

CAR REPAIR SHOPS

CAR REPAIR SHOPS - MECHANICAL AND ENGINES FOR THE REPAIR OF VEHICLES IN THE FLORENCE AREA

. SECTOR

CAR REPAIR SHOPS
(CAR REPAIR SHOPS - MECHANICAL AND ENGINES
FOR THE REPAIR OF VEHICLES
IN THE FLORENCE AREA)

2. ISTAT CODES

50.20.1							
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3. ISPESL CODE
(office use only)

SURVEY AREA

4. NATIONAL:

5. REGIONAL

6. PROVINCIAL

7. USL

8. YEAR OF SURVEY

1	9	9	8
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9. NUMBER OF WORKERS: 890

9A. CLERICAL: *Men* *Women*

9B. WORKERS: *Men* *Women*

10. NUMBER OF ENTERPRISES

11. SURVEY FACILITY

ARPAT – CEDIF Technical Sector
Via Baracca, 9 - 50127 - Florence

12. REFERENCE PERSON: Dr. Stefano Beccastrini

ADDRESS:

PO CODE:

CITY:

PROVINCE:

TELEPHONE:

FAX:

E-MAIL:

13. ACCIDENTS:

TOTAL: **OF WHICH FATAL**

14. OCCUPATIONAL DISEASES:

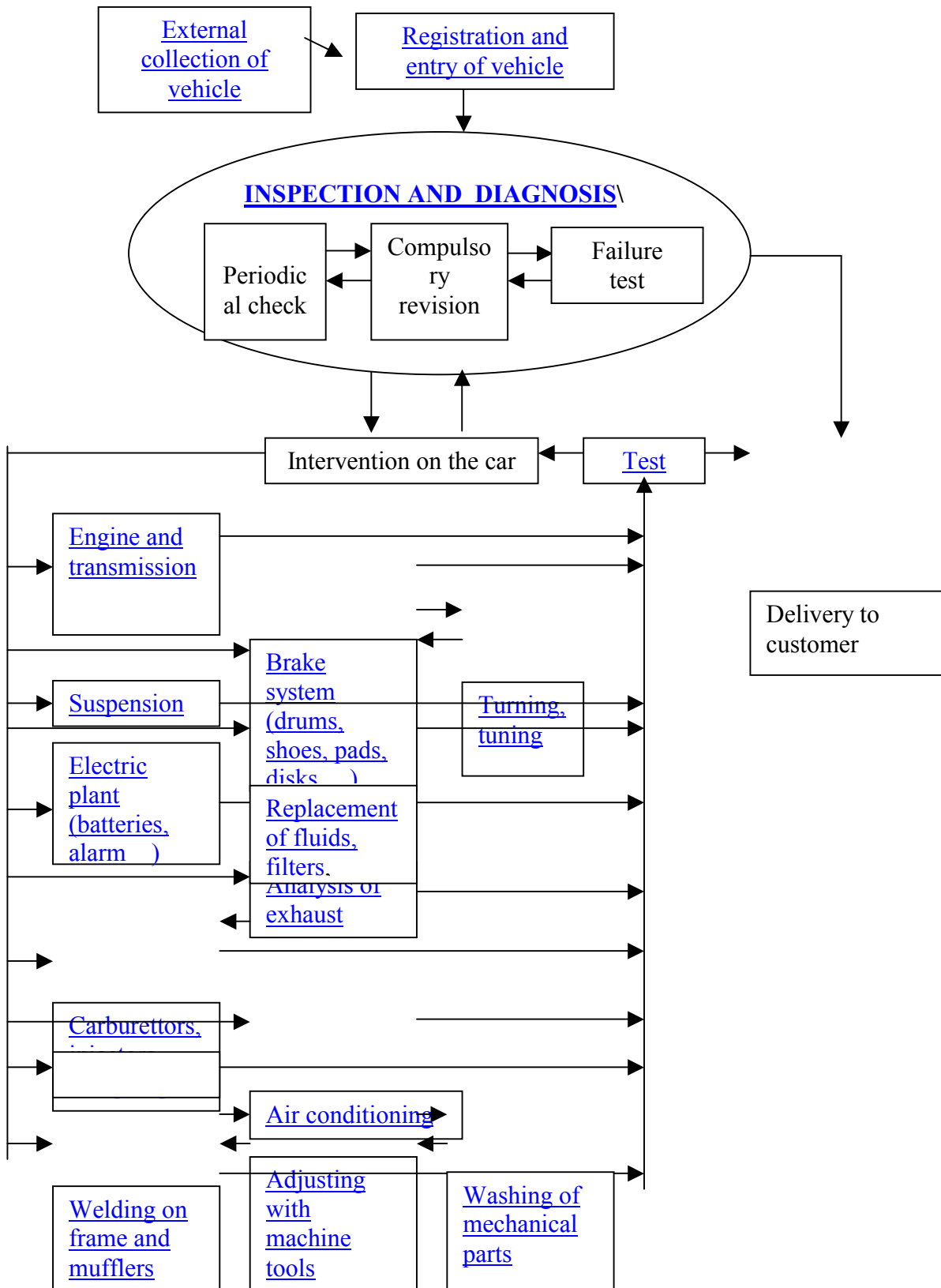
NAME	N° CASES	INAIL CODE

NOTES:

With regard to the data on the number of workers, enterprises, accidents and occupational diseases see Chapter 2.

1. - BLOCK DIAGRAM OF WORK

CAR REPAIR SHOP (mechanical repair of vehicles)



2. - SECTOR DOCUMENT.

GENERAL

This survey examines the sector of *car repair shops - mechanical and engines - for the repair of vehicles in the Florence area.*

This sector consists of approximately 380 enterprises and 890 workers (besides Florence also including the Municipalities of Bagno a Ripoli, Fiesole, Impruneta, Scandicci, Sesto Fiorentino).

In these enterprises, almost all the employees are workers in production, and only a few are office workers.

On the national and regional level (Tuscany), the following data on the number of enterprises, number of workers, accidents and occupational diseases with relative frequency and seriousness, are taken from the INAIL database and refer to the broader sector "Auto commerce and repair", which, besides the sector of repair shops for the mechanical repair of vehicles, also includes body shops, tyre shops and electric shops; it was not possible to extract the data only for the sector of car repair shops (mechanical and engines).

Number enterprises, workers, accidents and occupational diseases
Sector of economic activity: "G50 Auto commerce and repair"
(Source: INAIL database <http://dbase.inail.it/bancadati/Default.htm>)

Number of ENTERPRISES Year: 1998					
Sector of economic activity: "G50 Auto commerce and repair "					
Geographical area	Artisan enterprises	Non-artisan enterprises			Total
		Single location	Several locations	Total	
ITALY	106.159	52,636	95	52,731	158,890
TUSCANY	6.278	4,457	7	4,464	10,742

Number of WORKERS Year: 1998					
Sector of economic activity: "G50 Auto commerce and repair "					
Geographical area	Artisan enterprises	Non-artisan enterprises			Total
		Single location	Several locations	Total	
ITALY	190,992	170,620	5,253	175,873	366,865
TUSCANY	14,364	14,250	232	14,482	28,846

LABOUR ACCIDENTS REPORTED BY THE ENTERPRISES				
by type of enterprise. Year of event: 1998				
Sector of economic activity: "G50 Auto commerce and repair"				
Geographical area	Accidents reported by the enterprises			Total
	Artisan	Non-artisan	Undetermined	
ITALY	11,572	6,829	132	18,533
TUSCANY	1,058	602	9	1,669

LABOUR ACCIDENTS REPORTED BY THE ENTERPRISES WITH INDEMNITY PAID up to 30 June 1999, by type of consequence and location of the firm. Year of event: 1998						
Sector of economic activity: "G50 Auto commerce and repair"						
Geographical area	Type of consequence			Total	Average duration in days	Average indemnity in thousands of lire
	Temporary disability	Permanent disability	Death			
ITALY	15,838	622	26	16,486	21	1,120
TUSCANY	1,418	67	4	1,489	21	1,116

RELATIVE FREQUENCY OF ACCIDENTS average for 3-year period 1995/97 (per 1,000 workers)						
Sector of economic activity: "G50 Auto commerce and repair"						
IN NON-ARTISAN ENTERPRISES						
Geographical area	CLASSES OF WORKERS					TOTAL
	1-15	16-30	31-100	101-250	Over 250	
ITALY	36,46	47,53	48,83	36,58	41,74	39,10
IN ARTISAN ENTERPRISES						
Geographical area	SELF-EMPLOYED	WORKERS EMPLOYEES BY SIZE CLASS OF ENTERPRISES				TOTAL
		1-15	16-30	Over 30	Total	
ITALY	53,95	86,25	104	46,16	86,37	61,50
TUSCANY	61,07	91,46	72,26	-	91,40	69,30

RELATIVE FREQUENCY OF FATAL ACCIDENTS average for 3-year period 1995/97 (per 1,000 workers)						
Sector of economic activity: "G50 Auto commerce and repair"						
IN ARTISAN ENTERPRISES						
Geographical area	SELF-EMPLOYED	WORKERS EMPLOYEES BY SIZE CLASS OF ENTERPRISES				TOTAL
		1-15	16-30	Over 30	Total	
ITALY	0,08	0,09	-	-	0,09	0,08
TUSCANY	0,07	0,10	-	-	0,10	0,08

SERIOUSNESS RATIOS OF ACCIDENTS Average for 3-year period 1995/97 (per worker)						
Sector of economic activity: "G50 Auto commerce and repair"						
IN NON-ARTISAN ENTERPRISES						
Geographical area	CLASSES OF WORKERS					TOTAL
	1-15	16-30	31-100	101-250	Over 250	
ITALY	4,11	3,26	3,12	2,15	3,13	3,79
IN ARTISAN ENTERPRISES						
Geographical area	SELF-EMPLOYED	WORKERS EMPLOYEES BY SIZE CLASS OF ENTERPRISES				TOTAL
		1-15	16-30	Over 30	Total	
ITALY	6,26	7,86	7,20	14,13	7,86	6,63
TUSCANY	7,43	7,37	0,77	-	7,36	7,41

OCCUPATIONAL DISEASES REPORTED BY THE ENTERPRISES, BY YEAR OF EVENT. Sector of economic activity: "G50 Auto commerce and repair"					
Geographical area	1994	1995	1996	1997	1998
ITALY	394	394	350	308	229

OCCUPATIONAL DISEASES REPORTED BY THE ENTERPRISES AND DEFINED up to 30 June 1999, by type of definition. Year of event: 1998 Sector of economic activity: "G50 Auto commerce and repair"							
Geographical area	Indemnity paid				Indemnity not paid		Total defined
	Temporary disability	Permanent disability	Death	Total	Total	Of which degree 1-10%	
ITALY	5	28	1	34	169	19	203

NOTES ON THE SOCIO-ECONOMIC FRAMEWORK OF THE SECTOR

There follows a brief analysis of the technological developments and changes in the business aspect of the sector, on the basis of the data acquired by the Florence Artisan Enterprise Organisation.

Technological development

Technological innovation over the past 10 years has profoundly affected the sector of auto repairs in the broad sense of the term.

In this period a revolution has occurred in the manufacturing techniques of both 4-wheeled (automobiles, buses etc.) and 2-wheeled vehicles (motorcycles and mopeds).

The sector of motor vehicles has embodied and adopted (the evolution is still under way) the results of scientific research in a wide variety fields.

To cite some examples, we can recall the studies and research applied to the so-called "new materials" (e.g. ceramics for engines) increasingly used in the automobile industry, research in the field vehicle aerodynamics derived directly from the most advanced avionics industry, and the increasing application of electronics to vehicles, both in the engine and the electrical part. In this specific field the change has been so radical that a new technological branch called "atronics" has been formed.

The change in the manufacturing concepts of cars and motorbikes has also been heavily influenced by research on new and more advanced types of environmental compatibility and by the evolution of the concept of safety of the vehicle itself.

In order to make these concepts clearer, we can cite the significant example of the catalyser systems for exhaust emission of vehicles and the equipment for checking the safety of the vehicle.

In the sector of safety applied research has reached points of great sophistication and effectiveness; many of the experimental systems resulting from research (airbags, ABS, mechanisms to prevent

the vehicle from tipping over, new material and concepts for the vehicle tyres etc.) are now part of the series production of the vehicle.

