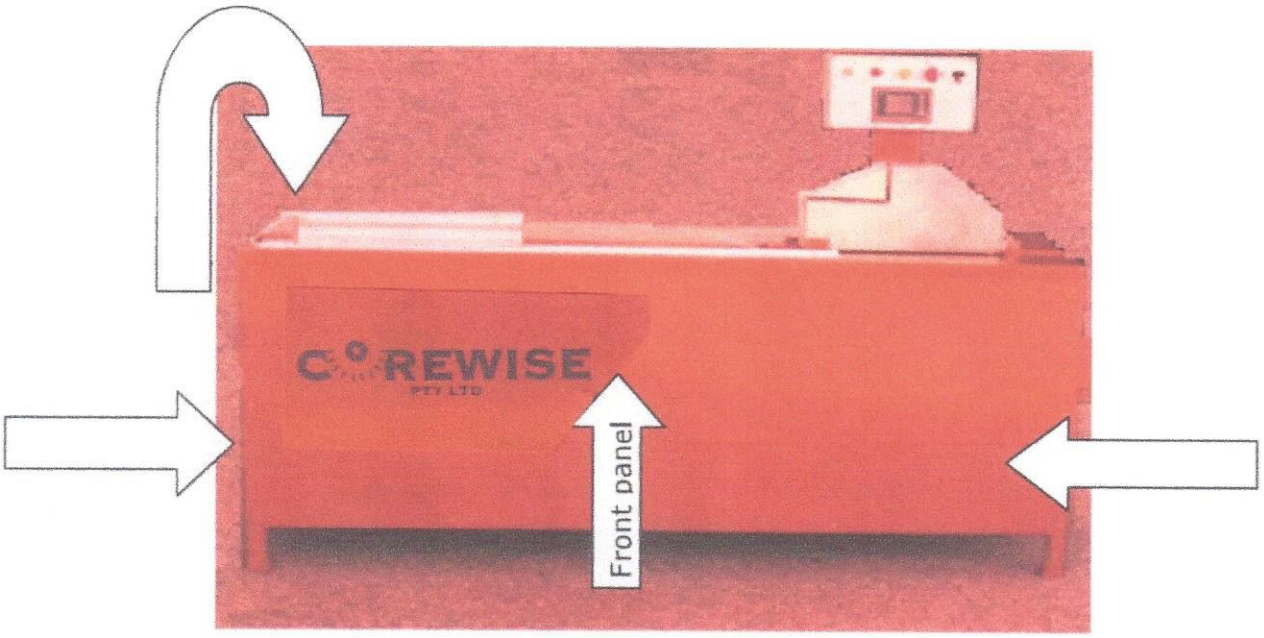
COMMENTS

OPERATOR'S SIGNATURE: _____ DATE: _____

SUPERVISOR'S SIGNATURE: _____ DATE: _____

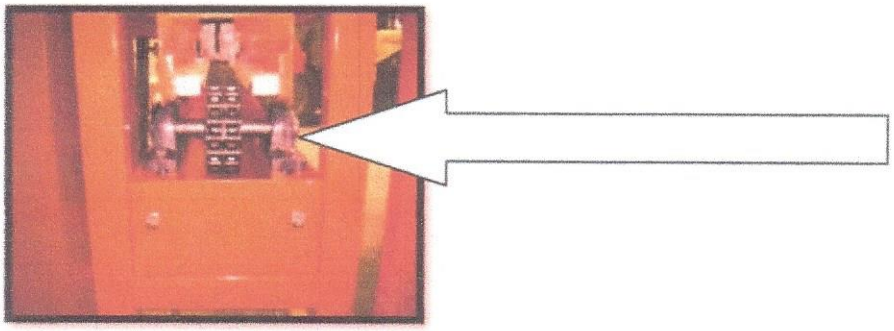
How to

All panels shown as described in the following procedures



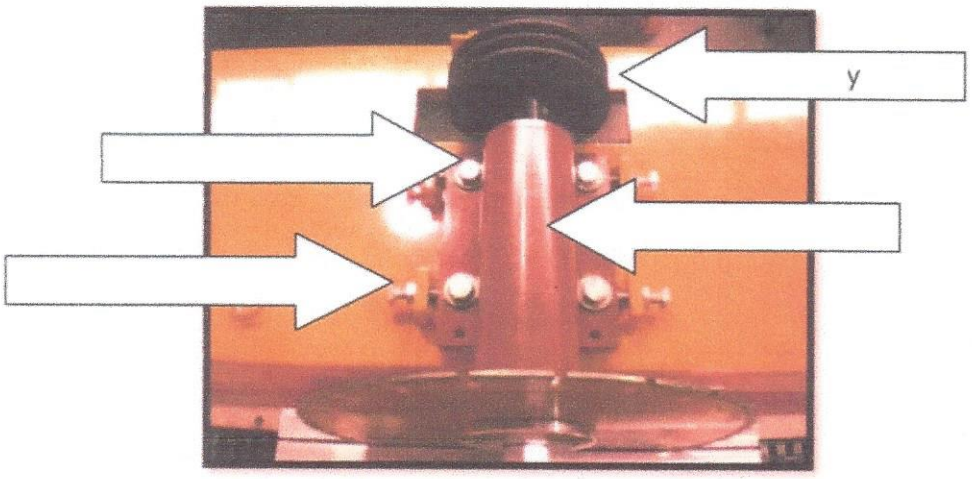
change chain belt

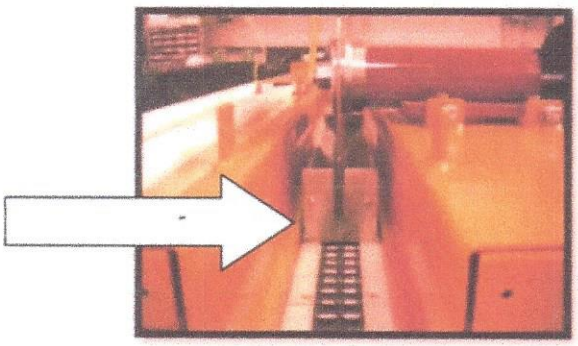
1. remove left and front panels
2. loosen left pillar blocks and tensioners
3. find chain link (always facing front panel) and remove.
4. Remove chain
5. Refit new chain
6. Tension chain until it supports its own weight
7. Tighten the 4 pillar bolts
8. Refit panels

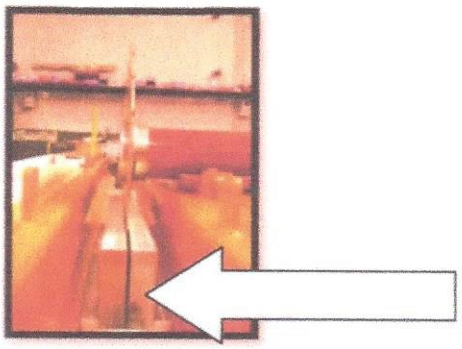


change the blade shaft

1. Remove blade (see blade replacement)
2. Remove rear panel
3. Remove 2 drive belts
4. Remove duplex pulley
5. Undo 4 bolts holding shaft housing
6. Loosen 4 adjusting bolts
7. Remove shaft
8. Fit new shaft
9. Re fit and Lightly tighten the 4 bolts in the shaft housing
10. Fit new blade
11. Slide in Jig or core holder
12. Tighten 4 adjusting bolts until the blade is square and runs true
13. Tighten 4 shaft housing bolts completely
14. Remove jig or core holder
15. Refit pulleys to shaft –Note must be aligned with pulley on motor
16. Fit belts and retension
17. Refit panel

