

3.3.3 Outline of Equipment and Tools to be Supplied

(1) Machine shop course

The equipment list for the machine shop course consists of equipment and tools required for basic and intermediate courses, including lathes, drilling machines, milling machines, shaping machines, and grinders.

Equipment and tools, their description and intended use, and applicable courses are summarized in Table 3.3.4.

Table 3.3.4 List of Equipment and Tools for the Machine Shop Course, and Purpose of Use

Code No	Equipment name	Description/use	Applicable course
MS- 1	Center lathe (360 x 550)	Machine to turn and cut a workpiece. The lathe is the most important and basic machine tool. This lathe is used for basic training for lathe operation.	Turning
MS- 2	Center lathe (510 x 1,500)	Used for training for machining medium-sized workpieces	Turning
MS- 3	Center lathe (510 x 2,000)	used for training for machining long workpieces	Turning
MS- 4	Upright drilling machine	Used to drill a hole in a workpiece. Also a basic element of machining operation	Drilling
MS- 5	Radial drilling machine	Suitable for drilling into large workpiece, with drill shaft capable of turning around the vertical column	Drilling
MS- 6	Vertical milling machine	Machine to cut workpiece by rotating circular cutter	Milling
MS- 7	Universal milling machine	Used to train a variety of machining operations, such as gear cutting, drilling, tapering, and dividing, by using attachments, in addition to milling operation	Milling

Code No	Equipment name	Description/use	Applicable course
MS- 8	Shaping machine	Machine to shape surface or groove of small workpiece The cutter moves reciprocally over the fixed workpiece	Shaping
MS- 9	Copying lathe	The lathe to automatically cut workpiece by feeding bit according to the shape of template	Copy shaping
MS-10	Surface grinding machine	Machine to grind surface of workpiece	Surface grinding
MS-11	Cylindrical grinding machine	Machine to grind outer face of equal diameter or tapered cylinder	Cylinder grinding
MS-12	Power hacksaw	Machine to cut metal by power operated hacksaw	Metal cutting
MS-13	Pedestal grinding machine	Machine to grind cutters, drills, and milling cutters by rotating grinding wheel	Grinding
MS-14	Twist drill grinding machine	Machine to grind drill cutters	Drill grinding
MS-15	Universal tool grinder	Machine to grind various cutting tools	Tool grinding
MS-16	Bench drilling machine	Machine to drill into workpiece by rotating drill	Drilling
MS-17	Cut-off grinding machine	Grinder for cutting metal	Metal cutting
MS-18	Air compressor	Machine to produce compressed air used for cleaning workpiece surface or prime mover for pneumatic equipment	Machine shop
MS-19	Face milling cutter	Cutter for face milling operation	Milling
MS-20	Plane milling cutter set	Milling cutter for surface cutting	Milling
MS-21	End mill set	Milling cutter set having cutters on circumference and edges, used to machine circumference, holes and grooves of workpiece	End milling

Code No	Equipment name	Description/use	Applicable course
MS-22	Heavy duty end mill set	Milling cutter set used for large and heavy duty end cutting.	End milling
MS-23	Ball end milling cutter set	The milling cutter to shape circular surface	Milling
MS-24	Shell end mill set	Also called the cylindrical bottom milling cutter set The large end mill with detachable end, mainly used to cut wide surface	Milling
MS-25	Roughing end mill	Milling cutter for rough cutting	Milling
MS-26	T-slot milling cutter set	Milling cutter for cutting T-shaped slot	Milling
MS-27	Side milling cutter set	Milling cutter having radial cutters on both sides of flat mill	Milling
MS-28	Concave milling cutter set	Milling cutter to shape concave surface	Milling
MS-29	Convex milling cutter set	Milling cutter to shape convex surface	Milling
MS-30	Single angular milling cutter set	Used to shape tapers, grooving, mill cutting	Milling
MS-31	Single angle milling cutter set	Milling cutter set to shape dovetail grooves	Milling
MS-32	Double angle milling cutter set	Milling cutter set to shape V grooves	Milling
MS-33	Gear cutter	Cutting tool attached to milling machine for gear cutting	Gear cutting
MS-34	Twist drill set	Cutting tool having twist grooves on circumference, and attached to drilling machine	Drilling
MS-35	Center drill	Drill used to bore a center hole	Drilling
MS-36	Taper reamer set	Tool to finish drilled hole to specified dimensions	Reaming
MS-37	Taper reamer set (finishing)	tool for finish reaming	Reaming

Code No	Equipment name	Description/use	Applicable course
MS-38	Cemented carbide chip	Chip attached to the end of bit and used for cutting	Cutting tool
MS-39	Knurl	Hard steel made tool used for making small ridges on workpiece	Knurling
MS-40	Dial test indicator with stand	Instrument to measure length and displacement with high accuracy	Measuring tool
MS-41	Vernier caliper (inch scale)	Precision measuring instrument to measure outer or inner diameters with ease by using vernier and caliper, on inch scale	Measuring tool
MS-42	Vernier caliper (millimeter scale)	Vernier caliper on millimeter scale	Measuring tool
MS-43	Digital micrometer	Digital type micrometer	Measuring tool
MS-44	Inside micrometer	Micrometer to measure inner diameter	Measuring tool
MS-45	Outside micrometer	Micrometer to measure outer diameter	Measuring tool
MS-46	Digital indicator	Digital type indicator	Measuring tool
MS-47	Vernier height gauge	Measuring instrument to measure height by using vernier caliper vertically	Measuring tool
MS-48	Vernier digital height gauge	Digital type height gauge	Measuring tool
MS-49	Thread micrometer	Micrometer to measure effective diameter of internal and external threads	Measuring tool
MS-50	Screw pitch gauge	Gauge to measure and check thread pitch and shape at field	Measuring tool
MS-51	Gear micrometer	Micrometer to measure gear pitch	Measuring tool
MS-52	Radius gauge	Used to measure surface roundness	Measuring tool
MS-53	Steel plain protractor	Steel protractor used to measure angles on workpiece	Measuring tool

Code No	Equipment name	Description/use	Applicable course
MS-54	Combination square	Straightedge combined with protractor, square, and center head for centering circle, also used as a straightedge	Measuring tool
MS-55	Graduated square	Square with graduation	Measuring tool
MS-56	Surface plate	Cast iron-made plate finished precisely flat and smooth, used for surface inspection and correction of distortion on thin plate	Measuring tool
MS-57	Multi tester	Used to measure voltage, current, and resistance	Electrical instrument
MS-58	Universal hardness tester	Instrument to measure mechanical hardness of metal	Measuring instrument
MS-59	Diamond dresser	Tool to dress grindstone	General tool
MS-60	Tool holder	Holder for cutting tool with square or circular section, used for lathe or drilling	General tool
MS-61	Bench vice	Tool to hold workpiece for manual finishing work, attachable to work bench	General tool
MS-62	Bench vice (universal type)	Vice with rotating table	General tool
MS-63	Tools cabinet	Cabinet to store tools	General fixtures
MS-64	Hand pallet truck	Used to transport workpiece	General work, safety
MS-65	Educational video tapes	Basic machining Basic lathing Lathing End mill grinding Finishing Drilling Surface grinding Turning tool Precision measuring tool Tool grinding	Machining in general Turning Turning Grinding Draw-filing Drilling Surface grinding Turning tool Measuring tool Milling

(2) Arc welding course

Equipment and tools to be supplied for the course include basic equipment and tools required for welding training, including welding machines and cutters, and auxiliary equipment including bending rollers, folding machines and power hacksaw.

Also included are non-destructive testing equipment essential in inspection of welds, such as X-ray radiographic equipment and ultrasonic tester, and magnetic particle tester. The universal tester should be shared with the machine shop course in consideration to a less frequent use compared to other testing equipment.

Equipment and tools, their description and intended use, and applicable courses are summarized in Table 3.3.5.

Table 3.3.5 List of Equipment and Tools for the Arc Welding Course, and Purpose of Use

Code No	Equipment name	Description/use	Applicable course
AW- 1	Arc welding machine	Machine to weld metal by heat produced by arc	Arc welding machine
AW- 2	Arc welding machine (large)	Arc welding machine with large current capacity	Arc welding machine
AW- 3	AC/DC integrated TIG welding set	Welding machine used for inert gas arc welding, using argon as inert gas, tungsten for electrode, and both AC and DC	TIG welding
AW- 4	MIG welding set	Inert gas arc welding machine using welding wire as electrode, used for welding iron, steel, aluminum, and titan welding	MIG welding
AW- 5	Plasma welding machine	Used for welding using electrically converged plasma arc	Plasma welding
AW- 6	Automatic flame plate cutting machine	Automatic gas cutter used for straight and arc cutting, and beveling	Automatic gas cutting

Code No	Equipment name	Description/use	Applicable course
AW- 7	Automatic flame pipe cutting machine	Power-operated automatic gas pipe cutter	Automatic gas cutting
AW- 8	Bevel cutting machine	Machine to bevel welding sections	Beveling
AW- 9	Gas welding kit	A set of tools used for gas welding and cutting, including blow pipe, gauge and hose	Gas welding and cutting
AW-10	Shearing machine	Machine to cut metal plate by shearing force	Boiler making
AW-11	Plate bending machine	Mechanical press used to bend long plates	Boiler making
AW-12	Pipe bender	Machine to bend pipe into an arc form	Boiler making
AW-13	Bending roll machine	Machine to fold plate into cylinder or to make rough roundness	Boiler making
AW-14	Pedestal grinding machine	Machine to grind cutters, drills, and milling cutters by rotating grinding wheel	Grinding
AW-15	Hand grinder	Portable power-operated grinder	Grinding
AW-16	Cut off grinding machine	Grinder for cutting metal	Grinding
AW-17	Bench drilling machine	Drilling machine used on bench	Drilling
AW-18	Upright drilling machine	Standalone drilling machine	Drilling
AW-19	Hand drilling machine	Portable power-operated drilling tool	Drilling
AW-20	Power hacksaw	Machine to cut metal by power operated hacksaw	Metal cutting
AW-21	Sheet metal folding machine	Machine to bend steel plate	Boiler making
AW-22	Flanging and bending machine	Machine to bend steel plate or to fold its end to form flange	Boiler making
AW-23	Riveting machine	Riveting machine using pneumatic or hydraulic pressure	Riveting
AW-24	Universal testing machine	Testing equipment to measure tensile, compression, and bending strengths of material	Material strength testing
AW-25	Material bending tester	testing equipment to measure bending strength of welded joints	Material strength testing

Code No	Equipment name	Description/use	Applicable course
AW-26	X-ray radiographic equipment	Instrument to detect weld defects by using X-ray	Weld inspection
AW-27	Ultrasonic tester	Instrument to detect weld defects by using ultrasonic wave	Weld inspection
AW-28	Magnetic particle tester	Instrument to detect weld defects by using magnetic force	Weld inspection
AW-29	Hydraulic tester	Used for pressure resistance test by applying water pressure to container or pipe	Weld inspection
AW-30	Air compressor	Machine to produce compressed air used for cleaning workpiece surface or prime mover for pneumatic equipment	Work shop
AW-31	Stationary electrode drier	Fixed type electrode drier	Basic welding techniques
AW-32	Portable electrode drier	Portable type electrode drier	Basic welding techniques
AW-33	Blower (fume extraction)	Blower to exhaust metal fumes produced in the welding process	Safety and health
AW-34	Positioner	Freely rotating work bench to keep the weld in best position	Welding work
AW-35	Welding table	Table used for welding	Welding work
AW-36	Safety trolley	Two-wheeler to transport gas cylinders	Auxiliary work, safety
AW-37	Ampere tongs	Tool to measure voltage, current, resistance by clamping cable and wire	Electrical measuring tool
AW-38	Work bench	Bench to fix vice and other tools	General tool
AW-39	Hand power chisel	Portable power-operated chisel used to remove slugs after welding	General tool
AW-40	Tap & die set (mm size)	Tool set used to cut mm-size internal or external threads into workpiece	General tool
AW-41	Tap & die set (inch size)	Tool set used to cut inch-size internal or external threads into workpiece	General tool

Code No	Equipment name	Description/use	Applicable course
AW-42	Pipe thread cutter	Tool used to cut threads into pipe	General tool
AW-43	Welding gauge	Gauge to measure build-up and concave dimensions of fillet	Weld inspection
AW-44	Square	Rule having right angle, used to check squareness and flatness of workpiece, or for scribing	Measuring tool
AW-45	Steel rule	Steel-made rule	Measuring tool
AW-46	Measuring tape	Tool to measure length	Measuring tool
AW-47	Self grip welding tongs	Used to hold electrode in the welding process	Welding tool
AW-48	Chipping hammer	Small hammer to remove solidified slugs after welding or to check welds	Basic welding techniques
AW-49	Anvil	Base for forging or metalworking	General tool
AW-50	Bench vice	Tool to hold workpiece for manual finishing work, attachable to work bench	General tool
AW-51	Dividers	Tool to divide lines for drawing or scribing	General tool
AW-52	Scriber	Tool having a needle to draw finishing dimensions on workpiece by using straightedge or surface gauge	General tool
AW-53	C clamp	C-shaped clamp fixing workpiece	General tool
AW-54	Pipe wrench	Hand tool to push in pipe joint and other accessories by turning a pipe	General tool
AW-55	Welding mask	Mask to protect eyes and face from harmful light, sputters and slugs produced from welding	Safety
AW-56	Slide projector	Projector to show slide	General education
AW-57	Overhead projector	Projector to show magnified images on a vertical screen	General education

Code No	Equipment name	Description/use	Applicable course
AW-58	Educational video tapes	General skills and work safety Arc welding Gas cutting Pipe welding Safety in welding shop	Basic welding techniques Arc welding Gas cutting Pipe welding Safety

(3) Refrigeration repair and service course

In line with the global commitment to the abolishment of flon gas, refrigeration equipment and tools using the R134a coolant with no ozone destruction effect will be used. In addition, the training centers are expected to teach maintenance and repair skills for old equipment using flon (R-12) gas, and equipment and tools used for replacement of coolants have been added.

Commercial refrigeration and air-conditioning equipment has been selected in consideration to the training effect. Among them, the absorption refrigeration system is designed under the new concept of air-conditioning, where cooling water (5°C) and warm water are supplied at the same time. The system does not use any type of coolant and burns gas or petroleum, instead of electricity, suitable for the country which is a major producer of natural gas and petroleum. Thus, it is expected to be proliferated in the country.

Equipment and tools, their description and intended use, and applicable courses are summarized in Table 3.3.6.

Table 3.3.6 List of Equipment and Tools for the Refrigeration Repair and Service Course, and Purpose of Use

Code No	Equipment name	Description/use	Applicable course
RS- 1	Refrigerator (1)	All are refrigerators or freezer/refrigerators for household use and will be used to teach the refrigeration cycle. Small models will be used for overhauling, as well as piping. Also, performance characteristics will be measured by using various measuring instruments (including thermometers and power meters).	Measurement/tool
RS- 2	Refrigerator (2)		Freezer
RS- 3	Combination refrigerator		Refrigerator
RS- 4	Freezer		Troubleshooting
RS- 5	Window type air-conditioner	Considering that a variety of models using different cooling capacities and systems are sold, efforts should be made	Measurement/tool
RS- 6	Split type air-conditioner		Air-conditioning
RS- 7	Package type air-conditioner		Troubleshooting

Code No	Equipment name	Description/use	Applicable course
RS- 8	Central air conditioning system	to teach maintenance and repair skills according to performance characteristics of each model. The first two types are mainly used at home and the last types at office.	
RS- 9	Absorption type air cooling system		
RS-10	Air compressor	These equipment will be used to teach the refrigeration cycle consisting of temperature rise by compression, cooling by an air-cooled condensing unit, and evaporation in an evaporator. Cooling efficiency will be measured by using instruments.	Measurement/tools Coolant Refrigerator Troubleshooting
RS-11	Condensing unit		
RS-12	Defrost heater		
RS-13	Single phase compressor		
RS-14	Air cleaning nozzle		
RS-15	Motor speed controller		
RS-16	Thermostat	Components of the control system to turn on and off the compressor on the basis of difference between the actual temperature measured by the sensor and the set temperature, and control relays and switches will be used to teach control functions used for refrigeration technology.	Measurement/tools Electrical drawing Troubleshooting
RS-17	Electronic thermostat		
RS-18	Differential thermostat		
RS-19	Air flow switch		
RS-20	Water level switch		
RS-21	Capacitor		
RS-22	Thermal relay		
RS-23	Electromagnetic switch		
RS-24	Sensor		
RS-25	Relay		
RS-26	Overload limit switch		
RS-27	Temperature probe		
RS-28	Pilot light		
RS-29	Air flow meter	Equipment and tools to measure cooling performance of air-conditioners, used to teach procedures for checking air-conditioner's performance after repair	Measurement/tools Troubleshooting
RS-30	Anemo meter		
RS-31	Hygrothermograph		
RS-32	Clip-on meter		
RS-33	Digital multimeter		
RS-34	Hygrostat		
RS-35	Gas leak detector (1)	Used for training to check the leakage of coolant after piping.	Measurement/tools Troubleshooting
RS-36	Gas leak detector (2)		

Code No	Equipment name	Description/use	Applicable course
RS-37 RS-38	Constant pressure valve Pilot Pressure Valve	Used for training to measure pressure after piping in order to check operating conditions of the whole system.	measurement/tools Troubleshooting
RS-39 RS-40 RS-41 RS-42 RS-43 RS-44	Vacuum pump Charging cylinder Charging manifold Charging hose Charging units Recovery & recycling system	Equipment and tools required to fill and refill coolant. In particular, training will focus on replacement of coolants which will become increasingly important as the use of flon gas (R-12, etc.) will be abolished in 1995.	Measurement/tools Coolant Air-conditioner Refrigerator
RS-45 RS-46 RS-47 RS-48 RS-49 RS-50 RS-51 RS-52 RS-53 RS-54	Gas cutting-welding set Pipe bender Swaging tool Electric pipe cutter Pipe reamer Flaring tool Extractor kit Glass cutter Pipe cutter for copper Socket	Piping is an important element of refrigeration technology. These requirement and tools will be used to train skills related to the bending and cutting of pipes as well as edge treatment.	Measurement/tools
RS-55 RS-56 RS-57 RS-58 RS-59 RS-60 RS-61 RS-62 RS-63	Pillar drilling machine Electric drill Impact electric drill Pedestal grinding machine Vice Pipe vice Tool terminal block set Bench vice Parts and tester	Tools required to install refrigeration equipment. Training for proper use of toos in actual work.	Common in all the courses
RS-64 RS-65 RS-66 RS-67	Refrigeration fundamental trainer (1) Refrigeration fundamental trainer (2) Heat pump cycle trainer Industrial refrigerator trainer	Used for training and experiment to learn the operating principle of refrigeration through operation of individual components	Freezing Refrigeration

Code No	Equipment name	Description/use	Applicable course
RS-68	Refrigeration diagnostic trainer		
RS-69	Refrigerator trainer		
RS-70	Educational video tapes	Introduction to refrigeration and air-conditioning Refrigerator domestic Testing equipment Air-conditioning and cold storage Fundamentals of air-conditioning	Lecture

(4) Pipe fitting course

Training equipment and tools for the pipe fitting course have been selected by excluding those to be less frequently used and requested for the welding course. It is recommended to share such equipment with the welding course.

Equipment and tools, their description and intended use, and applicable courses are summarized in Table 3.3.7.