Very briefly, vehicles are increasingly dominated by electronics in a large part of their functions; they are generally safer and more reliable, in line with needs to reduce pollution, and equipped with many comforts and refined extra accessories (HI-FI, Compact-Disk, air conditioning systems) which up to a few years ago were unthinkable.

These are only some examples of the direction and intensity of technological change in cars. Those who offer vehicle repair, maintenance and installation services must comply with these factors.

It is evident that besides the fact that new vehicles and motorcycles have been considerably improved with regard to reliability, this involves a radical change for those who have a car repair business.

Profiles and changes of the business world

There have been great changes of the entrepreneur and of the role of entrepreneurs who work in the sector of services for cars and motorcycles and mopeds, and this change is still fully under way due to the various elements analysed below.

An image reflecting the idea of the change that has occurred in the past 10-15 years is the comparison between the “old” artisan entrepreneur, bent over the bonnet and adjusting the engine phase with simple tools and listening to the roar of the engine, and the “new” entrepreneur who increasingly depends on electronic instruments, observing the tester or opacimeter.

The early 1980s saw the end of a historical phase with the massive and rapid “motorisation” of the Italian population. This tumultuous period led to the disorderly and sometimes also improvised appearance of an entire class of artisan entrepreneurs who opened a large number of car repair shops and electric shops, trusting in the long term unlimited growth of the process of motorisation. On the other hand, at that time there were no legislative limitations of any type on the start-up of vehicle repair and maintenance businesses. The consequence of this process was a medium-low professional level, in line with technical characteristics of the vehicles produced then.

Work in repair shops was constant, average waiting time was long, and vehicle repair and maintenance required long average time, so that the balance between the cost of labour component and the cost of spares was definitely in favour of the former.

With the “complication” of cars, the first difficulties occurred in the sector. The equipment and tools became increasingly sophisticated, and the relationship with the customer became more complex.

The relationship between cars in circulation and car service businesses became less balanced with respect to the services they provide; the work in repair shops became more fragmented with shorter repair time.

In the 1990s there was a violent acceleration of change. The entrepreneur working in the sector had to deal with a more complex and difficult situation, which we shall try to illustrate briefly.

From the legislative point of view the sector has a series of specific laws (L. 122/92) and general laws (waste disposal and handling, labour health and safety etc.) with an impact on the location of the enterprises set up in densely populated urban areas.

The application of the regulations undoubtedly has an impact on the individual company accounts, obliging the entrepreneur to adopt specific business strategies, unknown up to a short time before. The other important effect was the increasing process of selection in the number of production units.

There was a substantial change in the reference market in terms of professional skills, instruments and equipment to handle the technical problems of the vehicles for repair or maintenance. There is also a changing relationship with the customer, increasingly well informed, willing to compare repair estimates and attentive to the price/quality ratio. All this requires (or should require) considerable willingness to invest in people (entrepreneurs, workers) and in company structures (equipment, management, marketing etc.).

DATA ON AUTOMOBILES IN THE FLORENCE URBAN AREA

The most significant change in the composition of the stock of vehicles driven in the Florence urban area, estimated for the years 1999-2000 compared to those in 1996-97, regards the further replacement of non-lead-free petrol cars with cars having a catalytic exhaust device and lambda probe.

On the basis of sales statistics, the turnover of cars in circulation is estimated at approximately 7% per year of the entire stock of cars. It is reasonable to believe that the new vehicles mainly replace the oldest ones and in particular those registered before 1993 (not lead-free).

The stock in urban area of the city of Florence for the period 1996-97 was estimated to be 160,000 lead-free petrol cars and 240,000 non-lead-free petrol cars (KAT/NO KAT ratio 40:60), while for the current period the estimate is (1999-2000) 240,000 lead-free petrol cars and 160,000 non-lead-free petrol cars (KAT/NO KAT ratio 60:40).

3. - PHASE DOCUMENT - RISK FACTOR

This chapter contain the analysis of the risks, harm, prevention, reference legislation and external impact for the various work phases of the sector:

- 1) Eternal retrieval of broken vehicles
- 2) Registration of vehicles
- 3) Inspection and diagnosis of the vehicle by opening the bonnet
- 4) Inspection and diagnosis of the vehicle from the inspection hole
- 5) Inspection and diagnosis by lifting the vehicle
- 6) Testing of the vehicle (periodical overhaul required by law
- 7) Analysis of exhaust
- 8) Intervention on the engine and movement transmission parts
- 9) Checking and repair of brakes
- 10) Intervention on suspension
- 11) Replacement liquids, filters, sparkplugs
- 12) Intervention on air conditioning plant
- 13) Intervention on electric plant, replacement and battery recharge
- 14) Intervention on air conditioning plant
- 15) Intervention on carburettors, injectors and fuel pumps
- 16) Intervention on airbags
- 17) Washing pieces of engines and carburettors, cleaning
- 18) Adjusting, welding, mechanical work on machine tools
- 19) Supply of compressed air
- 20) Testing and road trial of vehicles

EXTERNAL RETRIEVAL OF BROKEN VEHICLES

DESCRIPTION OF PHASE

Sometimes, if the customer requests, the mechanics in the car repair shop may be asked to retrieve a broken vehicle. Cases are frequently due to start-up problems (the vehicle does not start). In this case the mechanics may try to repair the problem on site.

If the problem is due the battery being discharged, the car may be started with another battery in parallel connection, or the discharged battery may be replaced with a new one.

More serious problems require the use of a tow truck to remove the vehicle and bring it to the car repair shop; in this case the recovery service is contracted to specialised enterprises.

EQUIPMENT AND MACHINERY

Road assistance vehicle

This is generally a truck with equipment necessary for repair and a battery of adequate capacity for start-up using the cables of the broken car.

RISK FACTORS

Work in a road with vehicle traffic

The mechanics may be run over by another moving vehicle while he is working on the broken vehicle.

Exposure to atmospheric agents

During work the mechanics may be exposed to adverse atmospheric agents (rain, cold, snow, wind, heat etc.).

EXPECTED AND RECORDED HARM

In case of running over workers may suffer from serious injury, sometimes fatal.

For exposure to poor weather the mechanics way suffer from colds or heatstroke.

PREVENTIVE MEASURES

In order to reduce the risk of running over:

- Workers for road assistance must wear bright-coloured overalls to be very visible.
- Before working on a broken vehicle in a dangerous position (for example around a corner), the vehicle must be moved to a suitable place.
- Signs for a parked vehicle must be used (triangle, yellow warning light, dummy with flag etc.).
- Workers must be previously informed on the possible risks and trained in correct procedures.

In order to reduce exposure to atmospheric agents PPD are required (suitable clothing).

EXTERNAL CONTRACTS

This phase is in general contracted to an external firm specialised in road assistance and/or the removal of vehicles.

REFERENCE LEGISLATION

- Leg. Dec. 626/94

EXTERNAL IMPACT

Possible spilling of polluting liquids during the shifting of the vehicle.

REGISTRATION OF VEHICLES

DESCRIPTION OF PHASE

Once accepted from the customer, the car is brought into the repair shop to be submitted to the measures requested.

EQUIPMENT AND MACHINERY

Flexible tube for the aspiration of exhaust and aspiration plant

This is a corrugated flexible tube secured on one end to the exhaust pipe of the vehicle and on the other to the aspiration plant. The latter operates through a single pipe connecting the various flexible tubes connected to the exhaust pipe of the vehicles present.

The single pipe may be embedded in the floor and/or walls, or be fixed externally, for example to the ceiling along the perimeter of the repair shop.

The embedded plant has aspiration outlets where the flexible tubes are connected. When the pipe is all external, there is a stable connection between the common pipe and extensions of each flexible tube.

RISK FACTORS

Exposure to exhaust of vehicles

Exhaust gas contains: carbon monoxide (1-15%), carbon dioxide, uncombusted petrol vapour, lead chloride and bromide. Lead chloride and bromide derive from the reaction between the lead tetra ethylene and antidetonant additives (ethylene chloride and bromide), which have the function of converting lead oxide into volatile compounds (lead chloride and bromide), in order to prevent the formation of deposits in the combustion chamber. Therefore, with the exhaust, lead is diffused externally in organic form (lead tetraethyl in uncombusted petrol vapour) and inorganic form (lead bromide, chloride and oxide).

Benzene and lead tetraethyl are present in fuel.

It is easy to see that the risk of absorbing of carbon monoxide and other substances present in exhaust is greater in basement garage and in places with poor ventilation.

In the tuning, overhauling and cleaning of engines, the latter are run for long periods in neutral, with a high production of carbon monoxide and residues of burnt fuel.

In order to better describe the pollutant substances contained in vehicle exhaust, there follow the emission characteristics of the “average” vehicle of each of the following categories that may be present in the car repair shops of the sector examined:

- Non-lead-free petrol cars
- Lead-free petrol cars
- GPL cars
- Methane gas cars
- Diesel cars
- Diesel vans for commercial use

The following data have been taken from a survey organised and financed by the Municipality of Florence and the Florence Automobile Club, with a series of measurements of polluting emissions from motor vehicles, on the basis of a project arranged by the ARPAT Provincial Department of Florence and conducted with the technical collaboration of the ACI Tuscany – Florence Service. By tests on tens or hundreds of vehicles actually driven in the Florence area, the pollution potential of each category of motor vehicles has been estimated for the following pollutants:

- carbon monoxide (CO)

- nitrogen oxides (NO_x)
- total hydrocarbons (HC)
- benzene (C₆H₆).

Measurements have been repeated on the concentration of pollutants at the exhaust pipe of the vehicles tested, at minimum and maximum acceleration (2500 rpm) for petrol and gas engine cars, at minimum and 3500 rpm for diesel cars, and at three rates (minimum, medium, maximum) for average diesel vehicles.

The tests have been conducted with the engine without a load, which is the typical condition of the car in the repair shop.

The category “diesel vans” includes commercial vehicles having engines with cylinder capacity between 2000 and 6000 cc (typically 2500 cc, 2800 cc and 5800 cc), thus excluding buses and lorries.

The following shows the characteristics of the “average” vehicle representing each type, partly derived and partly estimated on the basis of primary data recorded by the forms (time, cylinder capacity, urban mileage), partly obtained comparison and processing of statistical information from various sources, partly processed on the basis of measurements conducted (concentration of pollutants in exhaust) or estimated (rpm).

Characteristics of the “average” vehicle representing each category

	Unleaded cars	Leaded cars	GLP cars	Methane gas cars	Diesel cars	Diesel vans
N° of times	4	4	4	4	4	4
Cylinder capacity [cc]	1.300	1.150	1.500	1.650	2.100	3.600
Rate [rpm]	1.750	1.750	1.750	1.750	1.200	1.100
Urban mileage [Km/year]	8,000	7,000	7,000	6,000	7,000	20,000
N° vehicles driven in the urban area (1999)	240,000	160,000	10,000	1,000	6,000	21,000
Carbon monoxide [% vol.]	0.13	2	2.0	0.20	0.01	0.03
Total hydrocarbons [ppm]	22	140	490	190	0.1	1.0
Nitrogen oxides [ppm]	23	195	136	138	100	120
Benzene [% on tot. HC]	6	5	-	-	-	-

Other pollutants:

- Lead (Pb) emitted by "leaded petrol cars"
- Black smoke (uncombusted particulate containing IPA), emitted by diesel vehicles

Notes

The measurements pollutant concentration have been conducted by analysers for exhaust, with the most common models on the market. For the analysis of smoke at the exhaust pipe of diesel vehicles, the line of sampling has been integrated with a particulate filter system, and CO and HC sensors having minimum rates increased by one measurement with respect to standard rates.

Together with measurements of pollutants, these analysers were used to detect concentrations of oxygen (O₂) and carbon dioxide (CO₂). In the case of cars equipped with exhaust catalyst the lambda rate provided by the instruments was also recorded.

In order to assess the efficiency of exhaust catalyst, measurements were made on approximately 50 cars simultaneously upstream and downstream from the device.

In order to guarantee the quality control on the data produced, the performance of analysers was repeatedly verified using gas mixtures with a known concentration of the component analysed.

The measurements of benzene have been performed by absorption on active carbon, elution in carbon sulphide and gas chromatography analysis.

