



## SERVICE MANUAL



**Puma 165 CVX**  
**Puma 180 CVX**  
**Puma 195 CVX**  
**Puma 210 CVX**  
**Puma 225 CVX**

# Contents

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## INTRODUCTION

## DISTRIBUTION SYSTEMS..... A

PRIMARY HYDRAULIC POWER SYSTEM.....	A.10.A
PRIMARY HYDRAULIC POWER SYSTEM Electro-hydraulic remote valve.....	A.10.C
SECONDARY HYDRAULIC POWER SYSTEM.....	A.12.A
HYDRAULIC COMMAND SYSTEM.....	A.14.A
ELECTRICAL POWER SYSTEM .....	A.30.A
ELECTRONIC SYSTEM .....	A.50.A
FAULT CODES.....	A.50.A
PNEUMATIC SYSTEM.....	A.20.A

## POWER PRODUCTION ..... B

ENGINE .....	B.10.A
FUEL AND INJECTION SYSTEM.....	B.20.A
AIR INTAKE SYSTEM.....	B.30.A
EXHAUST SYSTEM.....	B.40.A
ENGINE COOLANT SYSTEM .....	B.50.A
ENGINE COOLANT SYSTEM Fan reversing system.....	B.50.B
LUBRICATION SYSTEM .....	B.60.A
STARTING SYSTEM.....	B.80.A

## POWER TRAIN ..... C

TRANSMISSION Continuously Variable Transmission (CVT).....	C.20.G
REAR PTO Hydraulic.....	C.40.C
FRONT PTO Hydraulic.....	C.42.C

## TRAVELLING..... D

FRONT AXLE .....	D.10.A
REAR AXLE .....	D.12.A
2WD-4WD SYSTEM Hydraulic.....	D.14.C
STEERING Hydraulic.....	D.20.C
STEERING AutoPilot.....	D.20.E

SERVICE BRAKE Mechanical .....	D.30.B
SERVICE BRAKE Hydraulic.....	D.30.C
SERVICE BRAKE Pneumatic .....	D.30.E
PARKING BRAKE Mechanical .....	D.32.B
BRAKE CONNECTION Hydraulic.....	D.34.C
SUSPENSION Hydraulic .....	D.40.C
WHEELS AND TRACKS Wheels.....	D.50.C
PARKING BRAKE Electronic.....	D.32.D
<b>BODY AND STRUCTURE .....</b>	<b>E</b>
FRAME Primary frame .....	E.10.B
USER PLATFORM .....	E.34.A
ENVIRONMENT CONTROL Heating, ventilation and air-conditioning.....	E.40.D
SHIELD .....	E.20.A
<b>WORKING ARM .....</b>	<b>H</b>
HITCH Front hitch .....	H.10.B
HITCH Rear hitch.....	H.10.C
HITCH Electronic draft control.....	H.10.D





## INTRODUCTION

# Contents

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## INTRODUCTION

Foreword .....	3
Safety rules .....	9
Torque .....	21
Torque Hydraulic connectors .....	25

## Foreword

### Technical Information

This manual has been produced by a new technical information system. This new system is designed to deliver technical information electronically through CD-ROM and in paper manuals. A coding system called ICE has been developed to link the technical information to other Product Support functions e.g. Warranty.

Technical information is written to support the maintenance and service of the functions or systems on a customer's machine. When a customer has a concern on his machine it is usually because a function or system on his machine is not working at all, is not working efficiently, or is not responding correctly to his commands. When you refer to the technical information in this manual to resolve that customer's concern, you will find all the information classified using the new ICE coding, according to the functions or systems on that machine. Once you have located the technical information for that function or system then you will find all the mechanical, electrical or hydraulic devices, components, assemblies and sub assemblies for that function or system. You will also find all the types of information that have been written for that function or system, the technical data (specifications), the functional data (how it works), the diagnostic data (fault codes and troubleshooting) and the service data (remove, install adjust, etc.).

By integrating this new ICE coding into technical information, you will be able to search and retrieve just the right piece of technical information you need to resolve that customer's concern on his machine. This is made possible by attaching 3 categories to each piece of technical information during the authoring process.