Table 3.3.7 List of Equipment and Tools for the Pipe Fitting Course, and Purpose of Use

Code No	Equipment name	Description/use	Applicable course
PF- 1	Arc welding machine	A machine to weld metal by heat produced from arc	Arc welding Basic welding technique
PF- 2	Gas welding kit	A set of tools used for gas welding and cutting, including blow pipe, gauge, and hose	Gas welding and cutting
PF- 3	Gas pipe cutting set	A machine to automatically cut pipes by gas	Automatic gas cutting
PF- 4	Upright drilling machine	Standalone drilling machine	Drilling
PF- 5	Bench drilling machine	Drilling machine used on bench	Drilling
PF- 6	Hand grinder	Portable power-operated grinder	Grinding
PF- 7	Twist drill set	A set of drills in various sizes	Drilling
PF- 8	Pipe cutter	A tool used to cut steel pipe into specific length	Piping tool
PF- 9	Roll pipe cutter	Roll type tool to cut steel pipe	Piping tool
PF-10	Cast iron pipe cutter	A tool to cut cast iron pipes	Piping tool
PF-11	Pipe threading machine	Power-operated machine to cut threads into pipes	Threading
PF-12	Pipe thread handle (manual)	Handle for dies to thread pipes	Piping tool
PF-13	Pipe thread dies	A tool to thread pipes	Piping tool

Code No	Equipment name	Description/use	Applicable course
PF-14	Tap and dies set	A set of tools to cut internal or external threads into workpiece	General tool
PF-15	Work bench	Bench to fix vice and other tools	General tool
PF-16	Bench vise	A tool attached to work bench, used to hold and fix workpiece for manual finish work	General tool
PF-17	Sledge hammer	Large heavy hammer used for forging	General tool
PF-18	Blacksmith tongs	Used to hold heated metal	General tool
PF-19	Divider	A tool to divide lines for drawing or scribing	General tool
PF-20	Scriber	A tool having a needle to draw finishing dimensions on workpiece by using straightedge or surface gauge	General tool
PF-21	Adjustable wrench	Wrench with adjustable opening of grips	General tool
PF-22	Shears	Shears to cut sheet metal	General tool
PF-23	Hacksaw frame	Frame for hacksaw	General tool
PF-24	Cold chisel	A tool used for chipping and cutting of material	General tool
PF-25	Pipe wrench	A tool to turn and press pipe into pipe joint and other accessories	General tool
PF-26	Flat files & handles	A set of files to smooth work's surface or corner	File finishing
PF-27	Surface gauge	A tool to scribe or center workpiece on surface plate	General tool
PF-28	Center punch	A tool to punch a mark on mark-off line or center to depict mark-off lines	General tool
PF-29	Trammels	A drafting tool to draw a large circle by attaching to both ends of straightedge	Drafting
PF-30	Hydraulic pressure tester	Used to conduct pressure resistance test by applying water pressure to container or pipe	Welding inspection

Code No	Equipment name	Description/use	Applicable course
PF-31	Steel rule	A ruler made of steel	Measuring tool
PF-32	Measuring tape	A tool to measure length	Measuring tool
PF-33	Vernier calipers	A precision measuring instrument to measure outer or inner diameters quickly by using vernier and caliper	Measuring tool
PF-34	Vernier height gauge	A tool to measure height and size of workpiece and for scribing	Measuring tool
PF-35	Level	A tool to measure level	Measuring tool
PF-36	Square set	A rule having right angle, used to check squareness and flatness of workpiece, or for scribing	Measuring tool
PF-37	I-type square	A square having I-shaped section	Measuring tool
PF-38	Calipers	A tool to measure thickness of workpiece and diameter of round bars	Measuring tool
PF-39	Gate valve	A valve to open or close fluid passage vertically by valve body to align fluid flow	Piping material
PF-40	Globe valve	A valve having a spherical valve box, with center lines of inlet and outlet being aligned, and producing S-shaped fluid flow	Piping material
PF-41	Butterfly valve	A valve having a disk valve body which rotates around valve stem inside the valve box	Piping material
PF-42	Slip on flange	A flange inserted and welded into the edge of pipe	Piping material
PF-43	Welding neck flange	A flange having long hub for butt welding	Piping material
PF-44	Tee (straight)	A T-shaped pipe joint with same diameter, used to connect pipes three way	Piping material
PF-45	Tee (reducer)	A T-shaped pipe joint with different diameters	Piping material

Code No	Equipment name	Description/use	Applicable course
PF-46	Concentric reducer	A concentric choke tube used to connect pipes having different diameters straight	Piping material
PF-47	Eccentric reducer	An eccentric reducer	Piping material
PF-48	Short radius elbow	A pipe joint with relatively small radius of curvature, used to connect pipes which form a certain angle	Piping material
PF-49	Long radius elbow	An elbow with relative large radius of curvature	Piping material
PF-50	Safety goggles	Goggles for general work	Safety and health
PF-51	Welding goggles	Goggles to protect eyes from harmful light and particulate produced during the welding operation	Safety and health
PF-52	Welding mask	Mask to protect eyes and face from harmful light, sputters and slugs produced from welding	Safety and health
PF-53	Wraparound	A wraparound used to prevent body from burning during the welding operation	Safety and health
PF-54	Educational video tapes	Introduction to piping Pipe fitting method Basic lead and steel pipe connecting methods	Pipe fitting operation

(5) Automotive repair and service course

Efforts have been made to select a variety of equipment and tools, particularly those which can meet latest needs. Priority has been given to measuring instruments and tools which are commercially used, and engines which are effective in improving maintenance techniques. In addition, gasoline and diesel engines for ships have been selected to meet large demand in the country consisting of many islands.

Equipment and tools, their description and intended use, and applicable courses are summarized in Table 3.3.8.

Table 3.3.8 List of Equipment and Tools for the Automotive repair and Service course, and Purpose of Use

Code No	Equipment name	Description/use	Applicable course
AS- 1	Gasoline engine trainer	Gasoline and diesel engines for general vehicles, motorcycles, boats, and hand tractors, used to conduct field training for engine maintenance that requires the highest level of experience and skills	Gasoline engine Electricity Maintenance and troubleshooting
AS- 2	Diesel engine trainer		
AS- 3	Motor cycle engine trainer		
AS- 4	Boat engine trainer		
AS- 5	hand tractor engine trainer		
AS- 6	Cut-away model (gasoline)		
AS- 7	Cut-away model (diesel)		
AS- 8	Brake tester	Measuring instruments and testing equipment required for maintenance of motor vehicles, used to provide field training for reliable maintenance activity	Electricity Chassis Body
AS- 9	Headlight tester		
AS-10	Thermostat tester		
AS-11	Valve spring tester		
AS-12	Engine scope		
AS-13	Compression gauge for gasoline engine		
AS-14	Camber-caster-kingpin gauge		
AS-15	Tune up tester		
AS-16	Carburetor balancer		
AS-17	Electrical component tester		
AS-18	Nozzle tester		
AS-19	Timing light		

Code No	Equipment name	Description/use	Applicable course
AS-20	Inside micrometer	Engines and other precision equipment are required to have dimensional accuracy on a micron level. These devices are used to train accurate measurement of various parts	Work bench
AS-21	Outside micrometer		Maintenance and troubleshooting
AS-22	Brake drum gauge		
AS-23	Dial gauge		
AS-24	Feeler gauge		
AS-25	Hydraulic garage jack	Special tools for automotive maintenance, used to train efficient and reliable maintenance procedures	Chassis
AS-26	Auto lift		Body
AS-27	Portable crane		Work bench
AS-28	hydraulic press		Maintenance and troubleshooting
AS-29	Tire chhanger		
AS-30	Wheel balancer		
AS-31	Battery quick charger		
AS-32	Nozzle clearing kit		
AS-33	Spark plug cleaner		
AS-34	Pedestal grinding machine	General tools often used for maintenance of motor vehicles. Training will be conducted to get acquainted with their use for efficient maintenance work.	Chassis
AS-35	Bench drilling machine		Body
AS-36	Electric drill		Work bench
AS-37	Body-repair tool set		Maintenance and troubleshooting
AS-38	Spray gun		
AS-39	Brake lining rivetter		
AS-40	Air impact wrench set		
AS-41	Tube flaring and cutting tool		
AS-42	Vernier caliper		
AS-43	Taps and dies set		
AS-44	Socket wrench set		
AS-45	Torque wrench set		
AS-46	Hose clipper		
AS-47	Hammer		
AS-48	Caddy tool stand		
AS-49	Parts washing stand		
AS-50	Educational video tapes	Maintenance of gasoline engines Maintenance of diesel engines Maintenance of car body	General lecture

Code No	Equipment name	Description/use	Applicable course
		Rustproofing of body Wheel balbncing Precision tools for maintenance Operation and mainenance of diesel engines Introduction to diescl engine	

(6) Furniture course

The equipment for the furniture course are selected from hand tool of basic level to wood machine tools of practical level.

Equipment and tools, their description and intended use, and applicable courses are summarized in Table 3.3.9.

Table 3.3.9. List of Equipment and Tools for the Furniture Course, and Purpose of Use

Code No.	Equipment name	Description/use	Applicable course
FU- 1	Wood lathe	A machine to shape rotated wood by fixed tool, including shaving, threading, and tapering	Furniture making (I), (II)
FU- 2	Surface planer	A machine to smooth or shave wood by rotating tool	Furniture making (I), (II)
FU- 3	Automatic round-end tenoner	A machine to shape tenons for joining wood materials, used in combination with slotboring machine	Furniture making (I), (II)
FU- 4	Automatic slot Mortiser	A machine to shape holes for tenons, used in combination with automotive round-end tenoner	Furniture making (I), (II)
FU- 5	Hollow chisel mortiser	A machine to shape square tenons	Furniture making (I), (II)
FU- 6	Thickness planer	A plane to shave wood surface by means of automatic feeding while keeping reference plane in contact with surface plate	Furniture making (I), (II)
FU- 7	Band saw	Used to cut workpiece straight or circularly	Furniture making (I), (II)
FU- 8	Radial arm saw	A radial saw suspended by a rotating arm to cut and groove workpiece freely	Furniture making (I), (II)
FU- 9	Ripper	A machine to saw wide or thick plate in a direction of fiber forming	Furniture making (I), (II)

Code No.	Equipment name	Description/use	Applicable course
FU-10	Boring machine	A machine to shape slits for stack boards	Furniture making (I), (II)
FU-11	Spindle shaper	A machine to cut workpiece according to template by a cutter attached to vertical shaft rotating at high speed, for ornamenting outer face of furniture and fixture	Furniture making (I), (II)
FU-12	Portable belt sander	Used from surface grinding, polishing, to rough finishing and finishing	Finishing
FU-13	Disk sander and polisher	Used for removing rust or paint, glossing, and polishing groundwork	Finishing
FU-14	Circular saw	Portable power-operated saw used to cut wood	Woodworking machinery
FU-15	Electric jig saw	A saw to cut wood circularly with small radius of curvature	Woodworking machinery
FU-16	Electric drill	A power-operated tool to bore a hole into workpiece	Tool
FU-17	Recipro saw	A power-operated saw used for roughing	Woodworking machinery
FU-18	Portable router	A machine used for grooving, cut-out, engraving, embroidering, and chamfering	Woodworking machinery
FU-19	Portable planer	Hand-held power-operated plane used from roughing to finishing	Woodworking machinery
FU-20	Universal cutter grinder	A machine to sharpen planer's teeth	Woodworking machinery
FU-21	Circular saw grinder	A machine to sharpen circular saw teeth by setting method	Woodworking machinery
FU-22	Band saw grinder	A machine to sharpen band saw teeth	Woodworking machinery
FU-23	Welding equipment for band saw	Used to set band saw	Furniture making (I), (II)
FU-24	Saw setter	Jig to set position of saw	Furniture making (I), (II)

Code No.	Equipment name	Description/use	Applicable course
FU-25	Circular saw blade set	Detachable blades used according to the use and material, including ripping, cross-cutting, or chip	Furniture making (I), (II)
FU-26	Drill set	Drill bits for portable impact drill	Woodworking machinery
FU-27	Jig saw blades	Detachable saw blades according to the material, accuracy, and machining method	Furniture making (I), (II)
FU-28	Router bit set	Detachable bits according to surface design, including straight grooves, dovetail grooves, and round surface	Furniture making (I), (II)
FU-29	Drill Bits	A set of bits for drilling	Woodworking machinery
FU-30	Saw dust extractor	A device to collect dust from large woodworking machinery	General machinery
FU-31	Air compressor	Used for painting	Finishing
FU-32	Spray gun	Used for painting	Finishing
FU-33	Tools cabinet	Cabinet to store hand tools	Tool
FU-34	Hammer set	A set of hammers for manual work	Tool
FU-35	Chisel set	A set of chisels for manual work	Tool
FU-36	Saw set	A set of saws for manual work	Tool
FU-37	Plane set	A set of planes for manual work	Tool
FU-38	Ratchet brace	Hand drills	Tool
FU-39	Nail punch	Punch to press nail head into wood	Tool
FU-40	Center punch	Used to mark a center for drill	Tool
FU-41	Screwdriver set	A set of screw drivers	Tool
FU-42	File	A file to set saw teeth	Tool
FU-43	Bevel square	Bevel protractor	Tool
FU-44	Marking gauge	A device to scribe or draw line on wood	Tool
FU-45	Nail puller	A large pincer	Tool
FU-46	Hand drill	A hand tool to drill small hole	Tool

Code No.	Equipment name	Description/use	Applicable course
FU-47	Combination square set	A graduated square used for scribing and checking squareness	Tool
FU-48	Clamps	A set of clamps to fix glued wood materials	Woodworking machinery
FU-49	Oil stone	Grindstone for plane blade	Tool
FU-50	Mitre box	A tool to fix saw angle	Tool
FU-51	Plier	A plier to hold stick-shaped workpiece	Tool
FU-52	Doweling jig	Jig to fix drilling position	Woodworking machinery
FU-53	Marking knife	A general-purpose tool	Tool
FU-54	Spoke shave	a plane for circular surface	Tool
FU-55	Glass cutter	A tool to cut glass	Tool
FU-56	Mortise gauge	Jig to fix size of mortise	Tool
FU-57	Measuring tape	A general-purpose tool	Tool
FU-58	Vise for wood working	A device to clamp workpiece	Tool
FU-59	Ratchet screw driver	A set of screw drivers	Tool
FU-60	Electric handy carving machine	Used for engraving on wood	Woodworking machinery

(7) Industrial electronics and instrumentation course

This is the new course, and training equipment and tools have been selected on the basis of CEVEST's courses to meet latest industrial needs. In particular, basic equipment and tools for learning electronics have been selected to help understand characteristics of electronic components and electronic circuits. Also included are printed circuit board kits and electronic component kits to make a variety of electronic products on an experimental basis.

Major training equipment for instrumentation are pneumatic pressure control trainers and inverter control trainers. For sequence control technology, the basic control equipment - programmable controllers - will be obtained. In addition, industrial robots as well as trainers of positioning control and DC servo - key elements of robotics - have been selected.

Equipment and tools, their description and intended use, and applicable courses are summarized in Table 3.3.10.

Table 3.3.10 List of Equipment and Tools for the Industrial Electronics and Instrumentation Course, and Purpose of Use

Code No	Equipment name	Description/use	Applicable course
IE- 1	Air control trainer	To provide simulated training for instrumentation currently used by various industries, as well as control technology.	Hydraulic/pneumatic technology
IE- 2	Inverter motor control unit		Power electronics
IE- 3	Programable controller	To teach sequence control technology - the oldest and most widely used control technology - by using programmable controller	Sequence control
IE- 4	Robotic trainer	To provide simulated training for industrial robots in production environment, which are increasingly used in the manufacturing industry, as well as key technologies, positioning and speed control.	Automatic control
IE- 5	Positioning control unit		Electrical
IE- 6	DC servo unit		equipment

Code No	Equipment name	Description/use	Applicable course
IE- 7	Electronic circuit trainer	To conduct experiments and field training related to basic electronics including electrical and electronic circuits, and digital circuits.	Electrical and electronic circuits Digital circuits
IE- 8	Logic circuit trainer		
IE- 9	Pulse circuit trainer		
IE-10	Semiconductor trainer		
IE-11	Electronic counter trainer		
IE-12	IC troubleshooting kit		
IE-13	Oscilloscope	To conduct experiments and field training to help understand electronic circuits consisting of electrical and electronic components, and their functions in electronic equipment, including quantitative measurement by instruments.	Electrical measurement, measuring instruments Electrical and electronic circuits Electrical equipment Power electronics
IE-14	Pulse generator		
IE-15	Function generator		
IE-16	Digital multimeter		
IE-17	Circuit tester		
IE-18	Digital tester		
IE-19	Universal counter		
IE-20	DC ampere meter		
IE-21	DC volt meter		
IE-22	AC volt meter		
IE-23	AC ampere meter		
IE-24	Power meter		
IE-25	Frequency counter		
IE-26	AC electronics volt meter		
IE-27	Milli volt meter		
IE-28	Milli ampere meter		
IE-29	Lux meter		
IE-30	Emergency spotlight		
IE-31	PCB artwork tools	Training to make printed circuit boards by mounting actual electronic circuits	Electrical and electronic circuits Digital circuits
IE-32	Exposure unit		
IE-33	PCB board		
IE-34	Parts		
IE-35	Portable electric drills		
IE-36	DC power supply (1)	Equipment and tools required for experiments and training related to electronics	Commonly used by all laboratory courses
IE-37	DC power supply (2)		
IE-38	DC power supply (3)		
IE-39	Variable transformer		
IE-40	Soldering power unit		
IE-41	Solder fume extractor		
IE-42	Tool cabinet		
IE-43	Tool set		

Code No	Equipment name	Description/use	Applicable course
IE-44	Galvano meter	Standard equipment and tools to teach electrical and electronic measurement for calibration of electronic equipment owned by the course	Electrical measurement
IE-45	Standard cell		
IE-46	Wheatstone bridge		
IE-47	Adjustable register		
IE-48	Automatic LCR meter		
IE-49	Personal computer	To teach practical level of PC-based EDA, computer control technology through circuit design, simulation analysis, and PCB design. Also used to learn software programming for microprocessors.	Computer software
IE-50	Printer		Computer hardware
IE-51	X-Y plotter		
IE-52	Software		
IE-53	Microcomputer trainer	To teach theory of microcomputer and its operation, and to conduct experiments and training by making local processors widely used in the industry.	Software
IE-54	Logic analyzer		Hardware
IE-55	Logic comparator		
IE-56	Incircuit emulator		
IE-57	Digital storage scope		
IE-58	EPROM programmers		
IE-59	EPROM erasers		
IE-60	Educational video tapes	AC/DC theory Solid state components Electricity and safety	Commonly used in all laboratory courses

(8) Language laboratory

Training equipment and tools for the language laboratory consisting of one instructor and twenty students have been selected. As mentioned in 3.2.3 (8), interactive LL equipment using tape recorders is proven to be very useful for language education worldwide and will be used for the course.

Equipment and tools, their description and intended use, and applicable courses are summarized in Table 3.3.11.