With regard to the average emission characteristics of non-lead-free petrol cars, for CO the rate observed in the control of exhaust for the issue of the “seal” (average of values observed before and after any maintenance), for the other parameters the data from lead-free cars observed after the catalyst device was used.

The following considerations can be made:

- Emissions from non-lead-free petrol cars are rich in CO, HC, NO_x and benzene. The amounts emitted for these pollutants also have a high value with respect to other types of vehicles especially for CO, HC and benzene. In the case of premium petrol, emissions also have lead compounds.
- Emissions from GPL gas cars (without catalyst filter) are at the same level as for non-lead-free petrol cars for CO and with a significantly lower level for NO_x. HC emissions are high in absolute value but slight from the health point of view. Benzene and lead are absent.
- Emissions from methane gas engines without a catalysis filter are considerably lower for CO and significantly lower for NO_x with respect to those from other cars without a catalysis filter; HC levels appear to be higher but not very significant from the health point of view. Benzene and lead are absent.
- Emissions from the diesel car stock: HC appear to be slight and CO not very significant. Overall NO_x levels for vehicles with medium and large size engines are high, given the much higher smoke rate with respect to engines with immediate start-up. Benzene and the lead are absent while especially medium and large size engines have black smoke emissions (uncombusted particulate containing IPA).

Transit of persons near vehicles in movement

Workers or customers may be run over by vehicles in transit, especially in reverse.

Exposure a unfavourable microclimate

During the cold season workers may be exposed to temperature variations, drafts, low temperatures at the workplace.

Explosion or fire

The presence of inflammable substances (petrol in tanks, motor oil, turpentine) and the possibilities of triggering cause the risk of explosion or fire.

EXPECTED AND RECORDED HARM

Exposure to combustion products of vehicle engines, mainly formed by particulate of uncombusted hydrocarbons, nitrogen oxides (NO, NO₂), sulphur dioxide (SO₂), carbon monoxide (CO), formaldehyde (HCHO), aromatic and aliphatic hydrocarbons and volatile organic substances may cause pneumonia, oxycarbonism, irritation syndromes of the cephalic extremities, bronchial asthma, haemopathy, hepatopathy, neuropathy, nephritis, miocardiopathy, dermatitis or cancer.

Surveys conducted in other sectors show that workers exposed to combustion gas of motor vehicles suffer from irritation of the eyes and respiratory tract.

Surveys conducted in various garages show that mechanics are exposed to sub-toxic concentrations of oxyicarbonism for long periods. The symptoms to be related to oxyicarbonism are: headache, dizziness, fatigue, dyspepsia due to slight hepatic insufficiency, insomnia, and slightly low pressure. The value of the carboxyhaemoglobin proved to be higher with respect to that of persons not exposed to CO₂. The average value of the carboxyhaemoglobin, with respect to total haemoglobin, is 10% higher in some persons.

Analysis of blood samples taken in the morning (greater pollution) and afternoon (less pollution), has shown the correlation with the carbon dioxide rate in persons exposed to CO₂ in the confined air.

In case of running over workers may suffer serious injury.

In case of exposure at an unfavourable microclimate workers may suffer from colds.

In case of fire or explosion, workers may suffer from serious burns, traumatic injury and poisoning.

PREVENTIVE MEASURES

In order to reduce exposure to vehicle exhaust gas it is necessary to:

- Prepare a registration area where the customers leave their cars, which are then accepted by the worker. The registration area must be clearly marked, adequately ventilated and have the sign "STOP – turn off engine". There may also a bar with remote control to regulate access. If natural ventilation is not sufficient (this is may be especially during the cold season when le doors of the car repair shop are kept closed), wall aspirators must be installed at a height to aspire exhaust without the flow hitting the workers.
- Before the car is placed in the work area, a flexible tube for the collection and outside expulsion of smoke and exhaust must be connected to the exhaust pipe of the car, in order to avoid diffusion in the work environment. The flexible tube must be sufficiently long to follow the vehicle on its path from the registration zone to the working zone. The path must be adequately designed.

In order to reduce the risk of running over, it is necessary to:

- Prepare and mark safe paths for pedestrians, separated from paths for vehicles.
- No entry to working areas by outsiders.

In order to reduce exposure to an unfavourable microclimate during the cold season, it is necessary to heat working areas. Air cushions may also be produced in front of the car repair shop doors in order to create thermal separation, while keeping the doors open for the transit of vehicles.

In order to reduce the risk of fire or explosion it is necessary to:

- Reduce to the minimum possible stocks of inflammable and explosive, kept in separated places, suitably aired towards the outside (and not towards the work environment).
- Adopt systems in order to avoid the formation of explosive mixtures with prohibition of the use of open flames or unsuitable electrical equipment in zones with danger of fire or explosion.
- The electric plant must be adequate for the classification of the places where it is installed, conducted according to CEI regulations.
- The presence and marking of portable or fixed extinguishers and their periodical checking.
- Training of the personnel appointed to use extinguishers and PPD.

- Preparation, marking and keeping free the exit routes.
- When there are over 9 vehicles in the repair shop, the activity comes under the control of the Fire Department and it is necessary to obtain the Fire Prevention Certificate.
- Assessment of the fire risk pursuant to Min. Dec. 10.03.98.
- When 10 or more workers may be present in the car repair shop an emergency fire plan must be drawn up pursuant to Min. Dec. 10.03.98.
- The workers must be formed and trained with regard to dangers and the management of emergencies pursuant to Min. Dec. 10.03.98.

EXTERNAL CONTRACTS

This phase is not contracted.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Min. Dec. 16.02.82 amended by Decrees 27.03.85 and 30.10.86 and Min. Dec. 10.03.98
- Leg. Dec. 626/94

EXTERNAL IMPACT

The main impact is the vehicle exhaust emission conveyed to the air. These emissions are not very significant.

INSPECTION AND DIAGNOSIS OF THE VEHICLE BY OPENING THE BONNET

DESCRIPTION OF PHASE

The mechanics open the bonnet of the car and inspect the engine compartment. The inspection can take place with the engine off or on.

In order to better inspect the engine area, the mechanics can use portable lamps to bring near and sometimes place near the part to be inspected.

This operation may be conducted with the help of a device for electronic diagnosis (for the more recent cars) or without it.

The device for electronic diagnosis may be used to check the alternator, start-up motor, potentiometer, absorption tests, lambda probe (to measure the percentage of oxygen in the air/petrol ratio in order to regulate injection).

Sometimes an external gauge is required to measure the pressure of the supply circuit (which works at a constant pressure), and intervention for the dismounting and remounting of the petrol supply pump.

EQUIPMENT AND MACHINERY

Device electronic diagnosis

This is basically a Personal Computer with special software and interfaces for the connection of a series of probes to be inserted in the respective diagnosis plugs on the vehicle.

Portable electric lamps

These are electric lamps with glass protection covered by a metal grill. Half the grill is enclosed by a metallic screen in order to avoid blinding in the opposite direction from the area to be lit.

RISK FACTORS

Exposure to fuel

During the mounting of the gauge or intervention on the pump, workers are exposed to skin contact with the fuel and to inhaling of vapour.

Exposure to vehicle exhaust

During tests conducted with the engine on, exhaust may spread in the work environment.

Fire or explosion

If necessary, dismount the petrol pump (which may be inside the tank); sparks may occur due to contact between the electric power supply cables of the pump if there is voltage present. Although the tank is emptied previously, the vapours and the little petrol remaining may be sufficient to cause explosion or fire.

In case of explosion of a vehicle, fire may develop and may quickly reach other vehicles, triggering other explosions.

Use of portable electric lamps

If the lamp does not have low voltage power supply (24 V), in case of breakage of the lamp or cutting of the power supply cable, there is a risk of electrocution by direct contact with parts having voltage and by indirect contact with parts normally not powered such as the body of the vehicle.

The power supply cable of the lamp may interfere and make personnel trip.

Work near moving mechanical parts

In more recent cars the belts accessible to workers are all covered by carters. In older cars, when inspection takes place with the engine on, there is the risk of catching and dragging by transmission belts serving the various parts of the engine.

Furthermore in older cars, the radiator cooling fans were not covered by any protection, and consisted of metal blades, connected directly to the engine axle with a belt. In case of repair of these vehicles there is the risk of catching, dragging and cutting. Furthermore, it may happen that due to damage from a previous accident of the car, a blade of the fan breaks while the engine is running. Cases have occurred in which the blade has ejected so violently as to perforate the bonnet; it is therefore evident how serious the consequences could be when a worker is hit. Today this risk is virtually absent since cars have cooling fans protected by carters, but this risk factor must be taken into account in the case of repairs to older vehicles.

Work in forced postures

The mechanics must bend over with their chest forward to inspect the vehicle engine with the bonnet raised.

Work in dangerous positions

When the mechanics work under the open bonnet they are exposed to the risk of being hit by it if it closes suddenly. This possibility may occur when the rod supporting the open bonnet has not been correctly positioned and is hit by a mechanic during work.

EXPECTED AND RECORDED HARM

Upon inhalation, petrol has a general toxic action due to their solvent action on fats. This toxic action is stronger on the nervous and pulmonary systems. One of the components of petrol is hexane, the inhaling of which may cause, dizziness, anorexia, vomit and subsequently nervous symptoms. Chronic poisoning may cause various nervous disorders to the senses and motor functions. Car petrol is also contaminated by benzol and contains lead as an anti-detonant. French studies on exposure of mechanics to this risk factor show an excess of leukaemia with respect to the average population.

Skin contact with petrol causes dermatitis and eczema after long contact.

Exposure to combustion products of vehicle engines, mainly formed by particulate of uncombusted hydrocarbons, nitrogen oxides (NO, NO₂), sulphur dioxide (SO₂), carbon monoxide (CO), formaldehyde (HCHO), aromatic and aliphatic hydrocarbons, and volatile organic substances may cause bronco-pulmonary disease, oxycarbonism, irritation syndromes of the cephalic extremities, bronchial asthma, haemopathy, hepatopathy, neuropathy, nephritis, miocardiopathy, dermatitis or cancer.

In case of explosion or fire, workers can suffer from very serious burns, traumatic injury, poisoning.

In case of direct or indirect contact with parts with electric current, injury due to electrocution may occur.

In case of catching and dragging by belts, the mechanics may suffer injuries and contusion.

In case of catching and dragging by the fan (old cars) there may be injuries, contusion and cutting; a worker hit by fan blade that breaks and ejected may suffer from cuts that can also have very serious consequences according to the part of the body hit.

Work in non-ergonomic postures may lead to disturbances of the muscular-skeletal system.

In case of the bonnet falling the mechanics may suffer trauma on the head and upper limbs.

PREVENTIVE MEASURES

In order to reduce exposure to vehicle exhaust gas, the complete collection of exhaust by a flexible aspiration tube is necessary.

In order to reduce exposure to petrol vapours, a portable aspirator with a flexible aspiration tube and specific filters may be used. Furthermore, the workers must wear masks for the protection of the respiratory tract.

In order to avoid skin contact with fuel, workers must wear rubber gloves of the most resistant type, since the thin ones normally used for other work for protection from oil and dust, while guaranteeing greater sensitivity, consist of a material not suited to contact with petrol.

In order to reduce the risk of explosion during the dismantling of the petrol pump, before of continuing the operation, verify that the battery has been disconnected (turn off the panel and remove the key).

In order to reduce the risk of electrocution the portable lamps must have low voltage power (24 V). In order to avoid the wire from interfering, the location of electric plugs with respect to work zones must be properly planned, with the use of reels to wind the lamp cable having a spring for automatic rewinding.

In order to reduce the risk of catching and dragging by belts, the mechanics should avoid wearing loose clothing and wide sleeve overalls. Sleeves must have an elastic end in order to fit the wrist.

In order to reduce the risk of being hit by the fan during repairs on old models where fans are open, verify that the fan is complete and without any damage that could cause ejection of the blades; arrange protection to be installed before starting work and do not stand in the possible trajectory of fan blades.

In order to reduce the risks deriving from work in non-ergonomic postures adequate information and training on correct postures is required. Furthermore, the vehicle being repaired may be lifted by a hydraulic lift to a suitable height according to the work to be conducted and the height of the worker.

In order to reduce the risk of falling of the bonnet it is necessary to correctly position the support rod. If the model of the vehicle has a support rod not guaranteeing sufficient safety, extra supports must be applied. Information and training of workers is required.