The first category is the Location, the second category is the Information Type and the third category is the Product:

- LOCATION - is the component or function on the machine, that the piece of technical information is going to describe e.g. Fuel tank.
- INFORMATION TYPE - is the piece of technical information that has been written for a particular component or function on the machine e.g. Capacity would be a type of Technical Data that would describe the amount of fuel held by the Fuel tank.
- PRODUCT - is the model that the piece of technical information is written for.

Every piece of technical information will have those 3 categories attached to it. You will be able to use any combination of those categories to find the right piece of technical information you need to resolve that customer's concern on his machine.

That information could be:

- the description of how to remove the cylinder head
- a table of specifications for a hydraulic pump
- a fault code
- a troubleshooting table
- a special tool

## How to Use this Manual

This manual is divided into Sections. Each Section is then divided into Chapters. Contents pages are included at the beginning of the manual, then inside every Section and inside every Chapter. An alphabetical Index is included at the end of a Chapter. Page number references are included for every piece of technical information listed in the Chapter Contents or Chapter Index.

Each Chapter is divided into four Information types:

- Technical Data (specifications) for all the mechanical, electrical or hydraulic devices, components and, assemblies.
- Functional Data (how it works) for all the mechanical, electrical or hydraulic devices, components and assemblies.
- Diagnostic Data (fault codes, electrical and hydraulic troubleshooting) for all the mechanical, electrical or hydraulic devices, components and assemblies.
- Service data (remove disassembly, assemble, install) for all the mechanical, electrical or hydraulic devices, components and assemblies.

## Sections

Sections are grouped according to the main functions or a systems on the machine. Each Section is identified by a letter A, B, C etc. The amount of Sections included in the manual will depend on the type and function of the machine that the manual is written for. Each Section has a Contents page listed in alphabetic/numeric order. This table illustrates which Sections could be included in a manual for a particular product.

PRODUCT	SECTION										
	A - Distribution Systems										
	B - Power Production										
	C - Power Train										
	D - Travelling										
	E - Body and Structure										
	F - Frame Positioning										
	G - Tool Positioning										
	H - Working Arm										
	J - Tools and Couplers										
	K - Crop Processing										
L - Field Processing											
Tractors	X	X	X	X	X	X		X	X		
Vehicles with working arms: backhoes, excavators, skid steers, .....	X	X	X	X	X	X	X	X	X		
Combines, forage harvesters, balers, .....	X	X	X	X	X	X	X	X	X	X	
Seeding, planting, floating, spraying equipment, .....	X	X	X	X	X	X	X		X		X
Mounted equipment and tools, .....					X	X	X		X		



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This manual contains these Sections. The contents of each Section are explained over the following pages.

**Contents**

INTRODUCTION	
DISTRIBUTION SYSTEMS	A
POWER PRODUCTION	B
POWER TRAIN	C
TRAVELLING	D
BODY AND STRUCTURE	E
TOOL POSITIONING	G
CROP PROCESSING	K

**Section Contents**

**SECTION A, DISTRIBUTION SYSTEMS**

This Section covers the main systems that interact with most of the functions of the product. It includes the central parts of the hydraulic, electrical, electronic, pneumatic, lighting and grease lubrication systems. The components that are dedicated to a specific function are listed in the Chapter where all the technical information for that function is included.

**SECTION B, POWER PRODUCTION**

This Section covers all the functions related to the production of power to move the machine and to drive various devices.

**SECTION C, POWER TRAIN**

This Section covers all the functions related to the transmission of power from the engine to the axles and to internal or external devices and additional Process Drive functions.

**SECTION D, TRAVELLING**

This Section covers all the functions related to moving the machine, including tracks, wheels, steering and braking. It covers all the axles both driven axles and non-driven axles, including any axle suspension.

**SECTION E, BODY AND STRUCTURE**

This Section covers all the main functions and systems related to the structure and body of the machine. Including the frame, the shields, the operator's cab and the platform.