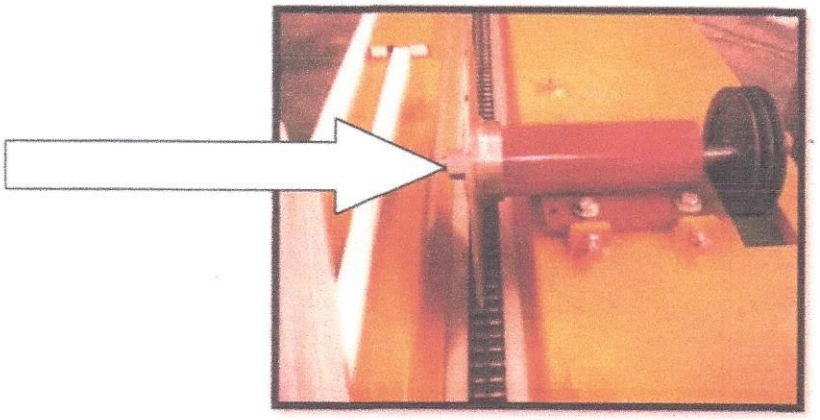




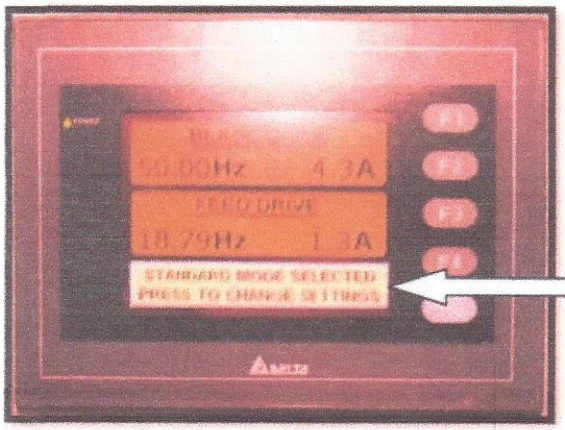


blade replacement

1. Unlock blade housing and swing open
2. Loosen and remove blade locking nut
3. Remove washer
4. Remove blade
5. Fit new blade onto the shaft, and ensure that the locating pin is secure to the blade. **Note the directional arrows on the blade <u>MUST NOT</u> face the operators console front panel**
6. Fit shaft washer
7. Fit blade locking nut and tighten securely
8. Close blade housing cover and lock down



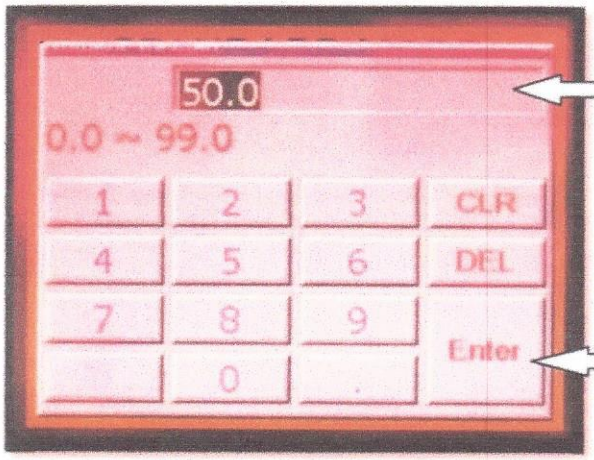
adjust the chain feed speed



Place finger on white section of control panel

This screen will be displayed

Place finger on Numeric percentage



Type in desired speed

(Higher the number = faster speed)

Press enter once finished

AUTOMATIC CORE SAW SPECIFICATIONS

PRODUCT CODE	GSBA013P	GSBA00SP
BLADE GAURD CAPACITY	300 mm	300 mm
MAX DEPTH OF CUT	Cuts from B to P size core	
BLADE ARBOUR SIZE	25.4mm	25.4mm
BLADE SHAFT DRIVE	TWO V BELTS	TWO V BELTS
BLADE GAURD	STAINLESS STEEL	
BLADE COOLANT	WATER	WATER
FRAME	POWDER COATED GALVANISED STEEL	
WEIGHT IN KG	440	170
CRATED	543	259
DIMENSIONS mm		
WIDTH	868	868
HEIGHT	1406	1406
LENGTH	2048	1638

POWER SOURCE

PRODUCT CODE		GSBA013P	GSBA00SP
MOTOR		ELECTRIC	ELECTRIC
KW		7.5KW	2.2KW
HP		10HP	3HP
VOLTAGE		380 - 460	220 - 240
BLADE SHAFT RPM			
CYCLE HZ	50	2400	2400
	60	2509	2509
PHASE		3	1
MAX LOAD CURRENT		12 AMP	10 AMP
STARTER		VARIABLE SPEED DRIVE	
COOLANT		AIR	

*** Specifications are subject to change without notice**

Notes