EXTERNAL CONTRACTS

This phase is not contracted.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86

- Leg. Dec. 626/94

EXTERNAL IMPACT

The main impact is the vehicle exhaust emission conveyed to the air. These emissions are not very significant.

Waste consists of the filters used for the aspiration device for petrol vapours.

INSPECTION AND DIAGNOSIS OF THE VEHICLE FROM THE INSPECTION HOLE

DESCRIPTION OF PHASE

The mechanics go down into a hole in the floor above which the car to be inspected is placed. Given the dangerous nature of the hole, many car repair shops have eliminated it, installing a hydraulic lift, but they are still in some small car repair shops. The hole has lighting, but to light particular work zones portable lamps may also be used.

EQUIPMENT AND MACHINERY

Inspection hole.

In general the depth of the hole is between 1.40 and 1.60 m. The hole has a ladder or steps for access.

RISK FACTORS

Exposure to exhaust

The presence of exhaust inside the inspection hole can reach a high concentration due to the shape of the hole.

Fire or explosion

The presence of oxygen and inflammable products in the inspection hole may easily lead to the formation of explosive atmospheres. In a hole 13 m³, one litre of petrol is sufficient to produce an explosive mixture with the air (source: INRS - Travail & Sécurité - July/August 1990).

Work in forced postures

The mechanics must bend their head back to look up, thus bending the neck. Furthermore they must hold their arms up for on the vehicle, and in this case, the effort is greater when heavy manual equipment is used.

Transit near holes in the floor

When a vehicle does not cover the hole, there is the risk of falling down, especially in case of poor lighting.

Transit with blocked floor

Falling is possible if the floor of the hole is full of work tools, since the mechanics may trip on them. Slipping is also possible if the floor of the hole is soiled with oil and grease.

Use of portable lamps

If the lamp does not have low voltage power (24 V), in case of breakage of the lamp or cutting of the power supply cable, there is the risk of electrocution by direct contact with electric current and for indirect contact with parts normally without current such as the body of the vehicle.

EXPECTED AND RECORDED HARM

Exposure to combustion products of vehicle engines may cause pneumonia, oxycarbonism, and irritation syndromes of the cephalic extremities, bronchial asthma, haemopathy, hepatopathy, neuropathy, nephritis, miocardiopathy, dermatitis or cancer.

The high concentration of pollutants that may accumulate in the inspection hole may lead to serious poisoning.

In case of fire or explosion inside the hole the mechanics may suffer from burns, traumatic injury and poisoning. Given the small area, in case of accident the consequences may be very serious.

Work in forced postures may cause muscular-skeletal disorders.

In case of falling on the floor of the hole, traumatic injury such as contusion, injuries or fractures may occur. If the mechanics fall into the hole from above the consequences may be even more serious.

In case of direct or indirect contact with parts having electric current, injury due to electrocution may occur.

PREVENTIVE MEASURES

Inspection holes are not recommended for light vehicles, for which a hydraulic lift can easily be used.

The exhaust of the vehicle must be conveyed to the exhaust pipe by flexible tube as described previously.

There should be guides for positioning the pan during the emptying of the oil sump. The pan may be equipped with a flexible tube and faucet for emptying in special channel leading to a collection tank.

There must be a certain slope of the hole and a collection shaft in order to facilitate the removal of any liquid present.

In order to prevent the risk of fire or explosion, it is necessary to guarantee air circulation with a minimum capacity of 500 m³/h in order to prevent the formation of explosive mixtures with the air. Air circulation must be designed in order to avoid an excessive velocity of the air. The air inlets may be embedded in the walls of the hole.

In any case the hole must not be ventilated with oxygen.

Emptying of fuel tanks in the channel is prohibited.

Welding is prohibited at a distance of less than 3 metres from the channel, unless particular precautions are taken.

(source: INRS - Travail & Sécurité - July/August 1990).

Install a sufficient number of electric plugs and distribute them adequately along the hole.

The lamps must be protected with glass and have a degree of protection at least IP55 and preferably embedded in the walls of the hole. There must also be lamps for emergency lighting with the same degree of protection.

The walls must be covered of light coloured waterproof material, resistant to solvents and easy to wash.

In order to reduce the risk of falling, the floor of the hole must be made of slip-proof material. In order to avoid blocking the floor of the hole, there can be niches in the walls for placing tools.

Place a ladder coated with a slip-proof product at both ends of the hole.

Clean the bottom of the hole and access ladders as often as necessary in order to prevent the accumulation of grease and oil. Non-harmful solvents and must be used for cleaning, avoiding petrol.

Place signs near the hole to show its position.

Install lateral grooves along the edges of the hole, to hold bendable parapets or other devices for covering the hole.

EXTERNAL CONTRACTS

This phase is not contracted.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 626/94

EXTERNAL IMPACT

The main impact is the vehicle exhaust emission conveyed to the air. These emissions are not very significant.

INSPECTION AND DIAGNOSIS BY LIFTING THE VEHICLE

DESCRIPTION OF PHASE

The lifting of the vehicle is indispensable for certain work, while for other work it may be helpful in order to reduce uncomfortable postures during work.

EQUIPMENT AND MACHINERY

Hydraulic lift

This is a device installed permanently on the floor of the car repair shop. There are various types and capacities.

They may have two columns, both equipped with a double pair of lateral mobile arms positioned manually under the frame of the vehicle. The lifting mechanism is of the endless screw type.

Another type uses four columns and two lateral platforms onto which the vehicle is driven. The lateral platforms are generally above floor level, and to facilitate access are hinged to inclined metallic planes with anti-slip surface. The lifting mechanism is generally of the endless screw type, but in the older models a cable system may still be used.

There are also platforms embedded in a trench 10-15 centimetres deep in order to be at the same height as the floor; in this case, when the lift is raised, the underlying space forms an opening in the floor. In this case the lifting mechanism consists of a pair of arms hinged in the middle to form an "X" with one end being fixed and the other running laterally along the floor of the trench. When it is brought closer the lift is raised, and when it is brought away the lift is lowered. In any case, the raising and lowering of lifts takes place slowly with the pressing of buttons (raise / lower) requiring the presence of personnel; i.e. the movement stops as soon as the button is released.

Portable lift

This is a small lift equipped with wheels to be used when necessary. It has a hydraulic mechanism and the lowering is protected by a mechanical gear system in order to prevent lowering by more than one stop in case of breakage of the hydraulic system.

Jack for manual lifting

This is a manual device with a hydraulic lever. The device is equipped with pedal for rapid lowering.

Horses

RISK FACTORS

Work in a dangerous position

The lifting platform, due to control defects, in case of breakage of the piping or due to erroneous control, may fall and hit the mechanics.

The jack can be subject to breakage or be hit by another worker passing nearby, so that the mechanics working under the vehicle may be crushed.

Work in forced postures

The mechanics must bend their head back to look up, thus bending the neck. Furthermore they must hold their arms up for on the vehicle, and in this case, the effort is greater when heavy manual equipment is used.

EXPECTED AND RECORDED HARM

In case of crushing under the vehicle the mechanics may suffer from traumatic injury with sometimes fatal consequences.

In our zone of reference an accident occurred due to the falling of a worker in the trench formed by the area under the hydraulic lift of the overhaul section.

Work in forced postures may cause muscular-skeletal disorders.

PREVENTIVE MEASURES

Hydraulic lift

One way to avoid falling of the platform in case of a defect in the hydraulic plant (for example breakage of the pipes) is to equip the lifting cylinder with a valve for this purpose.

Wrong handling may be avoided if the hydraulic plant under the lifting platform is designed in such a way as to prevent accidental manual lowering.

The data necessary for the safe functioning of the lifting platform must be indicated in clearly and easily visible for the user and located near the control mechanisms of the lifting device. The indications of the nominal capacity must appear on the platform and on the control board. The nominal capacity shown on the plant may not be exceeded.

The user is responsible for the correct and safe use of the device. Before operating the lift ensure that no one is in danger.

The control panel must be located in a position allowing safe operation of the plant and visible in the whole area where it is located. The panel must include at least a control button for raising, one for lowering and one for emergency stop. The raising and lowering buttons must be suitably protected against any accidental operation, and the emergency button, not protected, must be of the mushroom type and red-coloured.

Hydraulic lifts must be equipped with a device located under lower part of the mobile structure, designed to stop the descent of the device if parts of the body of the worker should interfere with the dangerous zone of the moving structure.

These devices may consist of immaterial barriers (photo cells) or panels mounted under all the sides and connected to a blockage system, designed to immediately stop the movement in case of contact with an external element (e.g. the worker's foot).

Lifts equipped with lateral walkways must, as far as technically possible, also must be supplied with parapets protecting the open sides, designed to prevent falling from above. These parapets must be at least 1 metre high and consist of at least two railings or vertical elements a suitable distance apart. The raising course of the lifting platform must not exceed 2 metres.

Moving parts should be painted with yellow/black stripes in order to better highlight the sources of danger. Clear and simple instruction on the use of hydraulic lifts must be shown on a specific signboard also containing the obligations and prohibitions, and applied near the control panel.

Floor slabs

Car repairs are often conducted on the round floors of residential buildings with basement floors or cellars underneath. It is absolutely necessary to acquire information on the maximum load of the floor on which car repair activities are to be conducted, verifying, for example, if the weight of the car together with of the hydraulic lift on the support points is compatible with the maximum load allowed on the floor.

Lifting with jacks

It is prohibited to go under a car raised and supported only by a jack. Before going under the car, the mechanics must position supports (see photo).

EXTERNAL CONTRACTS

This phase is not contracted.

REFERENCE LEGISLATION

- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 626/94

EXTERNAL IMPACT

The main impact is the vehicle exhaust emission conveyed to the air. These emissions are not very significant.

TESTING OF THE VEHICLE (PERIODICAL OVERHAUL REQUIRED BY LAW).

DESCRIPTION OF PHASE

The vehicles are subjected to periodical overhaul required by law. The periodical overhaul consists in a series of verifications according to a preset protocol.

EQUIPMENT AND MACHINERY

Test equipment for overhaul required by law

This consists of a device for the analysis of exhaust, the computerised panel for testing brakes and suspension and a hydraulic platform lift equipped with a device for testing of transmission clearance (semi axles, joints etc.).

For testing the shock absorbers, the wheels of the vehicle are brought onto a testing device (first the front wheels and then the same operation for the rear wheels); the system measures the weight according to which a certain performance of brakes and suspensions must occur.

For the testing of brakes, the wheels of the vehicle are lifted onto a system of rollers, and then the brake pedal is pressed and the computer of the test equipment provides the result of the test.

The device for testing oscillations consists of two platforms onto which the wheels are brought on and moved with lateral oscillation movement, while the mechanics visually check the absence of looseness, lighting the area under the wheel with a portable lamp.

RISK FACTORS

Work near protruding edges at the height of the head.

Sloping metal planes hinged to the platforms of the hydraulic lift, once the lift has been raised, are a danger since the edges of the platform are at the height of the head and the mechanics can hit them.

Work near vehicles in movement

The transit of vehicles in the areas of the car repair shop involve the risk of running over.

Work near a vehicle on the rollers for testing brakes

When the brake is operated on the rollers of the testing device, the vehicle may have an oscillation, which although slight, can be a risk for other workers present.

Work near a vehicle on the device for checking wheel oscillation

When the oscillation device for testing the clearance of the transmission, the vehicle may undergo unexpected shifts, hitting persons or, in the worst cases, with the collapse of the hydraulic lift.

Work near openings in the floor

Once the lift is raised, the trenches 10-15 centimetres deep in which the platform is embedded may expose workers to the risk of falling.

EXPECTED AND RECORDED HARM

In case of hitting against the sloping metal planes hinged to the platforms of the hydraulic lift the mechanics may suffer injuries and contusion to the head.

In case of running over by vehicles in transit the person involved may suffer from traumatic injury.

In case of hitting due to oscillations of the vehicle the person involved may suffer from traumatic injury.

In our zone of reference an accident occurred when a worker fell into the trenches under the hydraulic lift of the overhaul area.

PREVENTIVE MEASURES

The transit of persons not working in the operation area must be prohibited with a sign.

The path of the car must be marked and limited.

The area under the hydraulic lift platforms must be marked and limited.

In order to prevent the car from falling off the platform during clearance test, it is necessary to position a special bar which, in contrast with the seat, keeps the brake pedal pressed, in order to block all four wheels (since the handbrake only blocks two).