**SECTION G, TOOL POSITIONING**

This Section covers all the functions related to the final and/or automatic positioning of the tool once the tool is positioned using the Working Arm or the machine frame.

**SECTION K, CROP PROCESSING**

This Section covers all the functions related to crop processing.

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## Chapters

Each Chapter is identified by a letter and number combination e.g. Engine B.10.A The first letter is identical to the Section letter i.e. Chapter B.10 is inside Section B, Power Production.

### CONTENTS

The Chapter Contents lists all the technical data (specifications), functional data (how it works), service data (remove, install adjust, etc..) and diagnostic data (fault codes and troubleshooting) that have been written in that Chapter for that function or system on the machine.

### Contents

POWER PRODUCTION  
ENGINE \_ 10.A

#### TECHNICAL DATA

ENGINE - General specification (B.10.A - D.40.A.10)  
CS6050

#### FUNCTIONAL DATA

ENGINE - Dynamic description (B.10.A - C.30.A.10)  
CS6050

#### SERVICE

ENGINE - Remove (B.10.A - F.10.A.10)  
CS6050

#### DIAGNOSTIC

ENGINE - Troubleshooting (B.10.A - G.40.A.10)  
CS6050

### INDEX

The Chapter Index lists in alphabetical order all the types of information (called Information Units) that have been written in that Chapter for that function or system on the machine.

### Index

POWER PRODUCTION - B  
ENGINE

ENGINE - Dynamic description (B.10.A - C.30.A.10)  
CS6050

ENGINE - General specification (B.10.A - D.40.A.10)  
CS6050

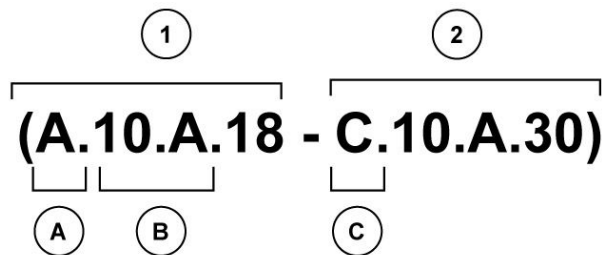
ENGINE - Remove (B.10.A - F.10.A.10)  
CS6050

ENGINE - Troubleshooting (B.10.A - G.40.A.10)  
CS6050

## Information Units and Information Search

Each chapter is composed of information units. Each information unit has the ICE code shown in parentheses which indicates the function and the type of information written in that information unit. Each information unit has a page reference within that Chapter. The information units provide a quick and easy way to find just the right piece of technical information you are looking for.

example information unit	Stack valve - Sectional View (A.10.A.18 - C.10.A.30)				
Information Unit ICE code	A	10.A	18	C	10.A.30
ICE code classification	Distribution systems	Primary hydraulic power	Stack valve	Functional data	Sectional view



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Navigate to the correct information unit you are searching for by identifying the function and information type from the ICE code.

- (1) Function and (2) Information type.
- (A) corresponds to the sections of the repair manual.  
(B) corresponds to the chapters of the repair manual.  
(C) corresponds to the type of information listed in the chapter contents, Technical data, Functional Data, Diagnostic or Service.  
(A) and (B) are also shown in the page numbering on the page footer.  
THE REST OF THE CODING IS NOT LISTED IN ALPHANUMERIC ORDER IN THIS MANUAL.
- You will find a table of contents at the beginning and end of each section and chapter.  
You will find an alphabetical index at the end of each chapter.
- By referring to (A), (B) and (C) of the coding, you can follow the contents or index (page numbers) and quickly find the information you are looking for.

## Page Header and Footer

The page header will contain the following references:

- Section and Chapter description

The page footer will contain the following references:

- Publication number for that Manual, Section or Chapter.
- Version reference for that publication.
- Publication date
- Section, chapter and page reference e.g. A.10.A / 9

### **Important information**

All repair and maintenance works listed in this manual must be carried out only by staff belonging to the Case I H Service network, strictly complying with the instructions given and using, whenever required, the special tools.