Table 3.3.11 List of Equipment and Tools for the Language Laboratory Course, and Purpose of Use

Code No	Equipment name	Description/use	Applicable course
LA- 1	Language training system	Tape recorders, microphones, speakers, headphones, control consoles for one instructor and twenty trainees, who practice taped conversations on an interactive basis	LL course
LA- 2	Japanese language training tapes	Tapes teaching Japanese in Indonesian	LL course
LA- 3	English language training tapes	Tapes teaching English in Indonesian	LL course

3.3.4 Operation and Maintenance Plan

(1) Operating expenses and financial sources

As discussed in 3.2.2 "Evaluation of the Project Implementation and Management Plan," costs and expenses required for daily operation of the vocational training centers in Indonesia are classified as follows:

- 1) Labor cost
- 2) Material procurement cost (including utilities)
- 3) Equipment maintenance cost
- 4) Other expenses (e.g., traveling expenses)

In addition to the operating budget, the cost for any special project implemented in a particular year is entirely granted by the government. Total operating budgets between 1990 and 1994 for the vocational training centers are shown in Table 3.2.1. Note that these figures are based on the assumption that the project is completed in FY1993. As seen in the table, the total operating budgets vary greatly in any year with or without the project. On the other hand, the changes in the equipment procurement and maintenance budgets (a sum of materials procurement and equipment maintenance costs), excepting labor cost (accounting for large portions of the total operating budget) and other expenses, are shown in Table 3.2.2. These budgets account for around 10% - 30% of the total operating budget, varying with years as well as centers. As seen in the table, equipment procurement and maintenance costs in the 1994 budget, after the project is completed, will increase approximately 40% over those in the 1992 budget (20% annually), which will be financed by the Ministry of Manpower. Since vocational training is specified as one of priorities under the current fifth five-year plan, the project cost will be fully financed.

(2) Equipment maintenance and staff

As discussed in 3.3.1 "Implementation Body and Organization," the administrative department (or section) of each vocational training center will take custody of the supplied equipment and tools, and

will record them in the form of assets list. The chief instructor of each course will be responsible for daily operation and maintenance, under the assistance of instructors and assistants. The number of instructors assigned to each course is summarized in Table 2.4.3. Each course has three or more instructors, which seem to be sufficient for appropriate operation and maintenance of training equipment. However, some training will be required for new types of equipment and tools to be introduced, and efforts will be required on the side of instructors and assistants to learn operation and maintenance standards and procedures for new equipment. Also, additional instructors should be assigned as required.

3.4 Technical Assistance

The Ministry of Manpower requested to the study team, on its visit to the country, for the training of instructors in Japan or other country in relation to operation and maintenance of new equipment. The study team responded that overseas training for operation and maintenance of supplied equipment is not covered by grant aid, while advanced equipment requiring special overseas training is not suitable for vocational training, and that CEVEST can be used to train instructors. The Ministry agreed with these views. Also, the study team explained procedures for receiving experts for special training, which was also requested. The study team and the Ministry confirmed that it would be a separate project.

CHAPTER 4 BASIC DESIGN

Chapter 4 Basic Design

4.1 Equipment Selection Criteria

In selecting equipment and tools specified in 3.3.3 "General Outline of Equipment and Tools," the following criteria are set as the guidelines.

(1) Suitability for vocational training

Equipment suitable for the purpose of vocational training is selected; training equipment and tools which are considered to be most suitable for the curriculum of each course at each vocational center, and which allow the centers to train workers with basic knowledge and skills that meet demand in the industrial community.

(2) Emphasis on teaching of operating principles

In light of the fact that training equipment is mainly intended for unskilled workers and intermediate-level technicians, it should focus on teaching of operating principles. Thus, equipment should not be overly automated.

(3) Quantity and versatility

Since equipment will be used to teach a group of trainees, it should be supplied in sufficient quantity and versatility to provide training opportunity for as many trainees as possible. In particular, general measuring instruments and tools are effective and essential means of training unskilled workers, and they should be provided in sufficient number to allow adequate training.

(4) Ease of operation and maintenance

Ease of maintenance, particularly the availability of spare parts and the back-up system, is an important factor in equipment selection. Also, ease of operation and maintenance should be important for cost reduction.

4.2 Evaluation of Design Criteria

4.2.1 Operating Conditions

Major operating conditions, room temperature and relative humidity at each vocational training center, are summarized as follows:

Table 4.2.2 Operating Conditions

	Pekanbaru	Tanjung Pinang	Tangerang/Pasar Rebo	Singosari
Temperature				
Maximum °C	32	32	31	32
Minimum °C	15	15	13	16
Relative humidity				
Maximum %	88	95	93	92
Minimum %	60	73	70	68

4.2.2 Buildings and Utilities

(1) Buildings

The training equipment and tools will be installed in the first floor of all the centers, except for the Pasar Rebo center (second floor). The centers will be responsible for the reinforcement of installation base and vibration isolation measures for heavy equipment or noise-producing equipment, such as machinery (machine tools), welding machines (universal material testers and shearing machines) and automobile (break tester).

(2) Power supply

The five vocational training centers are scattered in three states, but receive electricity at the same voltage and frequency, both three-phase and single-phase.

However, types of outlets and plugs vary from one center to another, as well as between workshops, and plug compatibility should be checked in advance. The centers will be responsible for boosting power supply capacity if the shortage is expected after the project. The power supply system assumed for equipment selection is as follows:

Three-phase AC	380V	+10%
Single-phase AC	220V	±10%
Frequency	50Hz	± 5%

4.3 Basic Plan

4.3.1 Equipment Plan

The equipment and tools selected for the courses on the basis of 3.3.3 "General Outline of Equipment and Tools" and 4.1 "Equipment Selection Criteria" are shown in Tables 4.3.2 through 4.3.9.

Note that capacity, performance and other basic specifications in each list are indicated for reference purpose.

Table 4.3.1 summarizes types of equipment and tools by course and training center. In addition, Appendix 7, attached to this report,

Table 4.3.1 Summary of Equipment Types by Course and Center

	Pekanbaru	Tanjung Pinang	Tangerang	Pasar Rebo	Singosari
(1) Machine shop course	61	62	63	-	-
(2) Welding course	53	53	52	-	-
(3) Refrigeration repair and service course	71	71	-	-	-
(4) Pipe fitting course	-	54	54	-	-
(5) Automotive repair and service course	32	51	-	-	-
(6) Furniture course	60	-	-	-	-
(7) Industrial electronics and instrumentation course	-	-	-	66	66
(8) Language laboratory course	-	3	-	-	-
Total	277	294	169	66	66

Table 4.3.2 List of Equipment and Tools Selected for the Machine Shop Course and Their Specifications

Code No	Equipment name	Q'ty	Major specifications
MS- 1	Center lathe (360 x 550)	8	Swing over bed : 360mm Distance between centers : 550mm
MS- 2	Center lathe (510 x 1,500)	11	Swing over bed : 510mm Distance between centers : 1,500 mm
MS- 3	Center lathe (510 x 2,000)	6	Swing over bed : 510mm Distance between centers : 2,000 mm
MS- 4	Upright drilling machine	4	Swing : 550mm Drilling capability : Steel plate 40mm Cast iron 45mm Vertical stroke of main spindle : 150mm
MS- 5	Radial drilling machine	3	Drilling capability : Steel plate 40mm Cast iron 45mm Tapping capability : 25mm Vertical stroke of main spindle : 200mm
MS- 6	Vertical milling machine	5	Working surface : 1,100x260 mm Max. travel : 700x250x400 mm
MS- 7	Universal milling machine	6	Working surface : 1,350x270 mm Max. travel : 750x270x400 mm
MS- 8	Shaping machine	6	Travel of table : Horizontal 610 mm Vertical 340 mm Max. stroke of tool : 670 mm
MS- 9	Copying lathe	3	Swing over bed : 400 mm Distance between centers : 800 mm
MS-10	Surface grinding machine	6	Table working cap. : 600x300 mm Max. travel : 750x340 mm
MS-11	Cylindrical grinding machine	3	Swing over Table : 200 mm Distance between centers : 500 mm
MS-12	Power hacksaw	6	Maximum cutting dimension: round material : 200 ϕ square material : 180x180mm
MS-13	Pedestal grinding machine	4	Pedestal type Grindstone : 255x25x19 mm
MS-14	Twist drill grinding machine	3	Drill diameter : Maximum 32 ϕ Minimum 3 ϕ
MS-15	Universal tool grinder	3	Swing over table : 250 mm Distance between centers : 700 mm
MS-16	Bench drilling machine	6	Swing : 360 mm Drilling capability : 13 mm Vertical stroke of main spindle : 80 mm
MS-17	Cut-off grinding machine	3	Outer diameter of grindstone : 350 ϕ Power : 2 HP
MS-18	Air compressor	3	Working pressure : 8.0~9.9 kg/cm ² Tank volume : 120 L Output : 3.7 HP

Code No	Equipment name	Q'ty	Major specifications
MS-19	Face milling cutter	6	4-inch and 5-inch types : 3 sets each Spare chips : 30 pieces each
MS-20	Plane milling cutter set	12	50 ϕ x 25.4 ϕ x 100 75 ϕ x 25.4 ϕ x 100 100 ϕ x 25.4 ϕ x 100 One piece each
MS-21	End mill set	12	End mill cutter, double-blade/four-blade : 3, 4, 5, 6, 8, 10, 12, 14, 15, 16, 18, 20, 22, 25mm one piece each
MS-22	Heavy duty end mill set	6	Double-blade/four-blade 25, 28, 30, 32, 35, 38, 40 mm One piece each
MS-23	Ball end milling cutter set	3	Straight shank 6 ϕ , 8 ϕ , 10 ϕ One piece each
MS-24	Shell end mill set	12	High-speed steel 75 ϕ x 25.4 ϕ x 60 80 ϕ x 25.4 ϕ x 60 100 ϕ x 25.4 ϕ x 60 One piece each
MS-25	Roughing end mill	12	Outer diameter 8, 12, 16, 20, 25mm ϕ One piece each
MS-26	T-slot milling cutter set	12	Straight shank, right-cut 6, 10, 12, 14, 18 mm ϕ
MS-27	Side milling cutter set	12	Outer diameter x cutter width x bore diameter : 50 ϕ x 8x15.875 ϕ 75 ϕ x 12x25.4 ϕ 125 ϕ x 16x31.75 ϕ 150 ϕ x 20x31.75 One piece 200 ϕ x 22x31.75 each
MS-28	Concave milling cutter set	12	Radius 1, 2, 3, 6, 10 One piece each
MS-29	Convex milling cutter set	12	Radius 1, 2, 3, 6, 10 One piece each
MS-30	Single angular milling cutter set	12	45° x 75 ϕ x 25.4 ϕ x 18 50° x 75 ϕ x 25.4 ϕ x 18 60° x 75 ϕ x 25.4 ϕ x 18 One piece each
MS-31	Single angle milling cutter set	12	Angle : 45° , 60° Outer diameter : 40, 50, 80mm ϕ One piece each
MS-32	Double angle milling cutter set	12	Angle : 60° , 90° Outer diameter : 40, 50, 60mm ϕ One piece each
MS-33	Gear cutter	3	Involute gear cutter Modules 1, 2, 3, 4, 5, 6 One piece each
MS-34	Twist drill set	6	Drill diameter 1.0 mm ~ 5.9 mm 0.1mm interval, 50 types, One piece each
MS-35	Center drill	3	1.0 ϕ x 35L, 2.0 ϕ x 45L, 3.0 ϕ x 55L 30 pieces each

Code No	Equipment name	Q'ty	Major specifications
MS-36	Taper reamer set	3	For taper shank roughing 6.3 ϕ , 10.4 ϕ , 16.4 ϕ , 20.5 ϕ , 25 ϕ roughing No.1,2,3 5 pieces each
MS-37	Taper reamer set (finishing)	3	For taper shank finishing 2~5 ϕ , 5~10 ϕ , 10~15 ϕ , 15~20 ϕ Finishing No.1,2,3 5 pieces each
MS-38	Cemented carbide chip	30	Soft steel cutting chip Thickness 3.5~6 mm
MS-39	Knurl	2	Types of die : parallel, right beveled, left beveled, mesh 20 pieces each Knurl holder (1 die and 2 dies) : 2 pieces each
MS-40	Dial test indicator with stand	6	Range of measurement : 10 mm Calibration : 0.01 mm
MS-41	Vernier caliper (inch scale)	1 set	Range of measurement : 0~12 inch Scale : 0.02 inch 12-inch ordinary type : 15 units 12-inch dial-gauge type : 8 units
MS-42	Vernier caliper (millimeter scale)	1 set	Range of measurement : 150mm 40 units 300mm, 1000mm 4 units each Scale : 0.05 mm
MS-43	Digital micrometer	1 set	Digital type Outside : 0~25, 25~50, 50~75mm 6 units each Inside : 25~50, 50~75, 75~100mm 6 units each Depth : 0~25, 0~50mm 6 units each
MS-44	Inside micrometer	1 set	Range of measurement 50~75, 75~100mm 6 units each 100~125, 125~150mm 2 units each Scale : 0.01mm
MS-45	Outside micrometer	1 set	Range of measurement : 100~125, 125~150mm 2 units each Scale : 0.01mm
MS-46	Digital indicator	6	Range of measurement : 0~50 mm Scale : 0.005 mm
MS-47	Vernier height gauge	3	Range of measurement : 0~300, 0~600 mm 1 unit each Scale : 0.02 mm
MS-48	Vernier digital height gauge	3	Range of measurement : 0~300 mm Scale : 0.01 mm

Code No	Equipment name	Q'ty	Major specifications
MS-49	Thread micrometer	6	For milli-thread and unified-thread Range of measurement : 0~25 mm Scale : 0.01 mm
MS-50	Screw pitch gauge	15	For Whitworth thread : 4~60mm For milli thread : 0.25~2.5, 0.5~7.0mm 1 unit each
MS-51	Gear micrometer	3	Range of measurement : 0~25, 25~50mm Scale : 0.01 mm 1 unit each
MS-52	Radius gauge	9	Range of measurement : For outer diameter, round : 1~7R 1~7R, 7.5~15R, 16~23R For square groove, round : 0.75~5R, 5.5~13R, 13~22R 1 unit each
MS-53	Steel plain protractor	3	Length of beam : 150 mm (scale : 1mm) Diameter : 90 mm Graduated angle : 0~180°
MS-54	Combination square	3	Total length of blade : 400 mm Protractor : 180° Calibration accuracy (length) : 1 mm Calibration accuracy (angle) : 1°
MS-55	Graduated square	3	Nominal dimension : 150 mm Dimensions : 150 x 100 x 25 x 5mm Scale : 1 mm
MS-56	Surface plate	3	1000mm x 1000mm x 125mm Machine finishing
MS-57	Multi tester	1	Digital type DCV : 200mV~1,000V ACV : 200mV~750V DCA : 2mA~1A ACA : 2mA~1A Ω : 200 Ω ~200M Ω
MS-58	Universal hardness tester	2	Rockwell, Brinell, Vickers
MS-59	Diamond dresser	9	1/2carats x 11 x 150 mml.
MS-60	Tool holder	6	Cutter holder for turning or drilling
MS-61	Bench vice	20	Nominal dimension : 125 Mouth width : 130, Mouth opening : 200 Mouth depth : 80
MS-62	Bench vice (universal type)	6	Nominal dimension with turn table : 125 Mouth width : 130, Mouth opening : 175 Mouth depth : 84

Code No	Equipment name	Q'ty	Major specifications
MS-63	Tools cabinet	15	880W x 400L x 1,790H
MS-64	Hand pallet truck	2	Truck size : 900 x 600 x 240 mm Maximum loading capacity : 500 kg
MS-65	Educational video tapes	3	Basic machining, basic lathing, end mill grinding, finishing, drilling, surface grinding, turning tool, precision measuring tool, tool grinding

Table 4.3.3 List of equipment and Tools Selected for the Arc Welding Course and Their Specifications

Code No	Equipment name	Q'ty	Major specifications
AW- 1	Arc welding machine	20	Range of current : 60 ~ 250A Power source : AC 220V 50Hz
AW- 2	Arc welding machine (large)	11	Range of current : 50 ~ 400A Power source : AC 220V 50Hz
AW- 3	AC/DC integrated TIG welding set	4	Range of current : DC5 ~ 300A AC 20 ~ 300A Primary input : single-phase, 380V
AW- 4	MIG welding set	4	Output current : 250A Primary input : three-phase, 220/380V, 50Hz
AW- 5	Plasma welding machine	3	Rated output current : 100A Primary input : three-phase, 220/380V, 50Hz
AW- 6	Automatic flame plate cutting machine	3	Cutting thickness (plate) : 3 ~ 150mm Cutting speed range : 80 ~ 800mm/min Primary input : single-phase, 100/20V, 50Hz
AW- 7	Automatic flame pipe cutting machine	3	Cutting thickness (pipe) : 5 ~ 30mm Effective cutting diameter : 150 ~ 600 ϕ Power source : AC 100V
AW- 8	Bevel cutting machine	3	Power source : three-phase, 220V, 50Hz Bevel cutting capacity : 0 ~ 15mm (angle:45°)
AW- 9	Gas welding kit	10	Cutting thickness (plate) : 1 ~ 30mm Welding thickness (plate) : 2 ~ 6mm Gauge and gas hose : 20m long, 1 set
AW-10	Shearing machine	3	Cutting dimension steel plate : 1,250 x 1.6 mm
AW-11	Plate bending machine	1	Capacity : 25 ton Bending length : 1,250mm
AW-12	Pipe bender	1	Bending diameter : 2 inches Power source : three-phase, 220V, 50Hz

Code No	Equipment name	Qty	Major specifications
AW-13	Bending roll machine	3	Power-operated type Roller diameter : 75mm ϕ Roll length : 1,000mm
AW-14	Pedestal grinding machine	3	Pedestal type Grindstone : 255 ϕ x 25 ϕ x 19
AW-15	Hand grinder	1 set	Power source : single-phase, 220V, 50Hz Outer diameter of grinding wheel : 125 ϕ 15 units Outer diameter of grinding wheel : 180 ϕ 6 units
AW-16	Cut off grinding machine	3	Cutting capacity : Round bar 65 ϕ Pipe 114.3 ϕ Shape steel 130 x 130mm Power source : single-phase, 220V, 50Hz
AW-17	Bench drilling machine	4	Capacity : 13 mm ϕ Swing : 360 mm Maximum drill stroke : 80 mm
AW-18	Upright drilling machine	2	Capacity : steel 40mm, cast iron 50mm Swing : 550 mm Maximum drill stroke : 220 mm
AW-19	Hand drilling machine	9	Portable Capacity : steel 13 mm
AW-20	Power hacksaw	3	Cutting dimensions : Round 250 mm ϕ Square 225 x 225 mm
AW-21	Sheet metal folding machine	3	Folding capacity : 2.0x2,000mm
AW-22	Flanging and bending machine	3	Bendable thickness soft steel plate : 1.6 mm Bendable width (ditto) : soft palate : 1,250 mm
AW-23	Riveting machine	15	Capacity : Maximum rivet diameter 4.8mm ϕ Required air pressure : 5.0 ~ 6.0 kg/cm ²
AW-24	Universal testing machine	3	Range of load : 500, 250, 100, 50, 25, 10 kN Maximum spacing : Tensile test 900 mm Compression test 810 mm Bending test 600 mm