The hydraulic lift must be equipped with a safety device preventing the sudden reabsorption, for example by a blockage device requiring a short raising command before the lift is lowered, so that the safety device operates.

Information and training of workers for correct procedures for safe work are indispensable.

EXTERNAL CONTRACTS

This phase may be contracted to an external firm, since many car repair shops do not have the necessary equipment.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 626/94
- Min. Dec. n.406 of 30.07.97

EXTERNAL IMPACT

The main impact is the vehicle exhaust emission conveyed to the air. These emissions are not very significant.

ANALYSIS OF EXHAUST GAS

DESCRIPTION OF PHASE

The exhaust of the cars is analysed in order to minimise the pollutants emitted. The analysis is required under the periodical overhaul required by law, as well as be municipal regulations by which cars without catalysis filters must undergo annual checking and have an adhesive mark, in order to reduce air pollution from vehicle traffic.

To make the analysis a probe is placed in the exhaust pipe of the vehicle.

EQUIPMENT AND MACHINERY

Device for checking exhaust

This is a computerised device equipped with a video terminal and a probe inserted in the exhaust pipe of the vehicle.

RISK FACTORS

Exposure to vehicle exhaust

If gas is not totally removed, the mechanics may be exposed to exhaust of the vehicle.

EXPECTED AND RECORDED HARM

Exposure to the combustion products of engines, consisting mainly of particulate from uncombusted hydrocarbons, nitrogen oxides (NO, NO₂), sulphur dioxide (SO₂), carbon monoxide (CO), formaldehyde (HCHO), aromatic and aliphatic hydrocarbons and volatile organic substances may cause pneumonia, oxycarbonism, irritation syndromes of the cephalic extremities, bronchial asthma, haemopathy, hepatopathy, neuropathy, nephritis, miocardiopathy, dermatitis or cancer.

PREVENTIVE MEASURES

In order to reduce exposure to vehicle exhaust gas it is necessary to capture all the exhaust by a flexible aspiration tube and place the measurement probe in a small cylindrical tube attached to the flexible tube on the exhaust pipe. Otherwise the analysis may be conducted outdoors.

EXTERNAL CONTRACTS

This phase cannot be conducted in all the car repair shops, and the vehicle may thus be brought to another car repair shop with which there is an agreement.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Leg. Dec. 493/86
- Leg. Dec. 626/94
- Min. Dec.A. n.163 of 21.04.99 "Regulations for identifying environmental and health criteria on the basis of which mayors adopt measures to limit traffic".

EXTERNAL IMPACT

The main impact is the vehicle exhaust emission conveyed to the air. These emissions are not very significant.

INTERVENTION ON THE ENGINE AND ORGANS OF MOTION TRANSMISSION

DESCRIPTION OF PHASE

Sometimes, in order to make repairs or replacements, it may be necessary to remove the engine from the vehicle. The removal and subsequent re-installment takes place with the help of mechanical lifting devices, in general portable cranes. Once removed, the engine is placed on special supports.

EQUIPMENT AND MACHINERY

Portable crane for lifting

Supports for disassembled engines

These are metallic structures with sufficient resistance for the weight to be supported. They are made so that trays can be placed underneath for possible oil leakage from the engine.

RISK FACTORS

Work in contact with parts soiled with oil

Since the mechanical are soiled with grease and oil, workers are exposed to skin contact with these substances. Used oil is more dangerous.

Manual handling of loads

Some disassembled mechanical parts, such as the exchange, may weigh dozens of kilograms. Furthermore, being greasy parts, they may slip and hit workers on lower limbs.

EXPECTED AND RECORDED HARM

Skin contact with oil may cause acute harm (allergies, dermatitis) and chronic harm (cancer), besides psychological problems for always having dirty hands.

For more details the paragraph on the work phase of changing oil in vehicles.

The manual handling of loads may cause trouble or injury to the muscle-skeletal system. In case of falling of heavy pieces, workers may suffer from injuries and contusion to lower limbs.

PREVENTIVE MEASURES

In order to avoid contact with oil, rubber gloves and suitable clothing must be used. The gloves normally used are very adherent to the hands and guarantee sufficient sensitivity.

During dismounting mechanical aid for handling may be used, or two workers may do the work.

Lifting devices

Cranes, hoists, winches and any other lifting devices with capacity exceeding 200 Kg, except manual ones, must be subjected to obligatory checking required by law.

Therefore before starting up or new plant or modifying plant, the plan, drawn up by a qualified technician, must be submitted to the ISPESL (Istituto Superiore per la Prevenzione e la Sicurezza del Lavoro), in order to obtain the license of the plant and operation with the relative booklet of the device.

Subsequently these devices are submitted to annual checking by the Local Health Authorities having jurisdiction.

Employers are obliged by law to make a quarterly check, using specialised personnel, on cables and chains of lifting devices. The check also involves devices not submitted to checking required under law (with capacity up to 200 Kg) and the result is to be recorded in the booklets or sheets complying with the forms stated in Ministry Decree 12.09.59. This form must also show the date of the check and the signature of the technician.

The metallic cables, chains, hooks for lifting and transport and the signals established for performing the manoeuvres must be shown in notices or signs that are clearly visible and located near the controls of the devices. The hooks of lifting devices must be equipped with a closing device at the end in order to prevent the release of cables, chains or other supporting parts.

The harnesses of loads must be handled using devices suited to prevent the falling or shifting of the load.

Each device must show the following on its structure: registration number, maximum allowed capacity and serial number issued by the control device.

The control devices must be located in a position to make their operation easy and safe. The parts must be shaped and protected in order to prevent accidental start-up and must show the clear indication of the operations required.

EXTERNAL CONTRACTS

In general this phase is not contracted.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 626/94

EXTERNAL IMPACT

Spilling of oil on the ground

Waste production

Waste identified by C.E.R	C.E.R. Code	Classification	Note
Waste from vehicle demolition	160208	Non-dangerous	Scrap metal, glass, brake pads etc.

CHECKING AND REPAIR OF BRAKES

DESCRIPTION OF PHASE

Cars have *disc brakes* or *drum brakes*. Some models have front disc brakes and rear drum brakes, while other models have front and rear disc brakes.

The most frequent operation is the replacement of disc brake pads. Also the discs sometimes need replacement.

Another operation is the replacement of the shoes of drum brakes.

The replacement of pads, discs and shoes means first removing the wheels of the vehicle. For unscrewing and putting back the bolts of the wheels, wrenches and/or compressed air screw guns are used.

Hand tools such as pliers are used to tighten pads.

The repair of rear drum brakes means opening the drums. This may be difficult, since with wear the friction on the shoes may cause a groove on the drum that blocks opening; in this case the mechanics sometimes use a hammer. Once the drum is open, the mechanics remove the dust inside with a brush.

The drum may require minor adjustments on the lathe or be sent for adjustment at a specialised external firm.

The circuit of the brake system has oil for the hydraulic system.

EQUIPMENT AND MACHINERY

Screw gun

This is a compressed air device for screwing and unscrewing.

RISK FACTORS

Exposure mixed dust and asbestos dust

During the repair and cleaning of the brakes of vehicles, dust from the material forming the brakes and other harmful dust due to road traffic (solid particulate etc.) may spread. If cleaning is conducted with compressed air the spread of dust is greater.

At the time of opening of the drum, especially when a hammer is used, flying dust may fall on the mechanics and spread in the work environment. The dust inside the drum is formed by the material from worn brakes (containing fibreglass, cellulose, carbon fibres, graphite etc.), with considerable amounts forming a pile.

Before the law on asbestos came into force, the material forming the brakes also contained asbestos fibres. There may still be asbestos during repair and cleaning with compressed air of the brakes in older vehicles, although after ordinary maintenance, the brakes of older vehicles have now been replaced.

Given the particular danger of asbestos fibres, attention for this risk factor is required.

Use of manual equipment

The use of hammer, pliers etc. may involve risks for the hands.

Exposure to noise

The screw gun produces significant noise.

Exposure to vibrations

The screw gun produces significant vibrations.

Handling of liquid for brake circuits

Brake liquid is classified as corrosive.

EXPECTED AND RECORDED HARM

In case of spreading of dust when the drum is opened, the mechanics may suffer from harm to the eyes.

Exposure to dust from the brake material may cause harm to the respiratory system (pneumoconiosis). Exposure to dust containing asbestos fibres causes asbestosis.

In case of accidental contact during the use of hand tools, the mechanics may suffer from traumatic injury (injuries, crushing contusion) to the hands.

Exposure to noise can involve deafness and collateral problems.

Exposure to vibrations may involve the Raynaud Syndrome.

Skin contact with brake liquid may cause skin irritation, and in case of prolonged contact, eczema.

PREVENTIVE MEASURES

In order to reduce exposure to dust, the information and training of workers is required, with the use of PPD (mask, gloves, glasses, overalls), and avoid the cleaning with compressed air, using an industrial aspirator instead.

In order to avoid skin contact with the oil of the brake circuit it is necessary to use PPD (gloves, glasses, overalls), and avoid keeping oily rags in pockets.

In order to reduce the risk of accidents to the hands during the use of hand tools, the information and training of workers is required, and use gloves.

In order to reduce exposure to noise and vibrations, compressed air screw guns must be sound-proofed and with low vibrations. According to the level of exposure, workers must be informed, trained and wear PPD for the protection of hearing (earplugs, earpieces, gloves).

EXTERNAL CONTRACTS

In general this phase is not contracted. Drum overhaul may be contracted.

REFERENCE LEGISLATION

- Pres. Dec. 547/55
- Pres. Dec. 303/56
- Leg. Dec. 493/86
- L.212/90
- D.L. 257/92
- Leg. Dec. 277/91
- Leg. Dec. 626/94

EXTERNAL IMPACT

The main impact of this phase consists of the production of waste:

Waste identified by the C.E.R	C.E.R. Code	Classification	Note
Waste from vehicle demolition	160208	Non-dangerous	Scrap metal, glass, brake pads etc.
Brake oil	130108	Dangerous	

INTERVENTION ON SUSPENSION (SHOCK ABSORBERS)

DESCRIPTION OF PHASE

The shock absorbers require periodical checking, and according to wear, they can be overhauled or replaced.

Testing of shock absorbers takes place by a specific device in the diagnosis phase of the car, as described in the phase of periodical overhaul required by law.

A shock absorber basically consists of a steel cylinder containing hydraulic oil, which is compressed by a piston running inside the cylinder, encountering some resistance. The piston consists of a rod (chrome-plated steel) ending in a plate that compresses the oil. Packing fixed by a metal ring ensures that the piston is air-tight. A threaded plug is placed at the top of the shock absorber to enable the extraction of the piston.

Some shock absorbers also have a steel spring that must sometimes be replaced or in any case removed in order to intervene on the shock absorber. A special press is used to remove the spring.

The overhaul of a shock absorber requires its removal from the car, washing, dismounting, replacement and remounting of the parts, recharge and reinstallation on the vehicle.

The shock absorber is secured on one end to the frame of the car and on the other to the axle for transmission of movement to the wheel. According to the model of the vehicle, access to the shock absorbers is from behind the wheels or directly from the engine area. In the first case, in order to remove the shock absorber the vehicle is lifted and the wheel is removed. A hydraulic lift is used, or the jack with safety horses being placed.

In the second case lifting is not technically necessary, but it may be useful for bringing the vehicle to a height favouring more comfortable postures during work.

Once dismounted, the shock absorber is washed in a special tray with the use of over 90% biodegradable surface-active products and subsequently dried.

The spring (if present) is then removed; the piston is released from the cylinder by loosening the nut and the blocking plug. The oil retainers and rings can then be replaced.

If the threading is ruined, the cylinder is cut and then re-threaded on the lathe.

Sometimes it may be necessary to overhaul on the lathe and/or re-apply the chrome plating of the piston rod.

The chrome plating is contracted to specialised enterprises.

The used oil is collected in barrels and delivered to specialised disposal firms (Consorzio Obbligatorio Used oil).

The oil new is contained in barrels and transferred with transfer pumps into smaller containers (cans with funnels).

EQUIPMENT AND MACHINERY

Compressed air screw gun

Compressed air screw gun.