Anyone who carries out the above operations without complying with the prescriptions shall be responsible for the subsequent damages.

The manufacturer and all the organizations of its distribution chain, including - without limitation - national, regional or local dealers, reject any responsibility for damages due to the anomalous behaviour of parts and/or components not approved by the manufacturer himself, including those used for the servicing or repair of the product manufactured or marketed by the Manufacturer. In any case, no warranty is given or attributed on the product manufactured or marketed by the Manufacturer in case of damages due to an anomalous behaviour of parts and/or components not approved by the Manufacturer.

## Safety rules

### IMPORTANT NOTICE

All maintenance and repair operations described in this manual should be carried out exclusively by authorised workshops. All instructions should be carefully observed and special equipment where indicated should be used. Anyone who carries out service operations described without carefully observing these instructions will be directly responsible for any damage caused.

### NOTES FOR EQUIPMENT

Equipment shown in this manual is:

- designed expressly for use on these tractors;
- necessary to make a reliable repair;
- accurately built and strictly tested to offer efficient and long-lasting working life.

### NOTICES

The words "front", "rear", "right hand", and "left hand" refer to the different parts as seen from the operator's seat oriented to the normal direction of movement of the tractor.

### SAFETY RULES

#### PAY ATTENTION TO THIS SYMBOL



This warning symbol points out important messages involving personal safety. Carefully read the safety rules contained herein and follow advised precautions to avoid potential hazards and safeguard your safety. In this manual you will find this symbol together with the following key-words:  
**WARNING** -it gives warning about improper repair operations and potential consequences affecting the service technician's personal safety.  
**DANGER** - it gives specific warning about potential dangers for personal safety of the operator or other persons directly or indirectly involved in the operation.



### TO PREVENT ACCIDENTS

Most accidents and personal injuries taking place in workshops are due from non-observance of some essential rules and safety precautions.

The possibility that an accident might occur with any type of machines should not be disregarded, no matter how well the machine in question was designed and built.

A wise and careful service technician is the best precautions against accidents.

Careful observance of this basic precaution would be enough to avoid many severe accidents.



**DANGER**



**Never carry out any cleaning, lubrication or maintenance operations when the engine is running.**

B013

### SAFETY RULES

Generalities

- Carefully follow specified repair and maintenance procedures.

## INTRODUCTION

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- Do not wear rings, wristwatches, jewels, unbuttoned or flapping clothing such as ties, torn clothes, scarves, open jackets or shirts with open zips which could get caught on moving parts. Use approved safety clothing such as anti-slipping footwear, gloves, safety goggles, helmets, etc.
- Wear safety glasses with side guards when cleaning parts using compressed air.
- Damaged or frayed wires and chains are unreliable. Do not use them for lifting or towing.
- Wear suitable protection such as approved eye protection, helmets, special clothing, gloves and footwear whenever welding. All persons standing in the vicinity of the welding process should wear approved eye protection. NEVER LOOK AT THE WELDING ARC IF YOUR EYES ARE NOT SUITABLY PROTECTED.
- Never carry out any repair on the machine if someone is sitting on the operator's seat, except if they are qualified operators assisting in the operation to be carried out.
- Never operate the machine or use attachments from a place other than sitting at the operator's seat or at the side of the machine when operating the fender switches.
- Never carry out any operation on the machine when the engine is running, except when specifically indicated. Stop the engine and ensure that all pressure is relieved from hydraulic circuits before removing caps, covers, valves, etc.
- All repair and maintenance operations should be carried out with the greatest care and attention.
- Disconnect the batteries and label all controls to warn that the tractor is being serviced. Block the machine and all equipment which should be raised.
- Never check or fill fuel tanks or batteries, nor use starting liquid if you are smoking or near open flames as such fluids are flammable.
- The fuel filling gun should always remain in contact with the filler neck. Maintain this contact until the fuel stops flowing into the tank to avoid possible sparks due to static electricity build-up.
- To transfer a failed tractor, use a trailer or a low loading platform trolley if available.
- To load and unload the machine from the transportation means, select a flat area providing a firm support to the trailer or truck wheels. Firmly tie the machine to the truck or trailer platform and block wheels as required by the transporter.
- Always use lifting equipment of appropriate capacity to lift or move heavy components.
- Chains should always be safely fastened. Ensure that fastening device is strong enough to hold the load foreseen. No persons should stand near the fastening point.
- The working area should be always kept CLEAN and DRY. Immediately clean any spillage of water or oil.
- Never use gasoline, diesel oil or other flammable liquids as cleaning agents. Use non-flammable non-toxic proprietary solvents.
- Do not pile up grease or oil soaked rags, as they constitute a great fire hazard. Always place them into a metal container.