Code No	Equipment name	Q'ty	Major specifications
AW-25	Material bending tester	3	Bending test for weld joints output : compression 20 ton, Tensile 10 ton
AW-26	X-ray radiographic equipment	3	Output : 70 ~ 200 kV Standard accessories Power source : single-phase, 220 V, 50 Hz
AW-27	Ultrasonic tester	3	Frequency : 0.4 ~ 10 MHz Range of measurement : 10 ~ 10.000 mm (logitudinal wave in steel) 5-step switchable
AW-28	Magnetic particle tester	3	Voltage : AC 100V Pole-to-pole distance : 130 mm Wet magnetic particles
AW-29	Hydraulic tester	1	Working pressure : 200 kg/cm ² Manual type
AW-30	Air compressor	3	Working pressure : 8.0 ~ 9.9 kg/cm ² Tank capacity : 120 liters Output : 3.7HP
AW-31	Stationary electrode drier	3	Drying capacity : 50 kg Operating temperature : 50 ~ 400 °C Power source : single-phase, 220 V, 50 Hz
AW-32	Portable electrode drier	20	Drying capacity : 5 kg Operating temperature : 50 ~ 300 °C Power source : single-phase, 100/200V 50 Hz
AW-33	Blower (fume extractor)	6	Wind draft : 15 m ³ /min Mobile type
AW-34	Positioner	1	Loading capacity : 40 kg Range of base angle slanting : 0° ~ 90°
AW-35	Welding table	45	Steel-made, grid surface table Dimensions : 600 x 750 x 600mmH Standard accessories
AW-36	Safety trolley	4	Carrying 1 oxygen cylinder and 1 acetylene cylinder each

Code No	Equipment name	Q'ty	Major specifications
AW-37	Ampere tongs	3	Maximum allowable applied voltage : 500V Maximum allowable applied current : 500A
AW-38	Work bench	15	For medium-duty work 1,200 x 750 x 740 mmH
AW-39	Hand power chisel	15	Portable, power-operated grinder equipped with chisel to remove slugs after welding
AW-40	Tap & die set (mm size)	20	Tap & die set for meter ordinary thread 3,4,5,6,8,10,12,14,16,18,20,22 24mm with one set of handle
AW-41	Tap & die set (inch size)	20	Tap & die set for whitworth ordinary thread 1/8,3/16,1/4,5/16,3/8,1/2,9/16 5/8,3/4,7/8,1 inch with one set of handle
AW-42	Pipe thread cutter	2	Automatic thread cutting Capability : 1/2~2 inch
AW-43	Welding gauge	15	Stainless steel made Range of measurement : 3~12mm
AW-44	Square	1 set	Flat square 150 x 100 mm 30 units 600 x 325 mm 15 units
AW-45	Steel rule	30	Steel made 1,000mm
AW-46	Measuring tape	15	Steel made 3.5 m, 5 m 1 unit each
AW-47	Self grip welding tongs	30	Applicable current : 300A Range of electrodes:3.2~6.4mm
AW-48	Chipping hammer	40	3/4 pound (350g)hammer for removing slug after welding
AW-49	Anvil	6	Single-horn type Work surface : 110 x 320 mm Horn length : 150 mm
AW-50	Bench vice	50	Chuck width : 130 mm Chuck opening : 200 mm
AW-51	Dividers	30	Steel made Length : 250 mm
AW-52	Scriber	30	Steel made length : 200 mm
AW-53	C clamp	15	Clutch opening : 105 mm Joint depth : 60 mm

Code No	Equipment name	Q'ty	Major specifications
AW-54	Pipe wrench	10	Dimension : 600 mm Pipe diameter : 115 mm
AW-55	Welding mask	55	Hand-hold type welding mask with shielding color glass
AW-56	Slide projector	3	Power source : AC 100V, 50Hz Slide feed : Remote control Forward and backward feed
AW-57	Overhead projector	3	Magnification factor : 4 times - 10 times Projection distance : 1.5m - 3.5m
AW-58	Educational video tapes	3	General skills and work safety, arc welding, gas cutting, pipe welding, and safety in welding operation

Table 4.3.4 List of equipent and Tools Selected for the Refrigeration Repair and Service Course and Their Specifications

Code No	Equipment name	Q'ty	Major specifications
RS- 1	Refrigerator (1)	10	Small, one door
RS- 2	Refrigerator (2)	3	Medium-size, one door
RS- 3	Combination refrigerator	3	Medium-size, two doors
RS- 4	Freezer	2	Small, one door
RS- 5	Window type air-conditioner	10	3 types
RS- 6	Split type air-conditioner	10	Separate type
RS- 7	Package type air-conditioner	2	Plenum type
RS- 8	Central air conditioning system	2	For simulation of air conditioning
RS- 9	Absorption type air cooling system	3	Refrigerator, coolant pipe, control panel, temperature measurement, pressure measurement
RS-10	Air compressor	4	Output : 1.5kW Discharge pressure : 9.5kg/cm ²
RS-11	Condensing unit	2	Fan diameter 400mm
RS-12	Defrost heater	2	
RS-13	Single phase compressor	2	7.0kg/cm ²
RS-14	Air cleaning nozzle	6	Nozzle diameter 1.7mm
RS-15	Motor speed controller	3	Input 4 - 20mA
RS-16	Thermostat	3	Window air conditioner type, Refrigerator type
RS-17	Electronic thermostat	3	Digital, 4-digit display
RS-18	Differential thermostat	3	Thermocouple, resistor, voltage, current,
RS-19	Air flow switch	3	Operating speed 2.4 - 7.0m/sec
RS-20	Water level switch	3	Interpolar current/voltage : 1mA/8VAC
RS-21	Capacitor	3	2 types, 6 units in total
RS-22	Thermal relay	15	For 3 elements
RS-23	Electromagnetic switch	15	3 types, 45 units in total
RS-24	Sensor	9	Platinum, 100 ohms
RS-25	Relay	7	3 types
RS-26	Overload limit switch	7	
RS-27	Temperature probe	3	-50 - 150°C
RS-28	Pilot light	30	LED, 5 VDC
RS-29	Air flow meter	2	125-560cm/sec.
RS-30	Anemo meter	2	0 - 5m/sec., 5 - 40m/sec.
RS-31	Hygrothermograph	3	
RS-32	Clip-on meter	4	
RS-33	Digital multimeter	3	
RS-34	Hygrostat	3	20 - 100%
RS-35	Gas leak detector (1)	6	Detection gas: R12, R22, R11, R500, R502

Code No	Equipment name	Q'ty	Major specifications
RS-36	Gas leak detector (2)	2	Detection gas: flammable gas (methane, isobutane, etc)
RS-37	Constant pressure valve	3	-76cmHg - 15kg/cm ²
RS-38	Pilot pressure valve	3	Small: 1 unit, large: 1 unit
RS-39	Vacuum pump	4	36.5l/min
RS-40	Charging cylinder	3	Pressure gauge, upper valve, lower valve
RS-41	Charging manifold	10	High pressure gauge, low pressure gauge, hose
RS-42	Charging hose	21	150cm x 3 pieces
RS-43	Charging units	10	Vacuum pump, charging cylinder gauge manifold
RS-44	Recovery & recycling system	2	Recovery & recycling system, cylinder, condenser for recovery
RS-45	Gas cutting-welding set	2	Oxygen, acetylene adjuster, gas welding machine, gas cutter, rubber hose
RS-46	Pipe bender	1 set	Small: 15 units, Medium: 25 units
RS-47	Swaging tool	1 set	Small: 15 units, Large: 3 units
RS-48	Electric pipe cutter	3	
RS-49	Pipe reamer	15	Deburring inner and outer faces
RS-50	Flaring tool	15	7 types
RS-51	Extractor kit	3	5 units in each kit
RS-52	Glass cutter	3	Diamond blade
RS-53	Pipe cutter for copper	1 set	Small: 15 units, Large: 15 units
RS-54	Socket	30	8 pins, screwed
RS-55	Pillar drilling machine	3	Swing: 550 mm Vertical stroke of main spindle: 150 mm
RS-56	Electric drill	4	For metalwork 10.0mm For woodwork 21.0mm
RS-57	Impact electric drill	4	2,300 strikes/minutes
RS-58	Pedestal grinding machine	2	Pedestal
RS-59	Vice	8	310x185x170mm
RS-60	Pipe vice	2	
RS-61	Tool terminal block set	30	Manual type
RS-62	Bench vice	3	
RS-63	Parts and tester	2	Breakers, motors, relays, timer switches

Code No	Equipment name	Q'ty	Major specifications
RS-64	Refrigeration Fundamental trainer (1)	2	Recipro type, cooling fan 13W/100V
RS-65	Refrigeration Fundamental trainer (2)	2	Compressor, evaporator, condenser
RS-66	Heat pump cycle trainer	2	Compressors, accumulators, liquid receivers, fans
RS-67	Industrial refrigerator trainer	2	Closed type compressors, valves, pipes, dryers, filters
RS-68	Refrigeration diagnostic trainer	2	
RS-69	Refrigerator trainer	2	Double evaporator type, compressors, evaporators, fluid meters, valves, pipes
RS-70	Educational video tapes	2	Introduction to refrigeration and air-conditioning, variable compression system, testing and inspection system, system operation

Table 4.3.5 List of Equipment and Tools Selected for the Pipe Fitting Course and Their Specifications

Code No	Equipment name	Q'ty	Major specifications
PF- 1	Arc welding machine	6	Range of current : 60 ~ 250 A power source : AC 220 V 50 Hz
PF- 2	Gas welding kit	7	Cutting thickness (plate) : 1~30 mm Welding thickness (plate) : 2~ 6 mm Gauge and gas hose, 20m length, 1 set
PF- 3	Gas pipe cutting set	3	Cutting thickness : 5 ~ 30 mm Effective cutting diameter : 150 ϕ ~ 600 ϕ power source : AC 110 V
PF- 4	Upright drilling machine	2	Swing : 550 mm Drilling capacity : Steel plate 40 mm Cast iron 45 mm Vertical stroke of main spindle : 150mm
PF- 5	Bench drilling machine	4	Capacity : 13 mm ϕ Swing : 360 mm maximum drill stroke : 80 mm
PF- 6	Hand grinder	1 set	Power source : single-phase 220 V 50 Hz Outer diameter of grinding wheel : 125 ϕ 15 units Outer diameter of grinding wheel : 180 ϕ 9 units
PF- 7	Twist drill set	4	Straight shank : 3,4,5,6,7,8,10.5,12.7 mm Taper shank : 16,20,21,23,24,25,28,30,31 mm 1 piece each
PF- 8	Pipe cutter	2	Cutting capacity : 1~4 inches
PF- 9	Roll pipe cutter	20	Cutting capacity: 10.5~60.5mm ϕ
PF-10	Cast iron pipe cutter	2	Cutting capacity: 75~ 200mm ϕ
PF-11	Pipe threading machine	2	Threading capacity : 1/2~4 inches, 15~100 mm
PF-12	Pipe thread handle (manual)	8	For gas pipe Threading capacity : 1/2~2 inches
PF-13	Pipe thread dies	8	For gas pipe Threading capacity : 1/2~2 inches

Code No	Equipment name	Q'ty	Major specifications
PF-14	Tap and dies set	8	Tap & die set for metric coarse screw thread 3, 4, 5, 6, 8, 10, 12, 14, 16, 20, 22, 24 mm Tap & die set for Whitworth coarse screw thread 1/8, 3/16, 1/4, 5/16, 3/8, 1/2, 9/16, 5/8, 3/4, 7/8, 1 inches With handle set
PF-15	Work bench	12	For medium duty work 1,800 x 900 x 740 mmH
PF-16	Bench vise	40	Jaw width : 130 mm Opening : 200 mm
PF-17	Sledge hammer	40	2.7 kg (6 pound) hammer
PF-18	Blacksmith tongs	8	Total length : 450 mm 4 types
PF-19	Divider	20	300, 400, 500, 600 mm each
PF-20	Scriber	30	Steel made Total length : 200 mm
PF-21	Adjustable wrench	14	200, 250, 300 mm each
PF-22	Shears	1 set	Dimension : 300 mm 2 types 12 pieces in total
PF-23	Hacksaw frame	15	Dimension : 250 mm
PF-24	Cold chisel	30	Flat chisel, octagonal 22 x 19 x 200
PF-25	Pipe wrench	20	Pipe diameter : 1/2~2 inches
PF-26	Flat files & handles	40	File length : 250 mm with handle Flat, halfround, round, triangle, each
PF-27	Surface gauge	10	Square base, 300 mm
PF-28	Center punch	20	End diameter : 1.6 ϕ ~ 9.6
PF-29	Trammels	2	Dimension : 1,000 mm
PF-30	Hydraulic pressure tester	2	maximum pressure : 20 kg/cm ²
PF-31	Steel rule	1 set	Steel made Dimension : 300mm 40units, 1,000mm 15units
PF-32	Measuring tape	30	Steel made 3.5 m, 5 m each
PF-33	Vernier calipers	40	For inner and outer diameters, and depth Range of measurement : 0~300mm
PF-34	Vernier height gauge	4	Range of measurement : 0~300 mm/ 0~12" measurement error : 0.02 mm

Code No	Equipment name	Q'ty	Major specifications
PF-35	Level	20	Aluminum alloy made Dimension : 750 mm
PF-36	Square set	1 set	Graduated flat square 600 x 400 mm 20 units 750 x 500 mm 15 units 150 x 100 mm 40 units 200 x 130 mm 20 units
PF-37	I-type square	15	600 x 350 mm
PF-38	Calipers	20	Steel made Inner measurement 200 mm Outer measurement 200 mm each
PF-39	Gate valve	6	10 kg/cm ² x 3 inches Cast iron made
PF-40	Glove valve	6	10 kg/cm ² x 3 inches Cast iron made
PF-41	Butterfly valve	4	10 kg/cm ² x 3 inches Cast iron made
PF-42	Slip on flange	15	For 10 kg/cm ² Steel made 3-inch 1 piece, 4-inch 2 pieces
PF-43	Welding neck flange	15	For 10 kg/cm ² Steel made 3-inch 1 piece, 4-inch 2 pieces
PF-44	Tee (straight)	21	For 10 kg/cm ² Steel made, butt weld 4 x 4 inches
PF-45	Tee (reducer)	21	For 10 kg/cm ² Steel made, butt weld 4 x 3 inches
PF-46	Concentric reducer	1 set	For 10 kg/cm ² Steel made, butt weld 4 x 3 inches 21 pieces 4 x 2 inches 15 pieces
PF-47	Excentric reducer	1 set	For 10 kg/cm ² Steel made, butt weld 4 x 3 inches 21 pieces 4 x 2 inches 15 pieces
PF-48	Short radius elbow	30	For 10 kg/cm ² Steel made, butt weld 4 inches x 90° 4 inches x 45° each
PF-49	Long radius elbow	30	For 10 kg/cm ² Steel made, butt weld 4 inches x 90° 4 inches x 45° each
PF-50	Safety goggles	45	Safety goggles for general work

Code No	Equipment name	Q'ty	Major specifications
PF-51	Welding goggles	40	Double flexible goggles for welding
PF-52	Welding mask	10	Hand-hold type welding mask with shielding color glass
PF-53	Wraparound	30	Long wraparound for welding
PF-54	Educational video tapes	2	Introduction to pipe fitting, pipe fitting methods, fundamentals of lead and steel pipe fitting methods

Table 4.3.6 List of Equipment and Tools Selected for the Automotive Repair and Service Courses and Their Specifications

Code No	Equipment name	Q'ty	Major specifications
AS- 1	Gasoline engine trainer	1 set	Gasoline/4-cylinder : 5 units Gasoline/6-cylinder : 4 units
AS- 2	Diesel engine trainer	1 set	Diesel/4-cylinder : 3 units Diesel/6-cylinder : 3 units
AS- 3	Motor cycle engine trainer	1 set	Motorcycle/2 stroke, 125/150cc : 6 units Motorcycle/2 stroke, 100cc : 4 units Motorcycle/4 stroke : 4 units
AS- 4	Boat engine trainer	1 set	Gasonline engine for boat : 4 units Diesel engine for boat : 4 units
AS- 5	Hand tractor engine trainer	1 set	Hand tractor engine : 2 units
AS- 6	Cut-away model (gasoline)	2	Multi-cylinder type
AS- 7	Cut-away model (diesel)	2	Distribution type
AS- 8	Brake tester	2	Maximum brake power : 20-100/100-500kgf
AS- 9	Headlight tester	2	Measuring distance : 1m Measuring method : manual
AS-10	Thermostat tester	2	-20° ~200°
AS-11	Valve spring tester	2	80φ x 210
AS-12	Engine scope	2	For gasoline engine
AS-13	Compression gauge for gasoline engine	2	For gasoline car
AS-14	Camber-caster-kinpgin gauge	1	Camber scale : -5° ~+5°
AS-15	Tune up tester	2	For 4-cycle engine For 2-cycle engine For rotary engine
AS-16	Carburetor balancer	2	Floating ball type
AS-17	Electrical component tester	1	Digital voltmeter, ampere meter, speedometer, torque gauge
AS-18	Nozzle tester	3	0-500kgf/cm ²
AS-19	Timing light	4	Dry battery type
AS-20	Inside micrometer	6	
AS-21	Outside micrometer	1 set	mm scale 10 units, inch scale 6 units
AS-22	Brake drum gauge	2	150-430mm
AS-23	Dial gauge	4	Range of measurment : 0~1 mm
AS-24	Feeler gauge	10	Thickness gauge, plug gap gauge

Code No	Equipment name	Q'ty	Major specifications
AS-25	Hydraulic gauge jack	1 set	1.5 tons 4 units, 6 tons 2 units
AS-26	Auto lift	1	2.5 tons, hydraulic/chain type
AS-27	Portable Crane	1	
AS-28	Hydraulic press	2	5 tons, ram stroke 150
AS-29	Tire changer	2	Applicable wheel, rim diameter 10~16", maximum rim width 8"
AS-30	Wheel balancer	2	Simultaneous measurement of 2 faces
AS-31	Battery quick charger	4	Input : AC 100V/1 ϕ , 14KVA
AS-32	Nozzle clearing kit	2	
AS-33	Spark plug cleaner	2	Air pressure 7-10kgf/cm ²
AS-34	Pedestal grinding machine	1	Stationary type
AS-35	Bench drilling machine	1	Precision type
AS-36	Electric drill	1	10 ϕ
AS-37	Body-repair tools set	1	Hammers, screw, drivers, wrenches, long-nose pliers
AS-38	Spray gun	5	Gravity type
AS-39	Brake lining rivetter	2	Stroke 45mm, air compressor type
AS-40	Air impact wrench set	1	Impact tools, sockets, extension, bits, bit holders
AS-41	Tube flaring and cutting tool	1	
AS-42	Vernier caliper	10	0-200mm
AS-43	Taps and dies set	4	Taps, dies, wrenches, holders, die handles
AS-44	Socket wrench set	40	Sockets, ratchet handles
AS-45	Torque wrench set	8	500-2,800kgf/cm
AS-46	Hose clipper	8	200mm long
AS-47	Hammer	4	Urethane
AS-48	Caddy tool stand	20	3-tier type
AS-49	Parts washing stand	10	Tank capacity : 100 liters
AS-50	Educational video tapes	2	Automobile/gasoline, automobile/diesel, engine operation/maintenance, wheel balance, use of maintenance tools, engine in general, body maintenance, rustproofing

Table 4.3.7 List of Equipment and Tools Selected for the Furniture Course and Their Specifications