Press for the removal and remounting springs

This consists of a column to which a shock absorber is secured with metal clamps. The upper part of the car is lowered and secured to the upper part of the spring. The holding nut is thus unscrewed and then slowly lifted to gradually eliminate the tension of the spring, preventing it from coming out violently. The opposite operation takes place to tighten the spring in its position.

Disc saw

This is an electric disc saw manoeuvred manually.

Lathe

This is an electric tool, equipped with a rotating disc to which the piece being processed is secured, with shreds being removed by steel elements mounted on mobile tower operated manually.

Column drill

This is a vertical drill equipped with a belt system for the regulation of speed, operated manually and with electric functioning.

Table mill

This is an electric machine equipped with rotating abrasive discs to which the piece being processed is applied manually.

Washing basin

This is a container supplied with hot and cold water and a drain on the bottom.

Adjusting tables

Metallic tables equipped with clamps and containers for tools.

RISK FACTORS

Exposure to dust

During removal from the vehicle and the subsequent reinstallation, the mechanics are exposed to the dust accumulated by the vehicle from driving, containing solid particulate etc.

Work near shred removing machinery

Work with machine tools with removal of shreds (drill, cutter, lathe etc.) may involve flying splinters.

Work near moving mechanical parts

This is mainly due to work with machine tools, such as in a mechanical repair shop, with possible accidents from catching and dragging in rotating parts and contact with tools, projection of the piece being processed.

Handling of oil for shock absorbers

This is hydraulic oil. The working temperatures are relatively low, therefore no substantial change occurs in the composition of the oil, except the presence of metallic particles deriving from the wear of the shock absorber.

Exposure to noise

This is mainly due to machine tools. The screw gun also produces significant noise.

EXPECTED AND RECORDED HARM

Harm to the eyes may take place due to flying splinters and shreds.

In case of contact with the tool workers may suffer from injuries and cuts to the hands. In case of catching and dragging they may also suffer from contusion.

Exposure to noise can involve deafness and collateral harm.

Skin contact with hydraulic oil for shock absorbers may cause irritation of the skin, and in case of prolonged contact, eczema.

PREVENTIVE MEASURES

For the protection from moving mechanical parts the workers must be adequately informed and trained, and machinery supplied with devices preventing sudden start-up in case of the return of electric power supply after this has been cut off. In particular:

Disc cutter: for the protection of the disc with cutting teeth, it must be equipped with a fixed carter and a mobile semi-carter leaving only the active portion of the disc uncovered, and be supplied with a button on the control device requiring the operator to be present.

Column drill: it must be equipped with a piece-holder, a protective screen near the tool and an interblock device on the cover of the rpm control.

Lathe: the rotating chuck must be protected with a mobile carter equipped with an interblock device, which prevents machine operation if the protection is raised. The tool must be protected by a transparent screen in order to avoid flying splinters and to allow visibility of processing. Also the rear of the lathe must be protected by a fixed screen. There must be a braking system of the chuck. In the case of start-up with protruding lever, there must be a device requiring start-up in two steps, in order to avoid accidental start-up.

Fixed mill: it must be equipped with a label on the structure or a sign if the diameter of the mill is less than 50 mm, indicating the type, quality, diameter and maximum velocity of use. The mill must be fixed to the chuck by two flanges of adequate resistance, with an equal diameter not less than one third of that of the mill. The rotating disks must be protected by strong metal shields surrounding most of the mill, designed to resist the shock of mill fragments in case of breakage. The piece holder must be adjusted at a distance not exceeding 2 mm in order to avoid the dragging of the piece being processed. It must be equipped with unbreakable screens for protection from flying splinters. Workers must wear PPD (glasses, gloves).

Press for the removal and remounting of springs: it must be equipped with protection screens against accidental release of shock absorber springs.

In order to reduce exposure to dust the information and training of workers is required, the of PPD (mask, gloves, glasses, overalls), and avoid the cleaning with compressed air, but instead use an industrial vacuum cleaners.

In order to avoid skin contact with hydraulic oil for shock absorbers, it is necessary to use PPD (gloves, glasses, overalls), and avoid keeping oily rags in pockets.

In order to reduce exposure to noise, compressed air screw guns must be sound-proofed. According to the level of exposure, the workers must be informed, trained and wear PPD for the protection of hearing (earplugs, earpieces).

EXTERNAL CONTRACTS

This phase may be contracted. There are also enterprises dealing exclusively with this work (except chrome plating, contracted to plating enterprises).

REFERENCE LEGISLATION

- Pres. Dec.547/55
- Pres. Dec.303/56
- Leg. Dec.493/86

- Leg. Dec.277/91
- Leg. Dec.626/94

EXTERNAL IMPACT

Waste water

The washing water of shock absorbers containing over 90% biodegradable surface-active products dust, traces of hydraulic oil, is poured into public sewers or conveyed to a water purification plant.

Spilling of hydraulic oil

In order to avoid spilling of hydraulic oil on the ground, containment basins are used.

Waste

Hydraulic oil, rubber rings, scrap metal.

REPLACEMENT LIQUIDS, FILTERS, SPARKPLUGS

DESCRIPTION OF PHASE

The replacement of engine oil involves two separate phases: the emptying of the used oil and the subsequent filling with the new oil.

For the emptying of motor oil, the vehicle is raised on the hydraulic lift or placed over the inspection hole.

The collecting pan is placed under the oil sump and a hand tool is used to open the screw.

After emptying, the oil sump screw is put back, the vehicle is brought to floor level, the bonnet is opened and the motor oil cap is removed for filling.

The oil new may be in tins (as occurs at service stations) or taken from barrels with pumps for transfer to smaller containers (cans or similar).

Other operations consist in the replacement of the engine oil filter, the replacement of the air filter and the replacement of sparkplugs.

EQUIPMENT AND MACHINERY

Container for recovery of used oil with compressed air emptying system

RISK FACTORS

Handling of oil

The oil used in cars is mineral oil which generally has a variable composition.

In general, used oil for internal combustion engine contains hydrocarbons, paraffin, naphthene compounds, aromatic compounds, mononucleates and polynucleates. For petrol engines the increase of IPA is up to 1000 times with concentration of benzopyrene up to 71 mg/Kg. The increase of IPA seems to be due to petrol combustion products. Used oil may be contaminated by lead up to 1%.

EXPECTED AND RECORDED HARM

Pathologies from the use oil

Motor oil contains a class of compounds with risks of acute harm (allergies, dermatitis) and chronic harm (cancer), besides psychological problems for always having dirty hands.

Dermatitis from skin contact may also occur from the use of solvents and soap that de-grease the skin. Oil in long-term contact with the skin (e.g. overalls soiled with oil) may cause folliculitis (inflammations due to the penetration of oil in the fat present in the follicles, favouring bacterial growth).

Petroleum products such as heavy oil may cause characteristic diseases such as "oil buttons", a dermatosis occurring on the forearms, chest and thighs. The oil acts on the follicular openings, producing hyperkeratosis with the closing of sebaceous flows in the follicles. There may also be various types of dermatitis or allergies due to the additives used.

Used oil, due to the high content of aromatic and benzopyrene compounds, may cause skin cancer. The disease occurs initially with scaling, and then dermatitis which after prolonged exposure degenerates into skin cancer.

Used oil has also been blamed on cancer of the scrotum. This cancer may be due to continuous contact of the scrotum with oily clothing; the scrotum contains many sebaceous glands and

therefore fats in which the lubricants may dissolve. In a French case study the correlation between scrotum cancer and the presence of large amounts of benzopyrene in the oil used has been documented in two workers.

In general, with regard to the cancer-causing features of oil, the IARC has established in two major categories:

- not heavily refined: classified as undoubtedly cancer-causing for man (Group 1).
- heavily refined: classified among the substances for which an opinion on cancer-causing cannot be established (Group 3).

However, the European Union, in classifying the products derived from petroleum and coal (obviously including mineral oil) has used different criteria from refining alone. The mixtures to which a single CAS identification number and a single EC index number have been assigned, classifying approximately 600 substances as cancer-causing (R45) unless the producer can show that they contain (Pres. Dec. n. 52/97):

- less than 0.1% weight/weight of 1,3-butadiene
- less than 0,1% weight/weight of benzene
- less than 3% of DMSO (Dimethyl sulphur oxide) extract according IP 346 standards
- less than the 0.005% weight/weight of benzo- (a) pyrene

or if the producer, knowing the entire refining cycle, can show that the substance from which the product is derived is not cancer-causing.

Besides physical harm, the psychological aspects should not be underestimated, especially for young workers. The skin of the hands, when constantly in contact with these substances, tends to absorb them. Therefore it becomes very difficult to clean the hands, with evident psychological consequences when the worker is outside the work environment.

PREVENTIVE MEASURES

Prevention during use of oil

For removing used oil it is necessary to use all precautions for avoiding spilling and soiling. In particular, collection trays on mobile waterproof containers may be used, with subsequent emptying by compressed air (see photo).

For putting in new oil, prevention consists in the first place in the use of the least dangerous type of oil, i.e. heavily refined (it is thus essential to read the label and safety data cards, which must be correctly filled in). In any case necessary soiling must be avoided.

Adequate information and training of workers is therefore necessary, with the use of individual protective devices such as gloves and aprons, and to avoid keeping in oily rags or using oily gloves.

EXTERNAL CONTRACTS

This phase is not contracted.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 626/94

EXTERNAL IMPACT

Spilling of used oil on the ground

When changing the oil of vehicles any spilling, spreading and percolation should be avoided. The replacement of used oil and operations filling up the oil must be conducted in conditions of maximum safety and hygiene in order to avoid careless operations or inadequate equipment from leading to spreading and spilling of oil on the ground or in the water.

Since motorists often buy the oil themselves at shops and supermarkets, the mechanics who change oil should explain to the customer that the oil is harmful to the environment and can harm everyone's health; all precautions and professional skills necessary for properly conducting this work should therefore be used.

Before of delivery firm specialised firm, the used oil should be stored properly and in safe conditions for environment and for workers. Containers preventing risks of breakage and spilling should therefore be used. Containers suited a this purpose must comply with precise rules. In particular they must be equipped with:

- Suitable closing to prevent leakage of the contents;
- Accessories and devices designed for filling and emptying in safe conditions;
- Containment basins in case of breakage or spilling;
- Holding devices to ensure safe handling operations.

The arrangement of containers must be designed in order to avoid any accidental hitting and other serious problems.

When the maximum of the oil container used is almost reached, call exclusively the person representing the "Consorzio Obbligatorio degli olii esausti" and deliver the oil in safe conditions (the delivery of unpolluted oil to the used oil Consortium is free of charge), paying the utmost attention to the handling of containers and the work situation of the operations of transferring the liquid.

Employers must therefore provide adequate instructions to employee and apprentices for the correct handling of used oil for purposes of environmental protection, without neglecting regulations for protection of health and safety. The oil is a source of risks (slipping, fire, poisoning) that must be assessed and reduced according to regulations set forth in the relevant legislative decrees 626/94 and 242/96.

Production of waste

Used oil: for correct handling, it is necessary not to mix used oil with water, watery mixtures, oily emulsions oleose and other contaminants. In order to re-use or adequately treat the oil for energy purposes, use oil must contain a percentage of water less than 15% and must not contain other hydrocarbons and organic solvents or chlorides. If these conditions are not met, not only would the re-use be impossible, but recovery could not take place free of charge. It is prohibited to mix used oil with different substances.

Waste identified by the C.E.R	C.E.R. Code	Classification	Note
Used oil from engines, transmissions, gears.	130202	Dangerous	
Brake oil.	130108	Dangerous	
Other oily waste not otherwise specified.	130601	Dangerous	Oil filters.
Rifiuti da demolizione vehicles	160208	Not dangerous	Sparkplugs ???, etc.
Absorbents, filter materials, rags, protective clothing.	150201	Not dangerous	Rags, sawdust, smoke filters.

INTERVENTION ON ELECTRIC PLANT, REPLACEMENT AND RECHARGE OF BATTERIES

DESCRIPTION OF PHASE

Car repair shops for engines generally contract specific intervention on the electric plant of vehicles to specialised enterprises which form another homogeneous sector. Car repair shops for engines may in any case conduct simpler operations that are sometimes necessary.

EQUIPMENT AND MACHINERY

Device for recharge

This may be un a simple battery charger connected by cables to the battery located in an acid-resistant container, or consist of a closed cabinet in acid-resistant material, with transparent doors and equipped with an aspiration system.