## START UP

- Never run the engine in confined spaces which are not equipped with adequate ventilation for exhaust gas extraction.
- Never bring your head, body, arms, legs, feet, hands, fingers near fans or rotating belts.

## ENGINE

- Always loosen the radiator cap very slowly before removing it to allow pressure in the system to dissipate. Coolant should be topped up only when the engine is stopped.
- Do not fill up fuel tank when the engine is running.
- Never adjust the fuel injection pump when the tractor is moving.
- Never lubricate the tractor when the engine is running.

## ELECTRICAL SYSTEMS

- If it is necessary to use auxiliary batteries, cables must be connected at both sides as follows: (+) to (+) and (-) to (-). Avoid short-circuiting the terminals. GAS RELEASED FROM BATTERIES IS HIGHLY FLAMMABLE. During

charging, leave the battery compartment uncovered to improve ventilation. Avoid sparks or flames near the battery area. Do no smoke.

- Do not charge batteries in confined spaces.
- Always disconnect the batteries before performing any type of service on the electrical system.

## HYDRAULIC SYSTEMS

- Some fluid coming out from a very small port can be almost invisible and be strong enough to penetrate the skin. For this reason, NEVER USE YOUR HANDS TO CHECK FOR LEAKS, but use a piece of cardboard or a piece of wood for this purpose. If any fluid is injected into the skin, seek medical aid immediately. Lack of immediate medical attention may result in serious infections or dermatitis.
- Always take system pressure readings using the appropriate gauges.

## WHEELS AND TYRES

- Check that the tyres are correctly inflated at the pressure specified by the manufacturer. Periodically check for possible damage to the rims and tyres.
- Stay at the tyre side when inflating.
- Check the pressure only when the tractor is unloaded and tyres are cold to avoid wrong readings due to over-pressure.
- Never cut, nor weld a rim with the inflated tyre assembled.
- To remove the wheels, block both front and rear tractor wheels. Raise the tractor and install safe and stable supports under the tractor in accordance with regulations in force.
- Deflate the tyre before removing any object caught into the tyre tread.
- Never inflate tyres using flammable gases as they may generate explosions and cause injuries to bystanders.

## REMOVAL AND INSTALLATION

- Lift and handle all heavy components using lifting equipment of adequate capacity. Ensure that parts are supported by appropriate slings and hooks. Use lifting eyes provided to this purpose. Take care of the persons near the loads to be lifted.

## HEALTH AND SAFETY

### CONTENT

Section	Description	Page
	HEALTH AND SAFETY PRECAUTIONS . . . . .	4
	ACIDS AND ALKALIS . . . . .	5
	ADHESIVES AND SEALERS - see Fire . . . . .	5
	ANTIFREEZE - see Fire, Solvents e.g. Isopropanol, Ethylene Glycol, Methanol. . . . .	5
	ARC WELDING - see Welding. . . . .	5
	BATTERY ACIDS - see Acids and Alkalis. . . . .	5
	BRAKE AND CLUTCH FLUIDS (Polyalkylene Glycols) - see Fire. . . . .	6
	BRAZING - see Welding. . . . .	6
	CHEMICAL MATERIALS - GENERAL - see Legal Aspects. . . . .	6
	DO'S. . . . .	6
	DO NOTS. . . . .	6
	CORROSION PROTECTION MATERIALS - see Solvents, Fire. . . . .	6
	DUSTS . . . . .	7
	ELECTRIC SHOCK. . . . .	7
	EXHAUST FUMES. . . . .	7
	FIBRE INSULATION - see Dusts.. . . .	7
	FIRE - see Welding, Foams, Legal Aspects.. . . .	7
	FIRST AID. . . . .	7
	FOAMS - Polyurethane - see Fire.. . . .	7