Code No	Equipment name	Q'ty	Major specifications
FU- 1	Wood lathe	2	Maximum distance between centers: 1,000 mm Swing over bed: 400 mm
FU- 2	Surface planer	1	Maximum cutting width: 300 mm With dust exhauster
FU- 3	Automatic round-end tenoner	1	Maximum tenoning dimensions Maximum width: 80 mm Maximum thickness: 30 mm
FU- 4	Automatic slot mortiser	1	Maximum width: 20 mm Maximum length: 120 mm
FU- 5	Hollow chisel mortiser	1	Table height: 700 mm Stroke: 400 mm
FU- 6	Thickness planer	1	Maximum cutting width: 500 mm Maximum thickness: 300 mm
FU- 7	Band saw	1	Maximum thickness: 300 mm Table dimension: 590 x 680 mm
FU- 8	Radial arm saw	1	Maximum width: 480 mm Maximum thickness: 120 mm
FU- 9	Ripper	1	Maximum thickness: 90 mm
FU-10	Boring machine	1	Maximum width: 600 mm Stack mortise, butt end, slant hole
FU-11	Spindle shaper	1	2-step shift Maximum thickness for chamfering: 100 mm
FU-12	Portable belt sander	5	Width: 76 mm, 100 mm With dust exhauster each
FU-13	Disk sander and polisher	5	Disk sander Outer diameter of grinding wheel: 150 mm Polisher Outer diameter of polisher: 180 mm
FU-14	Circular saw	2	Outer diameter of saw teeth: 165 mm
FU-15	Electric jig saw	2	Stroke: 18 mm
FU-16	Electric drill	2	Size of chuck: 13 mm
FU-17	Recipro saw	2	Stroke: 18 mm Bus fix type
FU-18	Portable router	2	Straight guide Template guide
FU-19	Portable planer	2	Maximum width: 82 mm Maximum depth: 1, 3 mm each

Code No	Equipment name	Qty	Major specifications
FU-20	Universal cutter grinder	1	Maximum grinding dimension: L=500 mm Water injection pump unit
FU-21	Circular saw grinder	1	Circular saw dimensions for setting: 152~610 mm
FU-22	Band saw grinder	1	Tooth width: 5~ 60 mm
FU-23	Welding equipment for band saw	1	To connect band saw teeth
FU-24	Saw setter	5	With grip
FU-25	Circular saw blade set	10	165 mm 3 types
FU-26	Drill set	5	1 - 13 mm 0.5mm interval
FU-27	Jig saw blades	20	4 types
FU-28	Router bit set	15	10 types
FU-29	Drill bits	1	5 types, 65 pieces in total
FU-30	Saw dust extractor	2	Duct hose 2 suction hoods With dust bag
FU-31	Air compressor	2	Exhaust : 440 L/min
FU-32	Spray gun	4	Gravity type
FU-33	Tools cabinet	4	8 drawers
FU-34	Hammer set	1	4 types, 62 units in total
FU-35	Chisel set	1	3 types, 60 units in total
FU-36	Saw set	1	8 types, 145 units in total
FU-37	Plane set	1	8 types, 100 units in total
FU-38	Ratchet brace	20	300 mm long
FU-39	Nail punch	5	0.8 ~ 4.0 mm 5 types
FU-40	Center punch	10	3.2 mm
FU-41	Screw driver set	10	6 types
FU-42	File	10	300 mm long
FU-43	Bevel square	20	Cutter length: 200 mm
FU-44	Marking gauge	20	214 mm long
FU-45	Nail puller	20	380 mm long
FU-46	Hand drill	10	350 mm long
FU-47	Combination square set	20	45°, 90°
FU-48	Clamps	1	4 types, 60 pieces in total
FU-49	Oil stone	20	2 types
FU-50	Mitre box	2	Corner cutting
FU-51	Plier	20	200 mm long
FU-52	Doweling jig	2	3/16 ~ 1/2 inches
FU-53	Marking knife	20	200 mm long
FU-54	Spoke shave	20	Cutter length: 52 mm
FU-55	Glass cutter	5	132 mm long
FU-56	Mortise gauge	20	For door fitting
FU-57	Measuring tape	20	5.5 mm

Code No	Equipment name	Q'ty	Major specifications
FU-58	Vise for woodworking	20	Jaw width: 150 mm
FU-59	Ratchet screw driver	10	Screw driver Diameter 5.5 mm
FU-60	Electric handy carving machine	5	Flexible shaft Rotary head Stroke head

Table 4.3.8 List of Equipment and Tools Selected for the Industrial Electronics and Instrumentation Course and Their Specifications

Code No	Equipment name	Q'ty	Major specifications
IE- 1	Air control trainer	2	Air compressor: 4kg/cm ²
IE- 2	Inverter motor control unit	10	Three-phase: AC 24V, 20-60Hz Three-phase Induction motor
IE- 3	Programable controller	4	16 input, 12 output, switching units RS 232C cable, analog sensor unit
IE- 4	Robotic trainer	2	Articulated robots, belt conveyors, metering equipment sensors
IE- 5	Positioning control unit	4	Step motor, 6V
IE- 6	DC servo unit	10	Servo motor, $\pm 12V$, 6W
IE- 7	Electronic circuit trainer	8	Amplification, rectification, AM receiving, transmission
IE- 8	Logic circuit trainer	20	AND OR NOT AND NOR
IE- 9	Pulse circuit trainer	20	Integral, differential, monostable, one shot
IE-10	Semiconductor trainer	20	Diode, thyristor, varister
IE-11	Electronic counter trainer	20	Frequency, adding factor
IE-12	IC troubleshooting kit	20	TTL/CMOS probe, logic prove, digital current tracer, logic clip
IE-13	Oscilloscope	20	100MHz/1mV, 2guns, 4traces
IE-14	Pulse generator	20	50MHz, 5ns, 16Vp-p
IE-15	Function generator	20	0.001Hz~19.99MHz
IE-16	Digital multimeter	20	DC 100mv~100V AC 100mv~750V
IE-17	Circuit tester	12	AC/DC 10mV
IE-18	Digital tester	20	AC/DC 200mV~, AC/DC 20mA~, $\Omega \sim 20M\Omega$
IE-19	Universal counter	12	10-120MHz, 20ns, 1000s GP-1B付
IE-20	DC ampere meter	1 set	0.1 - 3A: 20 units 1 - 30A: 20 units
IE-21	DC volt meter	1 set	0.3 - 10V : 20 units 3 - 100V : 12 units
IE-22	AC volt meter	1 set	300 - 750V : 20 units 15 - 30V : 20 units
IE-23	AC ampere meter	20	5 - 25A
IE-24	Power meter	1 set	For three-phase 120/240V 5A/2.5A: 12 units For single-phase 120/240V 1A/5A : 12 units
IE-25	Frequency counter	20	1GHz
IE-26	AC electronics volt meter	20	1.5mV~500V

Code No	Equipment name	Q'ty	Major specifications
IE-27	Milli volt meter	20	11.11mV - 111.1V
IE-28	Milli ampere meter	20	0.15 μ A - 5mA
IE-29	Lux meter	8	300 - 3,000 Lx
IE-30	Emergency spotlight	8	
IE-31	PCB artwork tools	40	Flexible tapes, tape cutters, transparent films, acid resistant pen
IE-32	Exposure unit	4	Cameras, makeshift dark rooms, developers, etching equipment
IE-33	PCB board	4	1.6 x 100 x 150, 1.6 x 300 x 200
IE-34	Parts	2	TTL-800 400ALS, HC40, AC800 HN-COS, HN-COS555, R001, 990
IE-35	Portable electric drills	4	
IE-36	DC power supply (1)	1 set	Output: 0 - 35V 20 units 0 - 55V 12 units 0 - 110V 20 units
IE-37	DC power supply (2)	8	Output: 0 - 18V
IE-38	DC power supply (3)	20	Output: 0 - 160V
IE-39	Variable transformer	10	0 - 260V, 5A, 1KVA
IE-40	Soldering power unit	40	
IE-41	Solder fume extractor	4	
IE-42	Tool cabinet	20	6 rows, 12 stages
IE-43	Tool set	40	
IE-44	Galvano meter	8	10 μ V/div $\pm 250 \mu$ V +20% -10%
IE-45	Standard cell	2	Unsaturated cadmium battery 1.0188-1.0195V
IE-46	Wheatstone bridge	8	1m Ω ~ 110 Ω
IE-47	Adjustable resistor	8	0.1 Ω - 111, 111 Ω
IE-48	Automatic LCR meter	12	0.1 μ H - 1,100H
IE-49	Personal computer	6	PS/2, display, keyboard, mouse, add-on memory
IE-50	Printer	8	With sheet feeder, cable
IE-51	X-Y plotter	4	HP-GL, A3-size, 6 pens
IE-52	Software	2	OrCAD/SDT, VST, PLD, PCB
IE-53	Microcomputer trainer	20	Basic boards, learning boards, training boards
IE-54	Logic analyzer	4	22 channels
IE-55	Logic comparator	16	1.4V, TTL/DTL
IE-56	Incircuit emulator	20	Emulators, bus analyzers, emulator boards, development software

Code No	Equipment name	Q'ty	Major specifications
IE-57	Digital storage scope	4	100MHz/1MHz/10Msps
IE-58	EPROM programmers	4	16K - 4M bit
IE-59	EPROM erasers	4	With automatic timer
IE-60	Educational video tapes	2	

Table 4.3.9 List of Equipment and Tools Selected for the Language Laboratory Course and Their Specifications

Code No	Equipment name	Q'ty	Major specifications
LA- 1	Language training system	1 set	Training equipment for 20 trainees & 1 trainer Tape recorder for instructor: 2 units Tape recorder for students: 20 units Headphone/microphone: 22 units Room speaker: 2 units Control console: 1 unit Desk assembly: 1 unit
LA- 2	Japanese language training tapes	1 set	Indonesian language
LA- 3	English language training tapes	1 set	Indonesian language

4.4 Implementation Plan

4.4.1 Implementation Policy

The project consists of two different portions; construction of buildings and equipment by the Indonesian side, and the procurement of training equipment and tools under grant aid by the Japanese government. The project implementation body, DGMPD of the Ministry of Manpower, will hire a Japanese consultant to conduct detailed design, tender documentation, tender evaluation, and supervision of installation of procured equipment in lieu of DGMPD. The overall structure of organizations involved in the project is illustrated in Figure 4.4.1.

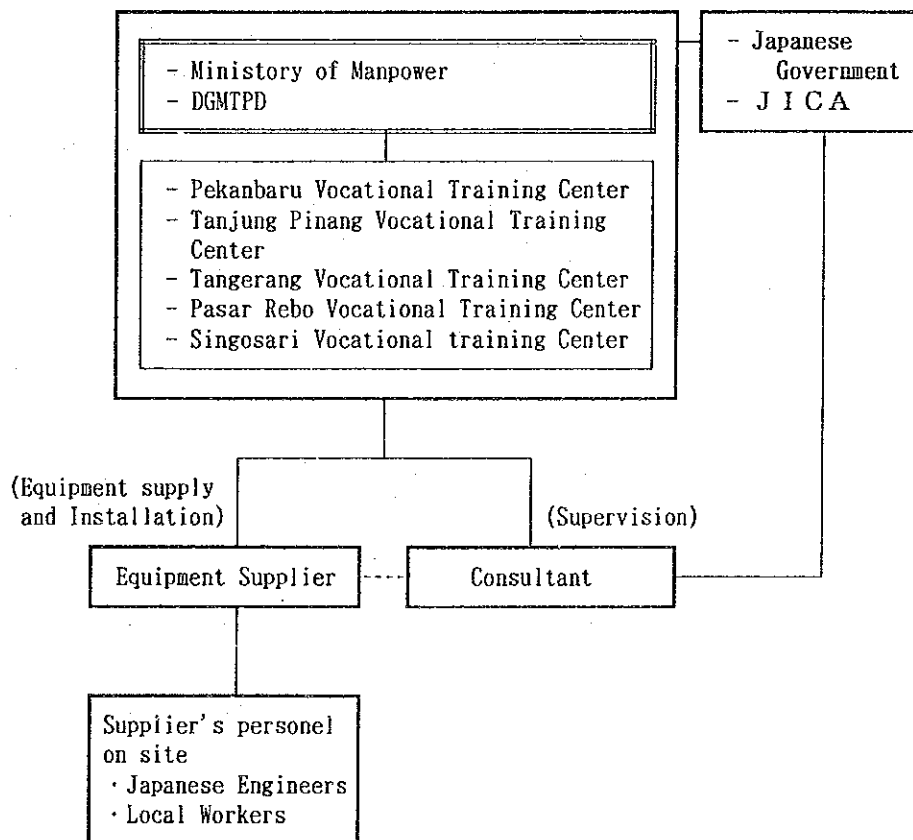


Figure 4.4.1 Organizational Structure of the Project

4.4.2 Points to Be Considered in the Execution

The dispatch of engineers for installation and operation of procured equipment at the vocational training centers needs to be planned carefully to ensure smooth work flow by minimizing waiting time.

4.4.3 Plan for Supervision of the Implementation

The consultant is expected to execute the project smoothly to its completion by a specially appointed project team according to the policy and principle of grant aid of the Japanese government, terms and conditions of the consulting agreement, and requirements and intents of basic project design, throughout the project implementation process from detailed design to contract administration and supervision. At the construction and installation stage, the consultant will send its engineers, whenever necessary, to contractors and suppliers as well as installation sites for the approval of design drawings and the attendance at completion tests at factory and installation at site, and inspection for final acceptance. Also, the consultant will monitor the progress of construction work executed by the Indonesian Side from time to time, and if any delay occurs, it will recommend necessary actions to ensure that the project progresses according to the overall schedule.

4.4.4 Equipment Procurement Plan

(1) Procurement Plan

The proposed equipment and tools will be procured through a general procurement contract awarded to a supplier (trading companies) selected in the open tender process. In principle, procurement will be made from Japan and Indonesia, but some equipment may be purchased from other countries under certain circumstances.

Care should be taken to check products which import is banned (including radio and TV sets, passenger automobiles, commercial vehicles, books, magazines, and periodicals in Indonesian and Chinese, etc.) or restricted (manufactured goods, food and agricultural products etc.), or countries from which imports are

prohibited. Periodical inquiry and investigation is required since import regulations are changed frequently.

(2) Transportation

The procured equipment will be shipped at the port nearest to the manufacturing sites, whole or in part, and will be unloaded at the Tanjung Priok port in the vicinity of Jakarta. After customs clearance, the equipment will be sorted for each center and will be transported on land or by sea.

4.4.5 Scope of the Work

(1) Scope of the Work of the Japanese Side

- 1) Procurement of equipment and materials, and transportation and installation related hereto.
- 2) electrical wiring work from a socket in the work shop to the installed equipment (however, a socket must be close to the equipment to be installed and the wiring work from a power source to the socket shall be done by the Indonesian side).
- 3) Test operation and adjustment of equipment. Instruction of operation and maintenance.
- 4) Consulting services including preparation of tender documents, management of tendering and supervision of the project implementation.

(2) Scope of the Work of the Indonesian Side

- 1) Civil work for the buildings contemplated to install the equipment, interior work of the building, foundation work of the equipment, and relocation work of the existing equipment and facilities.
- 2) Electric work for receiving, transforming and distributing electric power.
- 3) Plumbing work for water and drainage, and fuel gas work.
- 4) Electric lighting work.
- 5) Air conditioning work.
- 6) Draft and ventilation work.

- 7) Telephone and communication facility work.
- 8) Utensils and furniture.
- 9) Chemicals and consumables.
- 10) to take necessary measures for the unloading, custom's clearance and inland transportation of equipment, and to bear all the expenses necessary hereto.
- 11) To proceed with approvals necessary to carry on the project.
- 12) To bear commissions to a foreign exchange bank officially recognized by the Japanese Government for the banking services based on the Banking Arrangement.
- 13) To accord Japanese nationals whose service may be required in connection with the project such facilities as may be necessary for their entry into Indonesia and stay therein for the performance of their work.
- 14) To maintain and use properly the equipment purchased under the Grant Aid.
- 15) To bear all other expenses which are not including in the Grant Aid agreement but may be necessary to carry out the project.

4.4.6 Implementation Schedule

The project, under grant aid of the Japanese government, will be carried out in the following sequences.

(1) Detailed design

Based on the basic project design report, detailed equipment specifications will be finalized. Tender documents will be prepared and approved by related organizations, followed by tender procedures from evaluation to contract awarding. The process will take about 4 months.

(2) Manufacture and installation

The supplier will prepare and obtain approval of work drawings, manufacture equipment and tools, and ship them to Indonesia. Then, the supplier will be responsible for all the field activities, from unloading, customs clearance, inland transportation, installation to commissioning and instruction of maintenance.

(3) Completion and final acceptance

The installed equipment will be tested under the attendance of representatives of DGTMPD, the vocational training centers, the consultant, and other related parties, to see it operates according to specifications, and then delivered to Indonesian side. The Indonesian government will issue the certificate of completion to the supplier and the consultant. If everything goes as planned, the project will take about 8 months after the contract award.

The overall project schedule is shown in Fig.4.4.2.

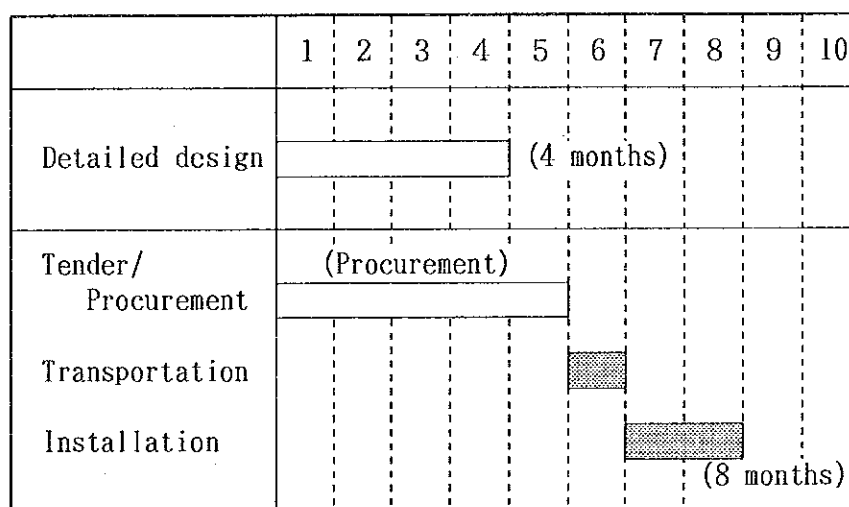


Fig 4.4.2 Overall Project Schedule

4.4.7 Preliminary Project Cost

The related project cost borne by the Indonesian side is estimated at 942 million rupiahs (49.9 million yen), which is the cost of buildings to be constructed in the vocational training centers of Pekanbaru, Tanjung Pinang and Tangerang, and the breakdown is shown below. Note that the Pasar Rebo and Singosari centers will use existing space for the industrial electronics and instrumentation course.

Vocational Training Center Construction cost
(million rupiahs)

Pekanbaru	343
Tanjung Pinang	384
Tangerang	215

Total	942
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CHAPTER 5 PROJECT EVALUATION AND CONCLUSION

Chapter 5 Project Evaluation and Conclusion

5.1 Project Evaluation

Indonesia has been implementing series of five-year national development plans aiming at modernization and industrial promotion. Under the current fifth five-year plan, it is working toward economic development by transforming its industrial structure: the shift from dependence on the oil and gas sector, promotion of export industries and creating employment opportunities for growing population and labor force. As part of its efforts, the upgrading of vocational training service is called for from the viewpoint of reinforcing human resources which are a major source of economic development. However, existing vocational training facilities and equipment are deteriorated due to aging and outmoded, thus to impede the reliable supply of skilled workers highly demanded by the industry.