Test board

This is used for conducting functional tests on the starter and alternator of the vehicle, by checking on instruments of electrical measurements.

RISK FACTORS

Manual handling of loads

Due to the operation of battery replacement.

Exposure to battery acid

During the recharge of batteries, workers may be exposed to skin contact and inhaling of vapours of acid.

Fire or explosion

The operation of battery recharge involves the danger of fire or explosion. During recharge, the passage of the current causes a process of electrolysis with the production of hydrogen. There is also a partial evaporation of the strong acids contained in the battery. Therefore, without proper ventilation, si there may be a level of environmental saturation that may cause the formation of an explosive mixture.

If an explosion occurs there may be a violent expulsion of strong acids contained in the battery.

Work in uncomfortable postures

EXPECTED AND RECORDED HARM

Manual handling may cause muscular-skeletal disorders and harm to the rachis.

Skin contact and inhaling of acid vapours may cause irritation and chemical burns of skin and mucous membranes due to contact.

In case of fire or explosion, workers may suffer from serious burns, traumatic injury, poisoning. If splashed by battery acid, they may suffer from from skin burns and harm to the eyes.

Work in uncomfortable postures may cause muscular-skeletal disorders.

PREVENTIVE MEASURES

The problem of the manual handling of batteries is solved by using mechanical lifting devices for the batteries and using trolleys for their transport. The information and training for correct postures during handling are essential.

The inhaling of vapours of the acid present in batteries is limited by recharging in a separate and adequately ventilated room. If natural ventilation is not sufficient an aspiration system is necessary. Otherwise closed equipment with aspiration may be used for the recharge.

In order to avoid contact of acid with the skin, during the operations of handling for the replacement of the batteries, caps must be closed and workers must wear acid-proof gloves. The addition of distilled water to the elements of the batteries may occur with an automatic system, with a safety valve preventing the overflow of the acid solution.

There must be a sign indicating the danger from corrosive substances and requiring the use of protective gloves.

In order to reduce the risks of fire or explosion it is necessary to conduct recharge in a room separate from other work areas, adequately ventilated, equipped with suitable electric plant on the basis of the classification of rooms pursuant to CEI 64-2 standards, so as not to be the cause of triggering. No other inflammable materials should be in this room.

Fire-fighting protection must include the presence at least of powder extinguishers of the approved type. In cases of higher risk it may be advisable to install an automatic extinguishing system (for example of the CO₂ type).

Smoking and open flames must be prohibited. These prohibitions must be shown on signs.

EXTERNAL CONTRACTS

This phase may be contracted since there are specialised enterprises undertaking exclusively work on car electric plants.

In general battery recharge operations are not contracted.

REFERENCE LEGISLATION

- Art. 19 "Separation of the dangerous rooms" Pres. Dec. n. 303 of 19.03.1956.
- Art. 20 "Defence of the air from pollution with harmful products" Pres. Dec. n. 303/56.
- Art. 303 "Batteries" Pres. Dec. n.547 of the 27.04.1955.
- Law 475/88
- Resolution of the Inter-Ministry Committee 27 July 1984
- Leg. Dec. 493/86
- Leg. Dec. 626/94

EXTERNAL IMPACT

Spilling of sulphuric acid and contamination of the ground with lead

Dead lead batteries are dangerous for man and the environment since they contain 60-65% in weight of lead and 20-25% of diluted sulphuric acid. Lead interferes with vital biochemical processes and its action attacks the liver, nervous system and reproductive system, while sulphuric acid causes burns and pollutes water.

Until the arrival of the COBAT (lead battery consortium) for collection, dead batteries shall be stored temporarily in mobile containers having the following characteristics (Resolution of the Inter-Ministry Committee 27 July 1984):

- Suitable closing to prevent the leakage of the contents;

- Accessories and devices designed for conducting the operations of filling and emptying in safe conditions;
- Handles to make handling operations safe and easy;
- Edges at least 20 cm above the maximum height of the pile of batteries;
- Marking with visible labels or signs, placed on the recipients themselves or located in storage areas;
- The recipients that have contained batteries and are not re-used for the same types of waste must be submitted to appropriate cleaning treatment for new uses. However, they can never be used to contain food products.

Production of waste

Batteries (lead batteries): These must not be abandoned in the environment, but until collection by the COBAT (Consorzio Obbligatorio Batterie al Piombo Esauste e Rifiuti Piombosi), must be stored with all due care. The residual part, i.e. plastic, involves visual pollution.

The recycling of dead batteries is economical because lead, although dangerous, is valuable, especially for Italy which is obliged to import it. Throwing away a dead lead battery in a refuse tip means losing economic resources and exposing the land to the danger of possible loss from leakage or percolation. With the recycling of the battery, we not only preserve water, air and soil (and therefore the population) from the lead risk, but we also contribute to energy saving when, producing secondary lead, the demand for energy required to process the mineral necessary for primary lead is reduced.

For small scale storage (temporary storage) regional authorisation is not necessary as long as the following conditions (Art. 6, para. 1, lett. m) of Legislative Decree 5 February 1997 n. 22, Ordinary Supplement n. 33 to G.U. n. 38 of 15 February 1997, are respected:

- Temporary storage takes place in the place where the waste is produced (repair shop);
- Absence of polychlorodi-benzodioxin, polychlorodi-benzofuran or polychlorodi.benzophenol in amounts not exceeding 2,5 parts per million (ppm), polychlorobiphenyl and polychlorotriphenyl in amounts not exceeding 25 ppm;
- Temporary storage must not exceed 10 cubic metres; (if this threshold is exceeded, removal shall be conducted at least every 2 months);
- Compliance with regulations on containers.

Compliance with these conditions shall be reported to the provincial authorities on headed paper of the company.

Waste identified by the C.E.R	C.E.R. Code	Classification	Note
Lead batteries	160601	Dangerous	

INTERVENTION ON THE AIR CONDITIONING PLANT

DESCRIPTION OF PHASE

Periodical recharge is conducted for the gas contained in the air conditioning plant of the vehicle. In case of maintenance intervention on the plant, for example for the replacement of tubes, the emptying of the circuit is undertaken by a special device which is then also used for the subsequent recharge.

The gas used in the plant is generally 1,1,1,2 Tetrafluoroethane.

EQUIPMENT AND MACHINERY

Device for charge/discharge of the air conditioning plant

Tanks containing gas for the air conditioning plant

These are steel tanks with a shape similar to those used for domestic gas.

RISK FACTORS

Exposure to 1,1,1,2 Tetrafluoroethane gas

During maintenance work on the plant accidental dispersion of gas in the work environment may occur.

Use of pressure tanks

Tanks containing the 1,1,1,2 tetrafluoroethane gas under pressure are a danger since they may explode due to the pressure of the gas contained inside.

EXPECTED AND RECORDED HARM

Exposure to 1,1,1,2 Tetrafluoroethane may cause dizziness and narcosis. In high concentrations it may cause asphyxia.

For more information on this product consult the monographic review on 1,1,1,2 Tetrafluoroethane of the World Health Organisation: "Concise International Chemical Assessment Document n.11 - IPCS (International Program on Chemical Safety) - W.H.O."

PREVENTIVE MEASURES

In order to reduce the risk of explosion, tanks containing 1,1,1,2 tetrafluoroethane gas under pressure must be stored correctly, a separate, ventilated place not exposed to sunlight and far from any sources of heat. The necessary precautions must be taken in order to avoid the dispersion of the gas in the work environment. In case of accidental dispersion, workers must have the necessary devices available for the protection of the respiratory tract.

EXTERNAL CONTRACTS

This phase may be contracted to an external firm.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 626/94

EXTERNAL IMPACT

Accidental release of the 1,1,1,2 Tetrafluoroethane gas in the air may occur.

INTERVENTION ON CARBURETTORS, INJECTORS AND FUEL PUMPS

DESCRIPTION OF PHASE

Injection pumps and injectors for petrol and diesel engines may need periodical cleaning and calibration accordance with the specifications of the manufacturer.

EQUIPMENT AND MACHINERY

Machine for the calibration of diesel injection pumps

This is a machine on which the injection pump is mounted and provides the analysis of its functioning through the measurement of the amount of gasoil that is injected. A special oily liquid and not gasoil is used for the test. The axle of the pump is rotated by the machine, simulating the functioning of the car engine. The pump is connected by metallic tubes to the injectors of the machine that simulate those of the car; through rubber tubes they inject the liquid into transparent cylindrical containers supplied with graduated scale. The machine base consists of a fine grill for the closed-cycle recovery of the liquid, which must be replaced periodically (for example once a year, according to the number of hours of functioning of the machine). The functioning temperature of the liquid circuit is approximately environment temperature.

Machine for testing diesel injectors

This is a machine started manually and holding the injector. A special oily liquid is used in the test to replace gasoil. The liquid is sprayed into a chamber equipped with aspiration.

Device for ultrasound cleaning and petrol injector test

The test method is similar to the previous one. Cleaning takes place in a tray containing water and surface-active agents with the ultrasound source to remove deposits.

RISK FACTORS

Exposure to noise

The machine for the calibration of pumps produces significant noise, due both the movement of the electric engine rotating the pump axle, and to the functioning of the injectors.

Work near moving mechanical parts

The rotating part of the machine for the calibration of pumps may be cause catching and dragging.

Exposure sprays of liquid for pump test

During the dismounting of the pump from the test machine, due to the residual pressure in the circuit, sprays may hit the mechanics.

Exposure to aerosol of pump test liquid

During the spraying by the injector of the liquid in the test device chamber, the diffusion of the aerosol of the liquid in the surrounding environment may occur, with consequent exposure of the worker.

Handling of liquid for pump test

During the mounting, dismounting and handling of pumps and injectors, and during the replacement of the oily liquid of the machine, the mechanics may be exposed in skin contact with the liquid.

EXPECTED AND RECORDED HARM

Exposure to noise may cause damage to hearing and other harm.

In case of catching and dragging by the rotating part of the injection pump test machine may cause traumatic injury.

Sprays of the oily liquid for pump test may cause irritation to the eyes.

The inhaling of aerosol of the oily liquid injector test may cause irritation of the respiratory tract.

The oily liquid used for the calibration of pumps and the testing of injectors may cause irritation when coming into contact with the skin.

PREVENTIVE MEASURES

The least noisy model of machine for injector test must be chosen, and the mechanics must wear PPD for the protection of hearing (earplugs, earpieces). The machine must be placed in a separate area and sound-proofed in order to avoid the propagation of noise to other work areas where other workers could be subjected to indirect exposure.

The rotating part of the pump test machine must be perfectly smooth and have protruding parts that could cause of catching and dragging. The mechanics must avoid wearing long-sleeved clothing that could get caught.

The mechanics of the pump test machine must wear PPD (gloves, glasses, overalls).

The aspiration of the injector test machine must be efficient and turned on before conducting the test. Use of PPD (mask) for the protection of the respiratory tract is recommended.

Workers must be adequately informed and trained.

EXTERNAL CONTRACTS

This phase may be contracted.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 277/91
- Leg. Dec. 626/94
- Leg. Dec. n. 22 of 1997 ("Ronchey Decree" on waste management)

EXTERNAL IMPACT

Diffusion of noise

Deriving from the injection pump test machinery.

Spilling of pollutant liquids on the ground

Spilling of the oily liquid used in pump and injector test machinery, during replacement.

Production of waste

The oily liquid used in pump and injector test machinery must be replaced once it has been fully used.

INTERVENTION ON AIRBAG

DESCRIPTION OF PHASE

Sometimes, especially after work conducted in body shop, it may be necessary to correctly install the connections of the airbag.

RISK FACTORS

Work near explosive products

In case of mistaken procedures or accidental hitting of the control device (located in the central channel of the vehicle interior) the activation of the explosive charge causing the opening of the airbag may occur.

EXPECTED AND RECORDED HARM

If the airbag explodes while mechanics are inside the vehicle, they may suffer from harm to the eyes.

PREVENTIVE MEASURES

If the airbag must be removed, it must be stored in special metallic cabinet with a lock and specific sign.

Emergency eyewash must be available.

EXTERNAL CONTRACTS

This phase cannot be conducted by all car repair shops.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 626/94

WASHING PIECES OF ENGINES AND CARBURETTORS, DEGREASING.