---

FUELS - see Fire, Legal Aspects, Chemicals - General, Solvents.. . . . .	8
GAS CYLINDERS - see Fire.. . . . .	8
GENERAL WORKSHOP TOOLS AND EQUIPMENT.. . . . .	9
LEGAL ASPECTS.. . . . .	9
LUBRICANTS AND GREASES.. . . . .	9
PAINTS - see Solvents and Chemical Materials - General.. . . . .	10
SOLDER - see Welding.. . . . .	10
SOLVENTS - see Chemical Materials - General Fuels (Kerosene), Fire.. . . . .	10
SUSPENDED LOADS.. . . . .	11
WELDING - see Fire, Electric Shock, Gas Cylinders.. . . . .	11

## HEALTH AND SAFETY PRECAUTIONS

Many of the procedures associated with vehicle maintenance and repair involve physical hazards or other risks to health. This section lists, alphabetically, some of these hazardous operations and the materials and equipment associated with them. The precautions necessary to avoid these hazards are identified.

The list is not exhaustive and all operations and procedures and the handling of materials, should be carried out with health and safety in mind.

## ACIDS AND ALKALIS

see Battery acids, e.g. caustic soda, sulphuric acid.  
Used in batteries and cleaning materials.

### **Irritant and corrosive to the skin, eyes, nose and throat. Causes burns.**

Avoid splashes to the skin, eyes and clothing. Wear suitable protective gloves and goggles. Can destroy ordinary protective clothing. Do not breathe mists.

Ensure access to water and soap is readily available for splashing accidents.

## ADHESIVES AND SEALERS

see Fire

Highly Flammable, Flammable, combustible.

Generally should be stored in "No Smoking" areas; cleanliness and tidiness in use should be observed, e.g. disposable paper covering benches; should be dispensed from applicators where possible; containers, including secondary containers, should be labelled.

### **Solvent based Adhesives/Sealers**

See Solvents.

Follow manufacturers instructions.

### **Water based Adhesives/Sealers**

Those based on polymer emulsions and rubber lattices may contain small amounts of volatile toxic and harmful chemicals. Skin and eye contact should be avoided and adequate ventilation provided during use.

Follow manufacturers instructions.

### **Resin based Adhesives/Sealers**

e.g. epoxide and formaldehyde resin based.

Mixing should only be carried out in well ventilated areas as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation; dermatitis and absorption of toxic or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation and avoid skin and eye contact. Follow manufacturers instructions.

### **Anaerobic, Cyanoacrylate and other Acrylic Adhesives**

Many are irritant, sensitizing or harmful to the skin. Some are eye irritants.



Skin and eye contact should be avoided and the manufacturers instructions followed.

Cyanoacrylate adhesives (super-glues) must not contact the skin or eyes. If skin or eye tissue is bonded cover with a clean moist pad and get medical attention. do not attempt to pull tissue apart. Use in well ventilated areas as vapours can cause irritation of the nose and eyes.

For two-pack systems see Resin based adhesives/sealers.

### **Isocyanate (Polyurethane) Adhesives/ Sealers**

see Resin based Adhesives.

Individuals suffering from asthma or respiratory allergies should not work with or near these materials as sensitivity reactions can occur.

Any spraying should preferably be carried out in exhaust ventilated booths removing vapours and spray droplets from the breathing zone. Individuals working with spray applications should wear supplied air respirators.

### **ANTIFREEZE**

see Fire, Solvents e.g. Isopropanol, Ethylene Glycol, Methanol.

Highly Flammable, Flammable, Combustible.

Used in vehicle coolant systems, brake air pressure systems, screenwash solutions.

Vapours given off from coolant antifreeze (glycol) arise only when heated.