In recognition of the situation, the Ministry of Manpower decided a plan to upgrade facilities and equipment of the vocational training centers. The project forms part of its efforts and is designed to modernize training equipment and tools at the five key training centers and to provide workers with skills which are most needed by the industry. In particular, major benefits expected from the project are summarized in Table 5.1.1.

Table 5.1.1 Expected Benefits of the Project - Improvement of Training Effect

Present situation and major problems	Improvement measures planned under the project	Effect of the project and level of improvement
<p>1) Training equipment available at the vocational training centers is limited in variety and quantity, and many of them are aged and outmoded, not suitable for providing students with training to keep abreast of rapidly advancing technology.</p>	<p>To provide training equipment and tools which are suitable for current vocational training requirements and help students learn basic knowledge and skills with ease. In particular, measuring instruments and hand tools will be obtained in sufficient number to make them accessible to many students.</p>	<p>Renewed training equipment and tools will help students effectively learn basic skills within a relatively short period of time. This will increase employment opportunities, resulting in a lower unemployment rate and the political and economic stability of the country.</p>
<p>2) Outmoded training equipment discourages both instructors and students from teaching and learning necessary skills seriously, somewhat contributing to the low level of education.</p>	<p>To provide latest training equipment suitable for the latest industrial need.</p>	<p>Availability of new equipment reflecting technological advancement will demand students and instructors to learn its operation and maintenance, as well as technologies and skills related thereto. Thus, it will help revitalize the training centers as a whole and improve overall technical levels of students and instructors. The narrowed gap between technical levels required by the industry and those trained at the centers will increase the confidence of local industries in the quality of education, encouraging them to employ graduates from the centers.</p>
<p>3) The shortage of adequate equipment also prevents local industries from effectively using the centers' facilities and staff for training their own employees.</p>	<p>To make training equipment meeting the industrial needs available in quantity and variety.</p>	<p>With the increased confidence in quality of the vocational training centers, local industries will increasingly use the centers' facilities and staff to train their own employees. This will lead to the improvement of technical levels of local industries, the quality improvement of Indonesian products, and their international competitiveness, which will ultimately contribute to the improvement of standards of living.</p>

5.2 Conclusion

Vocational training holds the key to the promotion of export industries, the increase in employment, and political and economic stability of the country, which are major policy objectives of the Indonesian government. In fact, the improvement of vocational training is one of the most important and pressing needs for the country. The project is designed to improve the quality of training for unskilled workers through upgraded training equipment, give them employment opportunities, and decrease the unemployment rate, and bring the political and economic stability. At the same time, the project will provide a place of training for workers having an intermediate level of skills, including in-house training for employees of private companies, which lead to the improvement of technical levels of local industries and the quality of Indonesian products and the strengthening of international competitiveness, thereby contributing to the overall economic development process of the country. On the other hand, the Indonesian government has sufficient resources to manage the project in terms of organization, manpower, and funds. It should be noted, however, the following efforts are required on the Indonesian side to implement the successful project.

(1) Execution of the works on the Indonesian side

Timely and effective execution of projects and services by the project implementation body and related organizations on the Indonesian side is essential and should be given of the highest priority, including construction and addition of workshop facilities to accommodate new training equipment, accompanied by electrical, plumbing and related work, necessary support related to the unloading, customs clearance, transportation, delivery, and installation of equipment by the supplier, in order to prevent loss or damage, and necessary action including application to ensure smooth documentation and its processing related to the above procedures.

(2) Continuous securing of operation and maintenance costs

Providing sufficient operating and maintenance costs on a continuous

basis is prerequisite to the effective use of training equipment. The project implementation body and related organizations are expected to make utmost efforts to secure the operating and maintenance budget for the vocational training centers to use the supplied equipment according to the purpose and intent of use.

(3) Establishment of the parts procurement and maintenance system

A significant number of equipment currently owned by the centers is not left in operating conditions mainly because of the lack of spare parts. In fact, it is very difficult to obtain spare parts for imported equipment in rural areas. Thus, the Ministry of Manpower is expected to take leadership in establishing a centralized procurement system to supply necessary parts upon request from each center in order to ensure proper equipment maintenance. On the other hand, each center needs to establish its own maintenance system which monitors equipment conditions and repair it quickly to ensure a long period of use.

(4) Training of instructors

Instructors and assistants play an important role in effective use of training equipment, and therefore should be properly assigned and trained according to actual manpower requirements. Continuous efforts to upgrade teaching skills and technical levels are critical to maintain and improve the quality of education. Also, the timely assignment of instructors to the new courses is important.

(5) Development of curriculum for the new courses

The industrial electronics and instrumentation course newly established at the two centers is virtually new for the public vocational training facilities in the country, and does not have a curriculum. The study team has therefore selected training equipment and tools for the course on the basis of CEVEST's curriculum and equipment list, and the intent of the Indonesian counterpart. Now, the project implementation body is expected to develop the formal curriculum for the course as soon as possible, including training items and hours, under the cooperation of CEVEST staff and engineers

of government-owned process industries.

APPENDICES

Appendix - 1 Members of the Basic Design Study Team

Takashi Hatakeyama	Team Leader Deputy Director First Project Management Division Grant Aid Project Management Department Japan International Cooperation Agency
Shinji Kure	Vocational Training Planning UNICO International Corporation
Jun Ikeda	Vocational Training Equipment Planning 1 UNICO International Corporation
Teruo Kobari	Vocational Training Equipment Planning 2 UNICO International Corporation

Appendix - 2 Itineraries of Basic Design Study Team
(Dec. 5, 1993 - Dec. 29, 1993)

1. Dec. 5th (Sun.) : Lv.Tokyo - Ar.Jakarta
(Mr. Kure, Mr. Ikeda, Mr. Kobari)
2. Dec. 6th (Mon.) : Jakarta
- Courtesy meeting at JICA Indonesia
- Meeting with the staff of DGMPD
3. Dec. 7th (Tue.) : Jakarta
- Meeting with the staff of DGMPD and CEVEST
4. Dec. 8th (Wed.) : Jakarta
- Meeting with the staff of DGMPD
: Lv.Jakarta - Ar.Pekanbaru
5. Dec. 9th (Thu.) : Pekanbaru
- Meeting with the regional staff of MOM
- Meeting with the teaching staff of Pekanbaru VTC
6. Dec. 10th (Fri.) : Pekanbaru
- Meeting with the teaching staff of Pekanbaru VTC
7. Dec. 11th (Sat.) : Pekanbaru
- Meeting with the teaching staff of Pekanbaru VTC
- visiting related industry
: Lv.Pekanbaru - Ar.Tanjung Pinang
8. Dec. 12th (Sun.) : Tanjung Pinang
- visiting industrial park
9. Dec. 13th (Mon.) : Tanjung Pinang
- Meeting with the teaching staff of Tanjung Pinang
10. Dec. 14th (Tue.) : Tanjung Pinang
- Meeting with the teaching staff of Tanjung Pinang
11. Dec. 15th (Wed.) : Lv.Tanjung Pinang - Batam - Ar.Pekanbaru
- Meeting with the regional staff of MOM
12. Dec. 16th (Thu.) : Pekanbaru
- Meeting with the teaching staff of Pekanbaru VTC
: Lv.Pekanbaru - Surabaya - Ar.Surabaya
13. Dec. 17th (Fri.) : Singosari
- Meeting with the teaching staff of Singosari VTC
14. Dec. 18th (Sat.) : Singosari
- Meeting with the teaching staff of Singosari VTC
: Lv.Singosari - Surabaya - Ar.Jakarta
15. Dec. 19th (Sun.) : Jakarta
- Team meeting
- Data arrangement

16. Dec. 20th (Mon.) : Lv.Tokyo - Ar.Jakarta
 (Mr. Hatakeyama)
 : Jakarta
 (Mr. Kure, Mr. Ikeda, Mr. Kobari)
 - Meeting with the teaching staff of Pasa Rebo VTC
17. Dec. 21th (Tue.) : Jakarta
 - Meeting at JICA Indonesia
 - Meeting with the staff of DGMPD
18. Dec. 22th (Wed.) : Jakarta
 - Meeting with the teaching staff of Tangerang
19. Dec. 23th (Thu.) : Jakarta
 - Meeting with the staff of DGMPD
20. Dec. 24th (Fri.) : Jakarta
 - Meeting at JICA Indonesia
 - Meeting with the staff of DGMPD
21. Dec. 25th (Sat.) : Jakarta
 - Team meeting
 - Data arrangement
22. Dec. 26th (Sun.) : Jakarta
 - Team meeting
 - Data arrangement
23. Dec. 27th (Mon.) : Jakarta
 (Mr. Kure, Mr. Ikeda, Mr. Kobari)
 - Meeting with the staff of DGMPD
 - Meeting with the staff of the CEVEST
 - Signing of the Minutes of Discussions
 : Lv.Jakarta
 (Mr.Hatakeyama)
24. Dec. 28th (Tue.) : Jakarta
 - Meeting with the staff of DGMPD
 : Lv.Jakarta
 (Mr. Kure, Mr. Ikeda, Mr. Kobari)
 : Ar.Tokyo
 (Mr. Hatakeyama)
25. Dec. 29th (Wed.) : Ar.Tokyo
 (Mr. Kure, Mr. Ikeda, Mr. Kobari)

Legend

- DGMPD : Directorate General of Manpower Training and Productivity
 Development
 CEVEST : the Center for Vocational and Extension Service Training

Appendix - 3 List of Interviewed Personnel

1. Ministry of Manpower
 1. A.Sangadji Rachman
 2. M.Moedjiman
 3. Ir.Besar Setyoko
 4. Drs.Djolipinem
 5. Drs.Anwari
 6. Drs.Djunara Wihardja Sasmita
 7. Wahadi Sugijono
 8. Untung Priyo Wibowo
 9. Sukaryono
2. Regional Department of Manpower
 1. Drs.Musni Tambusai
 2. Sj.Tambunan
3. Pekanbaru VTC
 1. Drs.Sunoto
 2. Yustinus Ponimin
 3. Sungkono Kolonodale
 4. Hadi Suyitno
 5. Basuki
 6. Drs.M.Faried
 7. Syaipul Prawira
 8. Syaiful Marzuki
 9. Bakhrum
 - 10.Drs.K.Hadiwibowo
 - 11.Drs.Soesanto
4. Tanjung Pinang VTC
 1. Drs.T.Tarigan
 2. Mr.Honesto Yusran
 3. Ir.Sofyan Ginting
5. Singosari VTC
 1. Drs.Slamet Goenadi
 2. Ir.Sulahjo
 3. Barkah Sunarjo
 4. Ir.Solek AH
 5. Drs.Susfairi Pb
 6. Dra.Siti Mutmainah
6. Pasar Rebo VTC
 1. Drs.J.D.Purba.SH.
 2. Suharto
 3. Wikanto
 4. Suhardi
 5. B.Manurung
 6. Ablul Holiq
 7. Alimur Djamaran
 8. M.Abd.Syukur
7. Tangerang VTC
 1. K.Simanjuntak.BA
 2. Jumarno
 3. Juniati
 4. Miswan
 5. Dedi Kusmayadi
8. JICA
 1. Koichiro Okazaki
 2. Hiroshi Kurakata
9. JICA Adviser
 1. Tetsuo Sakata
- 10.CEVEST
 1. Yukio Utsumi
 2. Norimasa Matsusima
 3. Hideki Nakamura
- 11.JOCV
 1. Masahiro Ito
 2. Shigeki Fujita
 3. Eiko Tokuda
- 12.JETRO
 1. Tomiyasu Nakamura

**MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY
ON
THE PROJECT FOR THE REFRESHMENT
OF VOCATIONAL TRAINING
EQUIPMENT IN THE REPUBLIC OF INDONESIA**

In response to a request of the Government of the Republic of Indonesia, the Government of Japan decided to conduct a Basic Design Study on the Project for the Refreshment of Vocational Training in The Republic of Indonesia (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Indonesia a study team headed by Mr. Takashi Hatakeyama, Deputy Director, First Project Management Division, Grant Aid Project Management Department, JICA scheduled to stay in the country from December 5 to December 28 , 1993.

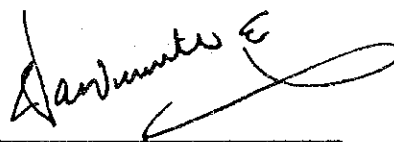
The Team held discussions with the officials concerned of the Directorate General of Manpower Training and Productivity Development, Ministry of Manpower and conducted field surveys at the projected areas.

In the course of discussions and field surveys both parties have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Jakarta, December 27, 1993



Hatakeyama Takashi
Leader,
Basic Design Study Team
(JICA)



M. Moedjiman
Secretary, Directorate General
of Manpower Training and
Productivity Development,
Ministry of Manpower,
Republic of Indonesia

ATTACHMENT

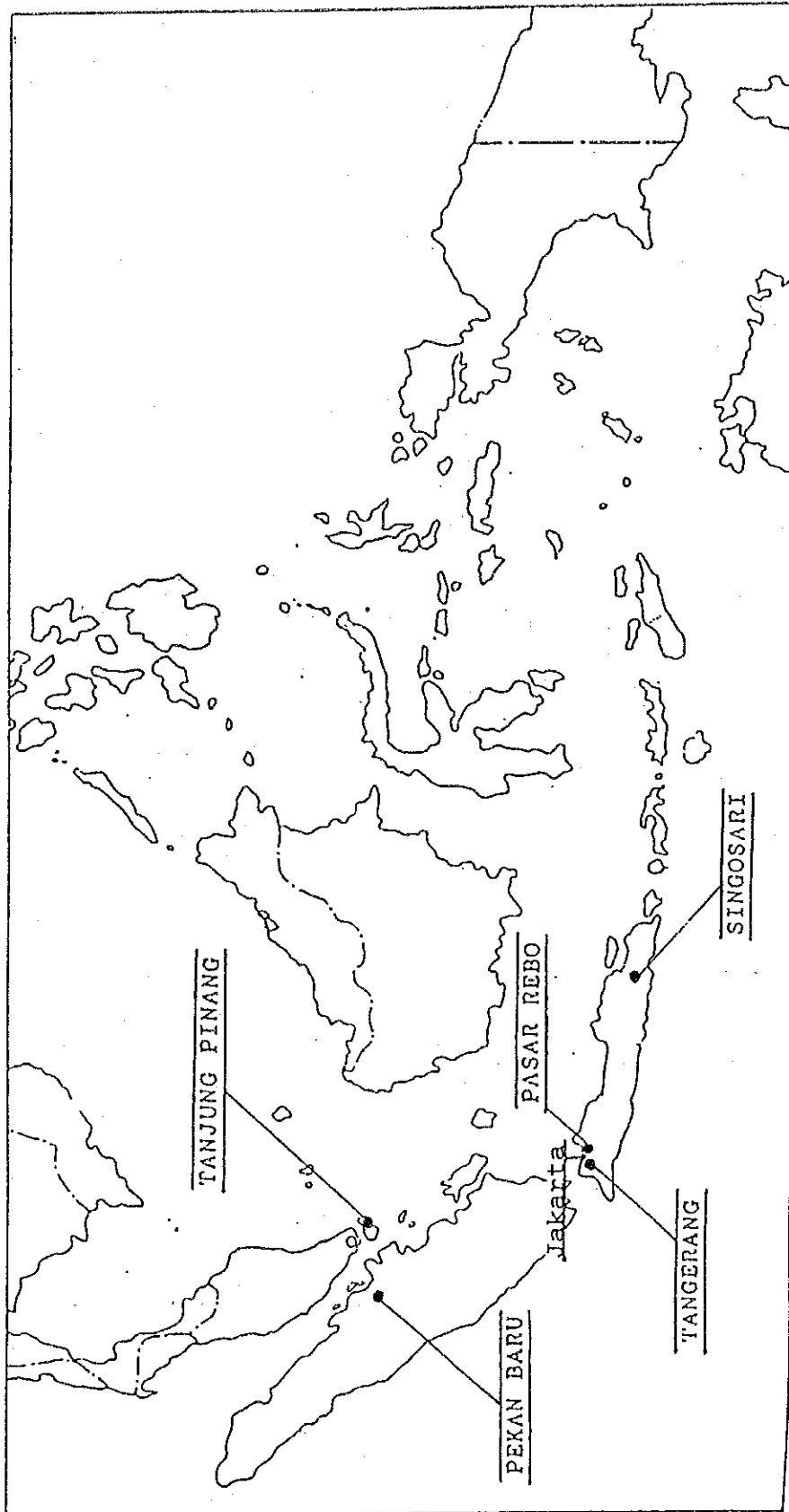
1. Objectives of the Project.
Due to the shortage of skilled engineers, the Indonesia industries have been facing great difficulties for technical development. The objective of the Project is to supply the equipment for the five selected Vocational Training Centers.
2. Project sites.
The sites of the Project are located at Tanjung Pinang, Pekanbaru, Pasar Rebo, Singosari, Tangerang.
(Project areas map is attached as ANNEX - 1)
3. Executing Agency : Directorate General of Manpower Training and Productivity Development (DGMPD)
Responsible Agency : Ministry of Manpower, Republic of Indonesia.
4. Items requested by the Government of Indonesia.
Items of equipment requested by DGMPD, Ministry of Manpower, Republic of Indonesia :
 - a. Equipment for Machine Shop
 - b. Equipment for Welding.
 - c. Equipment for Refrigeration
 - d. Equipment for Automotive
 - e. Equipment for Furniture
 - f. Equipment for Pipe Fitting
 - g. Equipment for Industrial Electronic and Instrumentation
 - h. Equipment for Language Laboratory.

Final list of equipment procured under the Grant Aid will be decided after further studies in Japan and it will be informed to the DGMPD, Ministry of Manpower.
5. Based on the requested equipment list which will be supplied by the Government of Japan to 5 VTCs, the DGMPD kindly request to the Team to allocate some amount of budget for procuring Indonesian products in Indonesia as much as possible.
6. Japan's Grant Aid Program
 - (1) The Government of Indonesia has understood the system of Japanese Grant Aid explained by the Team.
 - (2) The Government of Indonesia will take necessary measures, described in ANNEX - II, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.
7. Schedule of the study.
Based on the Minutes of Discussions and technical examination of the study, basic design study report will be sent to the Government of Indonesia by the end of March, 1994.



(B)

The map of the location of the VTC



ANNEX - II

Necessary measures to be taken by the Government of The Republic of Indonesia are as follows;

1. To provide necessary permissions, license and other authorizations for smooth implementation of the Project.
2. To bear advising commission of the Authorization to Pay (A/P) and Payment commission to the Japanese foreign exchange bank for banking services based upon the Banking Arrangement (B/A).
3. To ensure prompt unloading, tax exemption, and custom clearance of the goods for the Project at port of disembarkation in Indonesia.
4. To ensure prompt unloading and internal transportation of the goods purchased and/or imported under the Grant Aid for the Project.
5. To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such facilities as may be necessary for their entry into Indonesia, and stay therein for the performance of their work.
6. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Indonesia with respect to the supply of the products and services under the verified contracts.
7. To maintain and use properly and effectively the equipment and materials provided under the verified contracts.
8. To bear all the expenses other than those to be borne by the Grant.
9. To coordinate and solve any matters related which may arise with their party and inhabitants living in the Project areas during implementation of the Project.