DESCRIPTION OF PHASE

The washing of pieces of carburettors and engines, soiled with grease and of lubricating oil, is conducted using solvents such as petrol, gasoil, kerosene, perchloroethylene and trichloroethylene.

EQUIPMENT AND MACHINERY

Washing trays for pieces

RISK FACTORS

Handling and exposure a vapours of solvents and fuel

The solvents and fuels listed above and used degreasers may be absorbed by skin contact or by inhaling.

Petrol, gasoil and kerosene were sometimes also used also for washing hands; naturally this is prohibited.

Fire or explosions may occur.

Handling parts mechanical soiled with oil and grease

The handling of objects soiled with grease and oil involves exposure by skin contact to these chemical products.

Manual handling of loads

This is due to the transport of the pieces to be cleaned, which are slippery and can thus easily fall and hit the workers' feet. The weight of the objects is variable.

EXPECTED AND RECORDED HARM

All or almost all petroleum products, in contact with the skin, may cause dermatitis and eczema, especially with prolonged contact. Skin lesions produced by contact, due to loss of fats, are called "petroleum scabies" and workers suffer from dry and red skin and itching.

Upon inhalation, petrol has a general toxic action due to their solvent action on fats. This toxic action is stronger on the nervous and pulmonary systems. One of the components of petrol is hexane, the inhaling of which may cause, dizziness, anorexia, vomit and subsequently nervous symptoms. Chronic poisoning may cause various nervous disorders to the senses and motor functions. Car petrol is also contaminated by benzol and contains lead as an anti-detonant. French studies on exposure of mechanics to this risk factor show an excess of leukaemia with respect to the average population.

The inhaling of gasoil vapours, according to some studies, may cause gastritis, chronic gastroduodenitis of the hyperchloride type and subsequent ulcers.

Exposure to perchloroethylene and trichloroethylene may cause irritation of the mucous membranes and narcosis. Acute intoxication may cause headache, nausea, vomit, somnolence or coma. Chronic poisoning shows with dermatitis, eczema, liver damage, nervous trouble and somnolence.

Skin contact with oil may cause acute (allergies, dermatitis) and chronic harm (cancer), besides psychological problems for always having dirty hands.

For greater details see the paragraph on the work phase of replacement of vehicle oil.

During the handling of heavy mechanical parts, workers may suffer from traumatic injury to their feet due to falling, and according to the weight to be handled, there may be harm to the rachis and muscular-skeletal system.

PREVENTIVE MEASURES

If volatile and inflammable organic solvents are used, the washing device must be equipped with local aspiration; the electric plant must be suitable to the danger of the place where it is installed according to the CEI classification. Smoking and open flames must be prohibited. These prohibitions must be shown on signs. There must be fire-fighting equipment (extinguishers etc.).

In any case the use of non-inflammable solvents is recommended.

In order to avoid contact with oil, rubber gloves and suitable clothing must be used. The gloves normally used are very adherent to the hands and guarantee sufficient sensitivity, but they are not suited to contact with petrol for which it is necessary to wear rubber gloves of the most resistant type.

In order to reduce risks from manual handling, equipment may be used in handling (trolleys etc.). Workers must wear safety shoes supplied with a reinforced point.

EXTERNAL CONTRACTS

This phase in general is not contracted.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 626/94
- Leg. Dec. n. 22 of 1997 ("Ronchey Decree" on waste management)

EXTERNAL IMPACT

Spilling on the ground

Waste water

Production of waste

ADJUSTING, WELDING, MECHANICAL WORK ON MACHINE TOOLS

DESCRIPTION OF PHASE

Minor mechanical repairs may be necessary on machine tools. In general there may be several column drills, fixed mills and lathes. In any case the use of this machinery is limited and occasional. Welding for support rods of various parts (shock absorbers, etc.) may be conducted. On older machinery not protected by corrosion-proof paint, reinforcement welding on the frame may be required.

Furthermore welding for the repair of exhaust pipes and mufflers may take place. The latter operation may be contracted to external firms, since there are specialised firms exclusively repairing mufflers.

EQUIPMENT AND MACHINERY

Lathe

This is an electric machine equipped with a rotating chuck to which the piece to be processed is secured, with removal of shreds by steel tools mounted on a mobile tower operated manually.

Column drill

This is a vertical drill equipped with a belt system for the regulation of the speed, started manually and with electric functioning.

Table mill

This is an electric machine equipped with rotating abrasive discs to which the piece being processed is applied manually.

RISK FACTORS

Exposure to welding fumes

The welding involves exposure to risks of inhaling carbon monoxide, ozone, metallic fumes (iron, zinc, lead oxide).

It should be recalled in any case in activities of the sector, welding is an operation which is conducted occasionally, and therefore exposure is limited.

Exposure to non-ionising radiations

Welding involves exposure to infrared (IR) and ultraviolet (UV) radiation.

It should be recalled that in any case in the activities of the sector, welding is an operation which is conducted occasionally, and therefore exposure is limited.

Work that can involve flying incandescent splinters

Welding exposes workers to flying incandescent splinters, with risk for the eyes.

Fire or explosion

The incandescent splinters expelled during welding can reach petrol (for example a small leak) and dare thus cause a fire which can spread rapidly to the petrol tank causing the explosion of the vehicle.

If the panel of the car is on, the fuel pump could turn on, leading to possible leaks, perhaps while the mechanic is welding.

The risk of explosion is also considerable during the repair of mufflers and exhaust pipes when these are near the petrol tubes. This risk is lower in more recent cars with catalytic filter mufflers

since, working at higher temperature, the exhaust pipe and mufflers are far from petrol tubes. Furthermore catalytic filter mufflers are less likely to need repairs with welding.

The explosion of a vehicle may cause a fire which can propagate to the other cars present, leading to further explosions.

In our zone accidents of this type have taken place.

Use of portable electric equipment

Welding involves risks of electrocution.

EXPECTED AND RECORDED HARM

The massive inhaling of welding gas and fumes may cause cases of pulmonary edema, chronic bronchitis or obstructive emphysema or cause the syndrome of the "welder's lung" due to pneumoconiosis (siderosis) and the irritating action of welding fumes. Disturbance to the digestive system may likewise occur.

Exposure to the radiation emitted during welding may harm sight with cases of retina trauma with problems such as the sensation of light persisting although the eyelids are closed, or chronic alterations such as "welder's cataract" due to radiation (infrared in welding).

In case of explosion of a vehicle, workers may suffer from very serious burns, traumatic injury and poisoning.

PREVENTIVE MEASURES

In order to reduce exposure to welding gas and fumes it is necessary to use systems of local aspiration, for example portable aspirators with flexible tubes to be positioned as close as possible to the source of emission.

PPD for welding: apron, gloves in leather or fire-proof fabric, glasses, visors and masks, arm-pieces, shoe covers in leather or fire-proof fabric.

In order to reduce the risk of electrocution during welding, electric welding equipment must be equipped with a multi-polar safety device on the electric connection. The power supply of the clamp must be equipped with continuous insulation adequate for the voltage and for purposes of conservation and effectiveness, environment temperature and humidity and mechanical wear.

In order to reduce the risk of explosion during the welding is necessary, before welding:

- Turn off the engine and remove the key from the panel.
- Ensure that there is no petrol leakage from tubes, joints etc.... and if so eliminate them by repairing.
- Mark the area of operation by placing protection with fire-resistant material in order to avoid incandescent welding sparks from reaching inflammable parts.

Workers must be informed and trained and the electric plant must be suited to the risk classification of the place according to CEI regulations.

For protection from moving mechanical parts the workers must be adequately informed and trained, and machinery supplied with devices preventing sudden start-up in case of the return of electric power supply after this has been cut off. In particular:

Column drill: It must be equipped with a piece-holder, a protective screen near the tool and an interblock device on the cover of the rpm control.

Lathe: The rotating chuck must be protected with a mobile carter equipped with an interlocking device, which prevents machine operation if the protection is raised. The tool must be protected by

a transparent screen in order to avoid flying splinters and to allow visibility of processing. Also the rear of the lathe must be protected by a fixed screen. There must be a braking system of the chuck. In the case of start-up with protruding lever, there must be a device requiring start-up in two steps, in order to avoid accidental start-up.

Fixed mill: It must be equipped with a label on the structure or a sign if the diameter of the mill is less than 50 mm, indicating the type, quality, diameter and maximum velocity of use. The mill must be fixed to the chuck by two flanges of adequate resistance, with an equal diameter not less than one third of that of the mill. The rotating disks must be protected by strong metal shields surrounding most of the mill, designed to resist the shock of mill fragments in case of breakage. The piece holder must be adjusted at a distance not exceeding 2 mm in order to avoid the dragging of the piece being processed. It must be equipped with unbreakable screens for protection from flying splinters. Workers must wear PPD (glasses, gloves).

EXTERNAL CONTRACTS

This phase may be contracted to external firms.

REFERENCE LEGISLATION

- Pres. Dec. 303/56
- Pres. Dec. 547/55
- Leg. Dec. 493/86
- Leg. Dec. 277/91
- Leg. Dec. 626/94
- Law 447/95 on noise emissions outside car repair shops.

EXTERNAL IMPACT

Diffusion of noise

Noise from machine tools.

SUPPLY OF COMPRESSED AIR

DESCRIPTION OF PHASE

In a car repair shop compressed air is used for screw guns, to convey liquids such as oil from collection containers, or to inflate tyres.

EQUIPMENT AND MACHINERY

Compressor

This is an electric engine operating a piston pump which has the function of compressing the air and putting it in a pressurised metallic tank.

RISK FACTORS

Exposure to noise

The compressor produces considerable noise.

Explosion

The pressurised tank for compressed air may explode due to structural problems.

EXPECTED AND RECORDED HARM

The noise may cause damage to hearing and other harm.

In case of explosion of the tank with flying metallic parts, workers may suffer from traumatic injury.

PREVENTIVE MEASURES

In order to reduce exposure to noise, the compressor must be silenced by sound-absorbing and insulating shields, equipped with sound-proof valves and possibly in a separate room.

In the case of pressurised equipment or recipients, subject to regulations of the former ANCC, reporting for purposes of the testing to the relevant ISPESL department is obligatory. Subsequent periodical checking is undertaken by the supervisory bodies (Multinational of Prevention Department, plant and accident sector).

EXTERNAL CONTRACTS

This phase is not contracted.

REFERENCE LEGISLATION

- Law of 21.11.1972 "Regulations of construction of pressurised equipment" (authorised A.N.C.C. – now I.S.P.E.S.L. – to issue technical regulations and rules).
- Tit. IV, Chapter XIII, Art. 167 "Compressors" Pres. Dec. n.547 of 27.04.1955.
- Tit. VI, Chapter II, Art. 241 "Requisites of resistance and suitability" Pres. Dec. n.547 of 27.04.1955.
- Regulations UNI EN 1012/1, 1012/2
- Leg. Dec. 493/86
- Leg. Dec. 277/91
- Leg. Dec. 626/94
- Law 447/95 on noise emissions outside car repair shops.

EXTERNAL IMPACT

Diffusion of noise

The compressor may cause diffusion of noise outside.

TESTING AND ROAD TRIAL OF VEHICLES.

DESCRIPTION OF PHASE

Once the necessary repairs are completed, the car may be tested outside by testing personnel. In larger car repair shops, the tested conducts only this specific task.

Sometimes the outside vehicle testing is also conducted before repair, for example when the Customer reports having the impression of some malfunctioning or strange noise.

In both cases the tester drives the vehicle on the road, sometimes with the Customer present.

RISK FACTORS

Driving of vehicles

The main risk of this phase is due to possible involvement in road accidents.

The risk is increased by the fact that in order to test vehicle performance, the mechanics often drive in a brusque and impulsive way in streets near the repair shop, which are usually occupied by normal road traffic.

EXPECTED HARM

In case of road accident the mechanics may suffer from serious injury.

PREVENTIVE MEASURES

For the larger car repair shops with large external spaces, the construction of testing roads would be advisable. In any case this solution is impracticable for most urban car repair shops, therefore, in order to reduce the risk of road accidents, training of workers to careful driving is required, in particular for the fact that city streets may not be considered as "testing grounds".

EXTERNAL CONTRACTS

In general this phase is not contracted since the relationship of trust with the Customer is essential.

REFERENCE LEGISLATION

- Leg. Dec. 626/96