Antifreeze may be absorbed through the skin in toxic or harmful quantities. Antifreeze if swallowed is fatal and medical attention must be found immediately.

### **ARC WELDING**

see Welding.

### **BATTERY ACIDS**

see Acids and Alkalis.

Gases released during charging are explosive.

Never use naked flames or allow sparks near charging or recently charged batteries.

### **BRAKE AND CLUTCH FLUIDS (Polyalkylene Glycols)**

see Fire.

Combustible.

Splashes to the skin and eyes are slightly irritating.

Avoid skin and eye contact as far as possible.

Inhalation of vapour hazards do not arise at ambient temperatures because of the very low vapour pressure.

### **BRAZING**

see Welding.

### **CHEMICAL MATERIALS - GENERAL**

see Legal Aspects.

Chemical materials such as solvents, sealers, adhesives, paints, resin foams, battery acids, antifreeze, brake fluids, oils and grease should always be used with caution and stored and handled with care. They may be toxic, harmful, corrosive, irritant or highly inflammable and give rise to hazardous fumes and dusts.

The effects of excessive exposure to chemicals may be immediate or delayed; briefly experienced or permanent; cumulative; superficial; life threatening; or may reduce life-expectancy.

### **DO'S**

Do remove chemical materials from the skin and clothing as soon as practicable after soiling. Change heavily soiled clothing and have it cleaned.

Do carefully read and observe hazard and precaution warnings given on material containers (labels) and in any accompanying leaflets, poster or other instructions. Material health and safety data sheets can be obtained from Manufacturers.

Do organise work practices and protective clothing to avoid soiling of the skin and eyes; breathing vapours/aerosols/dusts/fumes; inadequate container labelling; fire and explosion hazards.

Do wash before job breaks; before eating, smoking, drinking or using toilet facilities when handling chemical materials.

Do keep work areas clean, uncluttered and free of spills.

Do store according to national and local regulations.

Do keep chemical materials out of reach of children.

### **DO NOTS**

Do Not mix chemical materials except under the manufacturers instructions; some chemicals can form other toxic or harmful chemicals; give off toxic or harmful fumes; be explosive when mixed together.

Do Not spray chemical materials, particularly those based on solvents, in confined spaces e.g. when people are inside a vehicle.

Do Not apply heat or flame to chemical materials except under the manufacturers' instructions. Some are highly inflammable and some may release toxic or harmful fumes.

Do Not leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas, pits etc.

Do Not transfer chemical materials to unlabeled containers.

Do Not clean hands or clothing with chemical materials. Chemicals, particularly solvents and fuels will dry the skin and may cause irritation with dermatitis. Some can be absorbed through the skin in toxic or harmful quantities.

Do Not use emptied containers for other materials, except when they have been cleaned under supervised conditions.

Do Not sniff or smell chemical materials. Brief exposure to high concentrations of fumes can be toxic or harmful.

### **Clutch Fluids**

see Brake and Clutch Fluids.

### **Clutch Linings and Pads**

see Brake and Clutch Linings and Pads.

### **CORROSION PROTECTION MATERIALS**

see Solvents, Fire.

Highly flammable, flammable.

These materials are varied and the manufacturers instructions should be followed. They may contain solvents, resins, petroleum products etc. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation and not in confined spaces.

### **Cutting**

see Welding.

### **De-Waxing**

see Solvents and Fuels (Kerosene).

### **DUSTS**

Powder, dusts or clouds may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

### **ELECTRIC SHOCK**

Electric shocks can result from the use of faulty electrical equipment or from the misuse of equipment even in good condition.

Ensure that electrical equipment is maintained in good condition and frequently tested.

Ensure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged.

Ensure that electric equipment is protected by the correct rated fuse.

Never misuse electrical equipment and never use equipment which is in any way faulty. The results could be fatal.

Use reduced voltage equipment ( **110 volt**) for inspection and working lights where possible.

Ensure that the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist. Use air operated mobile equipment where possible in preference to electrical equipment.