(S)

4

Appendix - 5 List of Equipment Requested

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
	MACHINE SHOP AND DIES MAKING							
MS - 1 **	CENTER LATHE 360 X 550	14	SET	5	5	4		
MS - 2 **	CENTER LATHE 510 X 1500	13	SET	5	4	4		
MS - 3 **	CENTER LATHE 510 X 2000	10	SET	3	3	4		
MS - 4 **	COLUMN DRILLING MACHINE	6	SET	2	2	2		
MS - 5 **	RADIAL DRILLING MACHINE	3	SET	1	1	1		
MS - 6 **	VERTICAL MILLING MACHINE	5	SET	2	2	1		
MS - 7 **	UNIVERSAL MILLING MACHINE	6	SET	2	2	2		
MS - 8 **	SHAPING MACHINE	6	SET	2	2	2		
MS - 9 **	LATHE COPYING	6	SET	2	2	2		
MS - 10 **	SURFACE GRINDING MACHINE	6	SET	2	2	2		
MS - 11 **	CYLINDRICAL GRINDING MACHINE	6	SET	2	2	2		
MS - 12 x	BORING MACHINE FOR AUTOMOTIVE	2	SET	1	1			
MS - 13	HOBING MACHINE	2	SET		1	1		
MS - 14 (***) x	CRANKSHAFT GRINDING MACHINE	3	SET	1	1	1		
MS - 15 x	CNC VERTICAL MACHINING CENTER	2	SET	1	1			
MS - 16 x	CNC MACHINING CENTER	1	SET			1		
MS - 17 x	CNC LATHE	3	SET	1	1	1		
MS - 18 x	CNC LATHE (SMALL)	2	SET			2		
MS - 19 x	COMPUTER AIDED DESIGN (CAD)	3	SET	1	1	1		
MS - 20 x	COMPUTER AIDED MFR (CAM)	3	SET	1	1	1		
MS - 21 x	EDM (ELECTRIC DISCHARGE M/C	3	SET	1	1	1		
MS - 22 **	POWER HACKSAW	6	SET	2	2	2		
MS - 23 **	PEDESTAL GRINDING MACHINE	4	SET	1	2	1		
MS - 24 **	SPECIAL TWIST DRILL GRINDING	6	SET	2	2	2		
MS - 25 **	TOOL AND CUTTER GRINDING	6	SET	2	2	2		
MS - 26 **	TENSILE STRENGTH MACHINE	3	SET	1	1	1		
MS - 27	BENCH DRILLING MACHINE	4	SET	1	2	1		
MS - 28 **	FACE MILLING CUTTER	6	SET	2	2	2		
MS - 29 **	GEAR CUTTER MI-M6	6	SET	2	2	2		
MS - 30 **	END MILL SET	6	SET	2	2	2		
MS - 31 **	COLLET END MILL SET	6	SET	2	2	2		
MS - 32 **	HEAVY DUTY END MILL SET	6	SET	2	2	2		
MS - 33 **	TOOL HOLDER	6	SET	2	2	2		
MS - 34 **	CHIP CEMENTED CARBIDE	30	PCS	10	10	10		
MS - 35	DIAL TEST INDICATOR W/STAND	6	PCS	2	2	2		
MS - 36	TWIST DRILL SET	2	SET	1	1			
MS - 37	SURFACE PLATE	3	SET	1	1	1		
MS - 38	KNURLING TOOLS	2	SET	1	1			
MS - 39-1	VERNIER CALIPER 12"	15	PCS	5	10			
MS - 39-2	VERNIER CALIPER 12" DIAL	8	PCS	2	4	2		
MS - 40-1	DIGITAL MICROMETER OUT 0-25 MM	6	PCS	2	2	2		
MS - 40-2	DIGITAL MICROMETER OUT 25-50MM	6	PCS	2	2	2		
MS - 40-3	DIGITAL MICROMETER OUT 50-75MM	6	PCS	2	2	2		
MS - 40-4	DIGITAL MICROMETER IN 25-50 MM	6	PCS	2	2	2		
MS - 40-5 **	DIGITAL MICROMETER IN 50-75MM	9	PCS	3	3	3		
MS - 40-6 **	DIGITAL MICROMETER IN 1"-2"	9	PCS	3	3	3		
MS - 40-7 **	DIGITAL MICROMETER DEPTH 0-25	9	PCS	3	3	3		
MS - 40-8 **	DIGITAL MICROMETER DEPTH 25-50	9	PCS	3	3	3		

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
MS - 41-1 **	INSIDE MICROMETER 0-25 MM	9	PCS	3	3	3		
MS - 41-2 **	INDISE MICROMETER 75-100MM	9	PCS	3	3	3		
MS - 41-3	INSIDE MICROMETER 100-125MM	2	PCS			2		
MS - 41-4	INSIDE MICROMETER 125-150 MM	2	PCS			2		
MS - 42-1	OUTSIDE MICROMETER 100-125 MM	2	PCS			2		
MS - 42-2	OUTSIDE MICROMETER 125-150 MM	2	PCS			2		
MS - 43-1	VERNIER CALIPER 150 MM	40	PCS	10	10	20		
MS - 43-2	VERNIER CALIPER 300 MM	4	PCS	1	1	2		
MS - 43-3	VERNIER CALIPER 1000 MM	4	PCS	1	1	2		
MS - 44 **	THREAD MICROMETER	6	PCS	2	2	2		
MS - 45	GEAR MICROMETER	3	PCS	1	1	1		
MS - 46	VERNIER HEIGHT GAUGE	3	PCS	1	1	1		
MS - 47	VERNIER DIGITAL HEIGHT GAUGE	3	PCS	1	1	1		
MS - 48 **	DIGIMATIC INDICATOR	6	PCS	2	2	2		
MS - 49	SCREW PITCH GAUGE	15	PCS	5	5	5		
MS - 50-1	RADIUS GAUGE 72-R7	3	PCS	1	1	1		
MS - 50-2	RADIUS GAUGE 72 A-B 15	3	PCS	1	1	1		
MS - 50-3	RADIUS GAUGE 72 B - B 25	3	PCS	1	1	1		
MS - 51	COMBINATION SQUARE	3	PCS	1	1	1		
MS - 52	DOUBLE SQUARE	3	PCS	1	1	1		
MS - 53	PRAIN STEEL PROTECTOR	3	PCS	1	1	1		
MS - 54	MEASURMENT CUPBOARD	3	SET	1	1	1		
MS - 55	BENCH VISE NO. 5	20	PCS			20		
MS - 56	HEAT TREATMENT FURNACE (ELEC.)	2	SET		1	1		
MS - 57	BENCH VISE UNIVERSAL TYPE	6	PCS	2	2	2		
MS - 58	GEAR CUTTER M1 - M4	1	PCS			1		
MS - 59	MULTI TESTER	1	PCS			1		
MS - 60	OUTOCOLY METER	1	SET			1		
MS - 61	TRANSPORT AND LIFT IM WIDE	2	SET		1	1		
MS - 62-1	ROOL HOLDER (KNURING) TYPE 101	2	PCS	1	1			
MS - 62-2	ROOL HOLDER (KNURING) TYPE 100	2	PCS	1	1			
MS - 62-3	ROOL HOLDER (KNURING) TYPE 95	2	PCS	1	1			
MS - 63 **	DIAMOND DRESSER	9	PCS	3	3	3		
MS - 64	CUT GRINDING MACHINE	3	SET	1	1	1		
MS - 65	UNIVERSAL HARDNESS TESTER	3	SET	1	1	1		
MS - 66	AIR COMPRESSOR	3	SET	1	1	1		
MS - 67	BASIC MACHINE TECHNOLOGY	3	SET	1	1	1		
MS - 68	BASIC ENGINE LATHE	3	SET	1	1	1		
MS - 69	INTERMEDIATE ENGINE LATHE	3	SET	1	1	1		
MS - 70	MILLING AND TOOL SHARPENING	3	SET	1	1	1		
MS - 71	BENCH METAL WORK	3	SET	1	1	1		
MS - 72	DRILL PRESS EXPLAINED	3	SET	1	1	1		
MS - 73	THE HORIZONTAL SURFACE GRINDER	3	SET	1	1	1		
MS - 74	LATHE CUTTING TOOLS EXPLAINED	3	SET	1	1	1		
MS - 75	MEASURING TOOLS EXPLAINED	3	SET	1	1	1		
MS - 76	MILLING MACHINE EXPLAINED	3	SET	1	1	1		
MS - 77	CENTRE DRILL	3	SET	1	1	1		
MS - 78	TAUER AND DEBURING COUNTERSINK	3	SET	1	1	1		

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
MS - 79	TAPER AND DEBURING COUNTERSINK SLOTTED 90°	3	SET	1	1	1		
MS - 80	BALL AND MILLING CUTTER SET	3	SET	1	1	1		
MS - 81	T-SLOT MILLING CUTTER SET	3	SET	1	1	1		
MS - 82	SINGLE ANGLE MILLING CUTTER 45°, AND 60 SET	3	SET	1	1	1		
MS - 83	COUNTER ROUNDING END MILL	3	SET	1	1	1		
MS - 84	SIDE MILLING CUTTER SET	3	SET	1	1	1		
MS - 85	HSS PLAIN MILLING CUTTER SET	3	SET	1	1	1		
MS - 86	HSS SHELL END MILE SET	3	SET	1	1	1		
MS - 87	SINGLE ANGLE MILLING CUTTER 45°, 60° AND 60 SET	3	SET	1	1	1		
MS - 88	DOUBLE ANGLE MILLING CUTTER 45°, 60° AND 60 SET	3	SET	1	1	1		
MS - 89	CONCOVE MILLING CUTTER	3	SET	1	1	1		
MS - 90	CONNEX MILLING CUTTER	3	SET	1	1	1		

Remark :

- * = The Last Priority
- ** = Change quantity
- = NO. MS-67 TO MS-90 NEW ADDITION EQUIPMENT

~~HSS~~
HSS = High speed steel.

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
	ARC WELDING							
AW - 1	WELDING MACHINE	20	SET	5	8	7		
AW - 2	WELDING MACHINE (LARGE)	11	SET	2	5	4		
AW - 3	GENSET WELDING MACHINE	1	SET			1		
AW - 4	TIG ARC WELDING	1	SET			1		
AW - 5	TIG DC WELDING SET	1	SET			1		
AW - 6	TIG INTEGRATED AC/DC WELDING	4	SET	1	2	1		
AW - 7	MIG-MAG WELDING	4	SET	1	2	1		
AW - 8	CO2 PLASMA WELDING MACHINE	3	SET	1	1	1		
AW - 9	PLASMA CUTTING MACHINE	3	SET	1	1	1		
AW - 10	AUTOMATIC FLAME PLAT CUTTING	3	SET	1	1	1		
AW - 11	FLAME PIPE CUTTING	3	SET	1	1	1		
AW - 12	AUTOMATIC FLAME PIPE CUTTING	3	SET	1	1	1		
AW - 13	PEDESTAL GRINDING MACHINE	3	SET	1	1	1		
AW - 14	ELECTRIC HAND GRINDER (5 INCI)	15	PCS	5	5	5		
AW - 15	ELECTRIC HAND GRINDER (7 INCI)	6	PCS	2	2	2		
AW - 16	CUT OFF GRINDING MACHINE	3	SET	1	1	1		
AW - 17	AMPERE TONG	3	SET	1	1	1		
AW - 18	BEVEL CUTTING MACHINE	3	SET	1	1	1		
AW - 19	GAS WELDING/CUTTING BLOW PIPES	10	SET			10		
AW - 20	SAFETY TROLLEY	4	SET	1	1	2		
AW - 21	MACHINE X-RAY	3	SET	1	1	1		
AW - 22	MATERIAL BENDING TESTER	3	SET	1	1	1		
AW - 23	ULTRASONIC TESTER	3	SET	1	1	1		
AW - 24	MAGNETIC PARTICLE TESTER	3	SET	1	1	1		
AW - 25	TENSILE STRENGTH TESTER	3	SET	1	1	1		
AW - 26	ELECTRODE DRIER STATIONARY	3	SET	1	1	1		
AW - 27	ELECTRODE DRIER FORTABLE	20	PCS	5	10	5		
AW - 28	POSITIONERS	1	SET			1		
AW - 29	WELDING TABLE	45	PCS	10	18	17		
AW - 30	SHEARING MACHINE	1	SET			1		
AW - 31	GUILLOTINE CUTTER	2	SET	1	1			
AW - 32	BLOWER (FUME EXTRACTOR)	6	SET	2	2	2		
AW - 33	MACHINE PLATE BENDING	1	SET			1		
AW - 34	MACHINE ROLLER PIPE	1	SET			1		
AW - 35	HYDRAULIC TESTER	1	SET			1		
AW - 36	WELDING GAUGE	15	PCS	5	5	5		
AW - 37	TEMPERING PLATE MACHINE	1	SET			1		
AW - 38	TEMPERING PIPE MACHINE	1	SET			1		
AW - 39	SLIDE PROJECTOR	3	SET	1	1	1		
AW - 40	OVERHEAD PROJECTOR	3	SET	1	1	1		
AW - 41-1	AUDIO VISUAL FOR WELDING	3	SET	1	1	1		
AW - 41-2	WELDING PROCESSING	1	SET			1		
AW - 41-3	WELDING TECNIQUI	3	SET	1	1	1		
AW - 41-4	WELDING INSPECTION AND TESTING	3	SET	1	1	1		
AW - 42	CHIPPING HAMMER	40	PCS	15	15	10		
AW - 43	HELMET	55	PCS	20	20	15		
AW - 44	POWER HACKSAW	3	SET	1	1	1		

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
AW - 45	BENCH VISE	50	PCS	20	20	10		
AW - 46	WORKBENCH	15	SET	5	5	5		
AW - 47	HAND POWER BRUSH	15	PCS	5	5	5		
AW - 48	ANVIL	6	PCS	2	2	2		
AW - 49	BENCH DRILLING MACHINE	4	SET	2	2			
AW - 50	COLUMN DRILLING MACHINE	2	SET	1	1			
AW - 51	HAND DRILLING MACHINE	9	PCS	3	3	3		
AW - 52	BLIND RIVET MACHINE	15	PCS	5	5	5		
AW - 53	C CLAMP.	15	PCS	5	5	5		
AW - 54	SELF GRIP WELDING TONG	30	PCS	10	10	10		
AW - 55	SQUARE	30	PCS	10	10	10		
AW - 56	SQUARE (LARGE)	15	PCS	5	5	5		
AW - 57	DEVIDERS	30	PCS	10	10	10		
AW - 58	SCRIBER	30	PCS	10	10	10		
AW - 59	STEEL RULE	30	PCS	10	10	10		
AW - 60	MESURING TAPE	15	PCS	5	5	5		
AW - 61	ROLLING MACHINE	3	SET	1	1	1		
AW - 62	TAP HADLE SET	20	PCS	10	10			
AW - 63	DIES HADLE SET	20	PCS	10	10			
AW - 64	TAP SET	20	SET	10	10			
AW - 65	DUES SET	20	SET	10	10			
AW - 66	PIPE WRENCH	10	SET	5	5			
AW - 67	PIPE THREAD CUTTER	2	SET	1	1			
AW - 68	SHEET METAL FOLDING MACHINE	3	SET	1	1	1		
AW - 69	FLANGING ANG BENDING MACHINE	3	SET	1	1	1		
AW - 70	AIR COMPRESSOR	3	SET	1	1	1		
AW - 71	WELDING WITH SHIELDED METAL-ARC	3	PCS	1	1	1		
AW - 72	OXYFUEL CUTTING	3	PCS	1	1	1		
AW - 73	PIPE WELDING	3	PCS	1	1	1		
AW - 74	BLUEPRINT READING FOR WELDERS	3	PCS	1	1	1		

Code no. 71 to 74 Addition Title.

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
	REFRIGERATION REPAIR AIR SERVICE							
RS - 1 **	AIR COMPRESSOR	4	SET	2	2			
RS - 2 *	AIR CLEANING NOZZLE	6	SET	4	2			
RS - 3 **	VACUUM PUMP	4	SET	2	2			
RS - 4 *	CHARGING CYLINDER	3	SET	2	1			
RS - 5 *	CHARGING MANIFOLD	10	SET	8	2			
RS - 6-1 *	CHARGING HOSE RED	7	SET	5	2			
RS - 6-2 *	CHARGING HOSE BLUE	7	SET	5	2			
RS - 6-3 *	CHARGING HOSE WHITE	7	SET	5	2			
RS - 7 **	CHARGING UNITS	10	SET	6	4			
RS - 8	GAS CUTTING/WELDING SET	2	SET	1	1			
RS - 9 **	REFRIGERATION SYSTEM DOMESTIC	10	SET	6	4			
RS - 10 *	COMPRESSOR REFRIGERATOR DOMESTIC	3	SET	2	1			
RS - 11	ABSORPTION REFRIGERATOR DOMESTIC	3	SET	2	1			
RS - 12 *	COMBINATION COMPRESSOR REFRIGERATOR DOMESTIC	3	SET	2	1			
RS - 13	DOMESTIC FREEZER	2	SET	1	1			
RS - 14 **	WINDOW AIR CONDITIONER 3 KIND	10	SET	6	4			
RS - 15 **	SPLIT AIR CONDITIONER DOMESTIC	10	SET	6	4			
RS - 16	PACKAGE AIR CONDITIONER	2	SET	1	1			
RS - 17 *	DEFROST HEATER CABLE 20 M	2	SET	1	1			
RS - 18	CENTRAL AIR CONDITIONER	2	SET	1	1			
RS - 19	AIR COOLED CONDENSING UNIT	2	SET	1	1			
RS - 20	GAS FLAME LEAK DETECTOR	6	SET	4	2			
RS - 21	GAS ELECTRIC DETECTOR	2	SET	1	1			
RS - 22 *	CAPACITY ANALYZER	2	SET	1	1			
RS - 23	ELECTRIC AIR VELOCITY	2	SET	1	1			
RS - 24 **	CLIP-ON VOLT-AMP-OHM METER	4	SET	2	2			
RS - 25 *	TEMPERATURE PROBE	3	PCS	2	1			
RS - 26	ELECTRONIC VOLT-WATT METER	3	PCS	2	1			
RS - 27	RECORDING HYGROMETER	3	PCS	2	1			
RS - 28	CONSTANT PRESSURE VALVE	3	PCS	2	1			
RS - 29	PILOT PRESSURE VALVE (SMALL)	3	PCS	2	1			
RS - 30	PILOT PRESSURE VALVE (LARGE)	3	PCS	2	1			
RS - 31	PIPE BENDING TOOL (MIDIUM)	25	SET	15	10			
RS - 32 *	PIPE BENDING TOOL (SMALL)	15	SET	10	5			
RS - 33	SWAGING TOOL	15	SET	10	5			
RS - 34	SWAGING TOOL (LARGE)	3	SET	2	1			
RS - 35	T EXTRACTOR KIT	3	SET	2	1			
RS - 36	MAIN SUCTION PRESSURE VALVE	3	SET	2	1			
RS - 37 *	WATER SUCTION CONTROLLED PRESSURE VALVE	3	SET	2	1			
RS - 38	THERMOSTATIC LIQUID LEVEL VALVE	3	SET	2	1			
RS - 39	COMBINATION PRESSURE SWITCH	3	SET	2	1			
RS - 40	MOTOR SPEED CONTROL	3	SET	2	1			