In cases of electrocution:-

- switch off electricity before approaching victim
- if this is not possible, push or drag victim from source of electricity using dry non-conductive material
- commence resuscitation if trained to do so
- SUMMON MEDICAL ASSISTANCE

## **EXHAUST FUMES**

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should only be run under conditions of adequate extraction or general ventilation and not in confined spaces.

### **Gasolene (Petrol) Engine**

There may not be adequate warning properties of odour or irritation before immediate and delayed toxic or harmful effects arise.

### **Diesel Engine**

Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.

## **FIBRE INSULATION**

see Dusts.

Used in noise and sound insulation.

The fibrous nature of surfaces and cut edges can cause skin irritation. This is usually a physical and not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organisation of work practices and the use of gloves.

## **FIRE**

see Welding, Foams, Legal Aspects.

Many of the materials found on or associated with the repair of vehicles are highly flammable. Some give off toxic or harmful fumes if burnt.

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Ensure before using electrical or welding equipment but that there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

## **FIRST AID**

Apart from meeting any legal requirements it is desirable for someone in the workshop to be trained in first aid procedures.

Splashes in the eye should be flushed with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

Inhalation affected individuals should be removed to fresh air immediately.

If swallowed or if effects persist consult a doctor with information (label) on material used.

Do not induce vomiting (unless indicated by manufacturer).

## **FOAMS - Polyurethane**

see Fire.

Used in sound and noise insulation. Cured foams used in seat and trim cushioning.

Follow manufacturers instructions.

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

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Individuals with chronic respiratory diseases, asthma, bronchial medical problems or histories of allergic diseases should not work with or near uncured materials.

The components, vapours, spray mists can cause direct irritation, sensitivity reactions and may be toxic or harmful. Vapours and spray mists must not be breathed. These materials must be applied with adequate ventilation and respiratory protection. Do not remove respirator immediately after spraying, wait until vapour/ mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes.

Smoking, open flames or the use of electrical equipment during foaming operations and until vapours/mists have cleared should not be allowed.

Any heat cutting of cured foams or partially cured foams should be conducted with extraction ventilation (see Body Section 44 Legal and Safety Aspects).

## FUELS

see Fire, Legal Aspects, Chemicals - General, Solvents.

Used as fuels and cleaning agents.

### Gasolene (Petrol).

Highly flammable.

Swallowing can result in mouth and throat irritation and absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Aspiration of liquid into the lungs, e.g. through vomiting, is a very serious hazard.

Gasolene dries the skin and can cause irritation and dermatitis on prolonged or repeated contact. Liquid in the eye causes severe smarting.

Motor gasolene may contain appreciable quantities of benzene, which is toxic upon inhalation and the concentrations of gasolene vapours must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkenness. Very high concentrations will result in rapid loss of consciousness.

Ensure there is adequate ventilation when handling and using gasolene. Great care must be taken to avoid the serious consequences of inhalation in the event of vapour build up arising from spillages in confined spaces.

Special precautions apply to cleaning and maintenance operations on gasolene storage tanks.

Gasolene should not be used as a cleaning agent. It must not be siphoned by mouth.

### Kerosene (Paraffin)

Used also as heating fuel, solvent and cleaning agent.

Flammable.

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs. Liquid contact dries the skin and can cause irritation or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances the low volatility does not give rise to harmful vapours. Exposure to mists and vapours from kerosene at elevated temperatures should be avoided (mists may arise in de-waxing).

Avoid skin and eye contact and ensure there is adequate ventilation.

### Gas-Oil (Diesel Fuel)

see Fuels (Kerosene).

Combustible.

Gross or prolonged skin contact with high boiling gas oils may also cause serious skin disorders including skin cancer.

## GAS CYLINDERS

see Fire.

Gases such as oxygen, acetylene, carbon dioxide, argon and propane are normally stored in cylinders at pressures of up to **140 bar (2000 lb/in<sup>2</sup>)** and great care should be taken in handling these cylinders to avoid mechanical damage to them or to the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well ventilated enclosures, and protected from ice and snow, or direct sunlight. Fuel gases (e.g. acetylene and propane) should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines, and to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.