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGK RANG	PASAR REBO	SINGO SARI
RS - 41	ELECTRIC CUTTER	3	PCS	2	1			
RS - 42 *	GLASS CUTTER	3	PCS	2	1			
RS - 43	PIPE CUTTER FOR COPPER 3-25MM	15	PCS	10	5			
RS - 44 *	PIPE CUTTER FOR COPPER 3-16MM	15	PCS	10	5			
RS - 45	PIPE REAMER	15	PCS	10	5			
RS - 46	FLARING TOOL	15	PCS	10	5			
RS - 47	RESURFING TOOL	3	SET	2	1			
RS - 48	ELECTRONIC HYGROSTAT	3	SET	2	1			
RS - 49 *	HIGH PRSSURE SWITCH SET	3	SET	2	1			
RS - 50 *	DEFERENTIAL PRESSURE SWITCH	3	SET	2	1			
RS - 51	LOW PRESSURE SWITCH WITH AUTOMATIC RE-SET	3	SET	2	1			
RS - 52	LOW PRESSURE SWITCH WITH MANUAL RE-SET	3	SET	2	1			
RS - 53	WINDOW AIR CONDITIONER TYPE THERMOSTAT	3	PCS	2	1			
RS - 54	REFRIGERATOR TYPE THERMOSTAT	3	PCS	2	1			
RS - 55	ELECTRONIC THERMOSTAT	3	PCS	2	1			
RS - 56	DEFERENTIAL THERMOSTAT	3	PCS	2	1			
RS - 57	AIR FLOW SWITCH	3	PCS	2	1			
RS - 58	WATER LEVEL SWITCH	3	PCS	2	1			
RS - 59	CAPACITOR (25 MFD)	3	PCS	2	1			
RS - 60	CAPACITOR (100 MFD)	3	SET	2	1			
RS - 61	OVERLOAD PROTECTOR BIMETAL 100 W (0,125 HP)	15	PCS	10	5			
RS - 62	STARTING RELAY 100 W(0,125 HP)	15	PCS	10	5			
RS - 63	STARTING RELAY (HOT WIRE TYPE) 100 W (0,125 HP)	15	PCS	10	5			
RS - 64	STARTING RELAY (POTENTIAL TYPE) 100 W (0,125 HP)	15	PCS	10	5			
RS - 65	THERMOSTAT							
RS - 65-1	SENSOR -25 TO + 15	3	PCS	2	1			
RS - 65-2	SENSOR -5 TO + 30	3	PCS	2	1			

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
RS - 65-3	SENSOR -15 TO + 45	3	PCS	2	1			
RS - 66	RELAY 3 KIND	7	SET	5	2			
RS - 67	OVERLOAD LIMIT SWITCH	7	PCS	5	2			
RS - 68	SIGNAL LIGTH	30	PCS	20	10			
RS - 69	TOGGLE SWITCH	30	PCS	20	10			
RS - 70	TOOL CONNECTIONS FEMALE SET	30	PCS	20	10			
RS - 71	TOOL TERMINAL BLOCK SET	30	PCS	20	10			
RS - 72	PILLAR DRILLING MACHINE	3	SET	2	1			
RS - 73	HEAVY DUTY MACHINE VICE	3	PCS	2	1			
RS - 74	ELECTRIC DRILL	4	SET	2	2			
RS - 75	IMPACT ELECTRIC DRILL	4	SET	2	2			
RS - 76	PEDESTAL GRINDER	2	SET	1	1			
RS - 77	VICE	8	PCS	4	4			
RS - 78	PIPE VICE	2	PCS	1	1			
RS - 79	TOOL STARGE CABINET	2	SET	1	1			
RS - 80	REFRIGERATION DEMONSTRATION	2	SET	1	1			
RS - 81	PROGRAMABLE COMPRESOR TRAINER	2	SET	1	1			
RS - 82	COMERCIAL REFRIGERATION TRAI- NER AND ADVANCED TRAINER FOR COMERCIAL REF. & AIR CONDITION	2	PCS	1	1			
RS - 83	INDUSTIAL REFRIGERATOR TRAINER	2	SET	1	1			
RS - 84	REFRIGERATION DIAGMATIC CENTER	2	SET	1	1			
RS - 85	DOMESTIC REFRIGERATOR TRAINER DOUBLE EVARATOR	2	SET	1	1			
RS - 86	AN LOCAL PRACTICAL AID TEACHIING BASIC REFRIGERATOR THEORY AND PRACTICE OF SINGLE EVAPORATOR SYSTEM	2	SET	1	1			
RS - 87	REFRIGERATOR DEMONSTRATION	2	SET	1	1			
RS - 88	REFRIGERATOR TESTING EQUIPMENT PAKAGE	2	SET	1	1			
RS - 89	SINGLE PHASE COMPRESSOR	2	SET	1	1			
RS - 90	AIR CONDITIONING AND REFRIGERATION	2	SET	1	1			
RS - 91	BASIC AIR CONDITIONING	2	SET	1	1			

Remark :

- * = The Last Priority
- ** = Change quantity
- = NO. MS-79 TO MS-91 NEW ADDITION EQUIPMENT

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
	PIPE PITTING							
PF - 1	FLAME CUTTING	7	SET		5	2		
PF - 2	FLAME PIPE CUTTING	3	SET		2	1		
PF - 3-1	HAND GRINDER 5"	15	SET		10	5		
PF - 3-2	HAND GRINDER 7"	9	SET		7	2		
PF - 4	STEEL RULE	15	PCS		10	5		
PF - 5-1	MEASURING TAPE 3 M	15	PCS		10	5		
PF - 5-2	MEASURING TAPE 5 M	15	PCS		10	5		
PF - 6	LEVELING	20	PCS		15	5		
PF - 7-1	SQUARE 400 X 600 MM	20	PCS		15	5		
PF - 7-2	SQUARE 500 X 750 MM	15	PCS		10	5		
PF - 8	FLANGE SQUARE	15	PCS		10	5		
PF - 9	WELDING TRANSFORMER	6	PCS		4	2		
PF - 10	DEVIDER	20	SET		15	5		
PF - 11	SCRIBER	30	PCS		20	10		
PF - 12 **	SLEDGE HAMMER (LOCKSMITH'S)	40	SET		20	20		
PF - 13	BLACKSMITH TONG	8	PCS		5	3		
PF - 14 **	PARALLEL BENCH VISE	40	PCS		20	20		
PF - 15	WORK BENCH	12	PCS		8	4		
PF - 16	ADJUSTABLE WRENCH	14	PCS		10	4		
PF - 17-1	SHEARS STREIGHT	8	PCS		5	3		
PF - 17-2	SHEARS LEFT HAND	4	PCS		3	1		
PF - 18	TRAMMEL	2	PCS		1	1		
PF - 19	GATE VALVE	6	PCS		4	2		
PF - 20	GLOVE VALVE	6	PCS		4	2		
PF - 21	BUTTERFLY VALVE	4	PCS		2	2		
PF - 22-1	SLIP ON FLANGE 4" X 125 PSI	30	PCS		20	10		
PF - 22-2	SLIP ON FLANGE 3" X 125 PSI	15	PCS		10	5		
PF - 23-1	WELDING NECK FLANGE 4"X125 PSI	30	PCS		20	10		
PF - 23-2	WELDING NECK FLANGE 3"X125 PSI	15	PCS		10	5		
PF - 24	TEE STREIGHT	21	PCS		16	5		
PF - 25	TEE REDUCER	21	PCS		16	5		
PF - 26-1	REDUCER COSENTRIC 4" X 3"	21	PCS		16	5		
PF - 26-2	REDUCER COSENTRIC 4" X 2"	15	PCS		10	5		
PF - 27-1	REDUCER EXCENTRIC 4" X 3"	21	PCS		16	5		
PF - 27-2	REDUCER EXCENTRIC 4" X 2"	15	PCS		10	5		
PF - 28-1	ELBOW SHORT RADIUS 4" X 90o	30	PCS		20	10		
PF - 28-2	ELBOW SHORT RADIUS 4" X 45o	30	PCS		20	10		
PF - 29-1	ELBOW LONG RADIUS 4" X 90o	30	PCS		20	10		
PF - 29-2	ELBOW LONG RADIUS 4" X 45o	30	PCS		20	10		
PF - 30	ELBOW REDUCER EXENTRIC	15	PCS		10	5		
PF - 31	ELBOW REDUCER COSENTRIC	15	PCS		10	5		
PF - 32	HACKSAW FRAME	15	PCS		10	5		
PF - 33	DIES HANDLE	8	PCS		5	3		
PF - 34	TAP HANDLE	8	PCS		5	3		
PF - 35	TAP AND DIES SET	8	SET		5	3		
PF - 36	COLUMN DRILLING MACHINE	2	SET		1	1		
PF - 37	TWIST DRILL SET	4	SET		2	2		
PF - 38	COLD CHISEL	30	PCS		20	10		
PF - 39	SAFETY GOUGLES	45	PCS		25	20		
PF - 40	WELDING GOUGLES	40	PCS		20	20		
PF - 41	HELMET	10	PCS		5	5		
PF - 42	WRAPROUND	30	PCS		20	10		

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGG SARI
PF - 43	PIPE AND BOLT THREADING M/C	2	SET		1	1		
PF - 44	SYMBOL OF MATERIAL FITTINGS	4	PCS		3	1		
PF - 45	SYMBOL OF OPERATING	4	PCS		3	1		
PF - 46	LIFTING OPERATING SYMBOL	6	PCS		5	1		
PF - 47	PIPE TREADER HANDLE (MANUAL)	8	PCS		4	4		
PF - 48	PIPE TREADER DIES 1/2" TO 2"	8	PCS		4	4		
PF - 49	HEAVY DUTY PIPE CUTTER 2" TO 4"	2	PCS		1	1		
PF - 50	ROLL PIPE CUTTER Q 1/8" TO 2"	20	PCS		12	8		
PF - 51	CAST IRON PIPE CUTTER	2	PCS		1	1		
PF - 52	PIPE WRENCH	20	PCS		10	10		
PF - 53	VERNIER CALIPERS	40	PCS		20	20		
PF - 54	DRILLING MACHINE	4	SET		2	2		
PF - 55-1	MACHINIST'S FLAT FILES & HANDLES	40	PCS		20	20		
PF - 55-2	MACHINIST'S FLAT FILES & HANDLES	40	PCS		20	20		
PF - 56	VERNIER HEIGHT GAUGES	4	PCS		2	2		
PF - 57	SURFACE GAUGES	10	PCS		5	5		
PF - 58-1	SQUARES	40	PCS		20	20		
PF - 58-2	MITRE SQUARES	20	PCS		10	10		
PF - 59	HAND SQUARES	40	PCS		20	20		
PF - 60	STEEL RULES	40	PCS		20	20		
PF - 61	CENTRE PUNCH	20	PCS		10	10		
PF - 62	HYDROLIC PRESSURE TESTER	2	UNIT		1	1		

REMARK

** Change Quantity

Code No. PF 53 to PF 62 Addition Equipment

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
	AUTOMOTIVE REPAIR AND SERVICE							
AS - 1	HIDRAULIC JAC 1.5 TON	4	SET	1	3			
AS - 2	HIDRAULIC JAC 6 TON	2	SET	1	1			
AS - 3	PETROL ENGINE STAND 4 CYL	5	SET	2	3			
AS - 4 **	PETROL ENGINE STAND 6 CYL	4	SET	2	2			
AS - 5	DIESEL ENGINE STAND 4 CYL	3	SET	1	2			
AS - 6	DIESEL ENGINE STAND 6 CYL	3	SET	1	2			
AS - 7	MOTOR CYCLE ENGINE STAND 2 STROKE 125 CC AND 150 CC	6	SET	3	3			
AS - 8	MOTOR CYCLE ENGINE STAND 4 STROKE	4	SET	2	2			
AS - 9	MOTOR CYCLE ENGINE STAND 2 STROKE 100 CC	4	SET	2	2			
AS - 10	BOAT DIESEL ENGINE STAND	4	SET	2	2			
AS - 11	BOAT PETROL ENGINE STAND	4	SET	2	2			
AS - 12	TIRE CHANGER	2	SET	1	1			
AS - 13	HYDRAULIC PRESS	2	SET	1	1			
AS - 14	LIFT SERVICE	1	SET		1			
AS - 15	HAND TRACTOR ENGINE	2	SET		2			
AS - 16	BATTERY CHANGER	4	SET	2	2			
AS - 17 **	BRAKE TESTER	2	SET	1	1			
AS - 18	FLASH SYSTEM TESTER	2	SET	1	1			
AS - 19	THERMOSTAT TESTER	2	SET	1	1			
AS - 20	NOZZLE CLEARING MACHINE	1	SET		1			
AS - 21	WHEEL BALANCING MACHINE	1	SET		1			
AS - 22	VALVE SPRING TESTER	2	SET	1	1			
AS - 23 *	ENGINE BRAKE TELESCOPE	2	SET	1	1			
AS - 24	INSIDE MICROMETER 0 - 125 MM	6	SET	3	3			
AS - 25	BRAKE DRUM MICROMETER	2	SET	1	1			
AS - 26	CYLINDER COMPRESSION GAUGE	2	SET	1	1			
AS - 27 *	CARBURATOR SYNCHRONISING TESTER	2	SET	1	1			
AS - 28	HIGH PRESURE CHASIS	1	SET		1			
AS - 29	GENERATOR/ALTERNATOR AND DISTRIBUTOR TEST BENCH	1	SET		1			
AS - 30	CRANE MOVABLE	1	SET		1			
AS - 31	MINIBUS (DIESEL)	1	SET		1			
AS - 32	MINIBUS (BENZIN)	1	SET		1			
AS - 33	VERNIER CALIPER	10	SET		10			
AS - 34	CHAMBER TESTER	1	SET		1			
AS - 35	TAP AND DIES SET	4	SET		4			
AS - 36	MICROMETER OUTSIDE 0 - 100 MM	10	SET	5	5			
AS - 37	MICROMETER OUTSIDE 0 - 4 "	6	SET	2	4			
AS - 38	SCREW PITCH GAUGE	4	SET		4			
AS - 39	FEELER GAUGE SET	10	SET	5	5			
AS - 40	SOCKET WRENCH SET INCHI & MM	10	SET	5	5			
AS - 41	NOZZLE TESTER	3	SET	1	2			
AS - 42	GRINDING MACHINE	1	SET		1			
AS - 43	BENCH DRILL	1	SET		1			
AS - 44	ELECTRICAL DRILL	1	SET		1			
AS - 45	SPARK PLUG CLEANER	2	SET	1	1			

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
AS - 46-1	TORQUE WRENCHES 25 - 100 NM	2	SET	1	1			
AS - 46-2	TORQUE WRENCHES 5 - 33 NM	2	SET	1	1			
AS - 46-3	TORQUE WRENCHES 12 - 68 NM	2	SET	1	1			
AS - 46-4	TORQUE WRENCHES 25 - 135 NM	2	SET	1	1			
AS - 47	ANVILS FOR BODY REPAIR (16 PIECES)	1	SET		1			
AS - 48	SPRAYGUN	5	SET		5			
AS - 49	BLIND RIVETED TOOLS	2	SET	1	1			
AS - 50	SELF GRID WRENCHIES	8	SET	4	4			
AS - 51	COMPRESSED AIR TOOLS WITH ACCESORIES	1	SET		1			
AS - 52	FLAKING TOOLS	1	SET		1			
AS - 53	DIAL TEST INDICATOR	4	SET	2	2			
AS - 54	WRENCHIES FOR VARIOUS JOB	30	PCS	10	20			
AS - 55	HAMMER 100 GR, 250 GR, 500 GR, 1000 GR	4	PCS		4			
AS - 56	TOOLS TROLY (THREE STAGE)	20	SET	10	10			
AS - 57 *	WASHIES BASIN	10	SET		10			
AS - 58	TUNE UP TESTER	2	PCS	1	1			
AS - 59	TIMING LIGHT	4	SET	2	2			
AS - 60	AUTOMOTIVE ENGINE	2	SET	1	1			
AS - 61	AUTOMOTIVE ENGINE	2	SET	1	1			
AS - 62	AUTO BODY REPAIR	2	SET	1	1			
AS - 63	AUTO BODY RUST REPAIR	2	SET	1	1			
AS - 64	ELECTRONIC WHEEL BALANCHING	2	SET	1	1			
AS - 65	ELECTRONIC IGNITION TUNE UP	2	SET	1	1			
AS - 66	ELECTRICAL SYSTEM	2	SET	1	1			
AS - 67	FUEL SYSTEM	2	SET	1	1			
AS - 68	HOW TO BALANCE WHEELS	2	SET	1	1			
AS - 69	HOW TO USE AUTO PRECISION TOOL	2	SET	1	1			
AS - 70	SMALL ENGINE	2	SET	1	1			
AS - 71	SMALL GAS ENGINE	2	SET	1	1			
AS - 72	THE CHARGING SYSTEM EXPLEINED	2	SET	1	1			
AS - 73	DIESEL ENGINE	2	SET	1	1			
AS - 74	THE FOUR CYCLE DIESEL ENGINE	2	SET	1	1			
AS - 75	DIESEL OPERATION & MAINTENANCE	2	SET	1	1			
AS - 76	DIESEL ENGINE EXPLAINED	2	SET	1	1			

Remark :

- * = The Last Priority
- ** = Change quantity
- = NO. AS-58 TO AS-76 NEW ADDITION EQUIPMENT

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
	FURNITURE							
FU - 1	WOOD LATHE	2	SET	2				
FU - 2	BELT SANDER PORTABLE	3	SET	3				
FU - 2 - 1	BELT SANDER PORTABLE	2	SET	2				
FU - 3	DISK SANDER	3	SET	3				
FU - 3 - 1	POLISHER	2	SET	2				
FU - 4	CIRCULAR SAW PORTABLE	2	SET	2				
FU - 5	CIRCULAR SAW BLADE	2	SET	2				
FU - 5-1	RIB BLADE	5	PCS	5				
FU - 5-2	CROSS CUT	5	PCS	5				
FU - 5-3	COMBINATION	5	PCS	5				
FU - 5-4	CARBIDE SAW BLADE	5	PCS	5				
FU - 6	ELECTRIC JIG SAW (LARGE)	2	SET	2				
FU - 7	JIG SAW	20	SET	20				
FU - 8	ELECTRIC HAMMER DRILL PORTABLE	2	SET	2				
FU - 9	TWIST DRILL SET	5	SET	5				
FU - 10 *	RECIPRO SAW	2	SET	2				
FU - 11	ELECTRIC ROUTER PORTABLE	2	SET	2				
FU - 12	SURFACE PLANER MACHINE	1	SET	1				
FU - 13	TENONER MACHINE	1	SET	1				
FU - 14 *	UNIVERSAL CHAIN MORTISER	1	UNIT	1				
FU - 15 *	THICKNESSER	1	UNIT	1				
FU - 16 *	BAND SAW	1	UNIT	1				
FU - 17 *	SPINDLE MOULDER	1	UNIT	1				
FU - 18 *	RADIAL ARM SAW	1	SET	1				
FU - 19 *	VERSATILE SLOTBORING MACHINE	1	SET	1				
FU - 20 *	STRAIGHT GROUND TOOTH SHARPENER	1	SET	1				
FU - 21 *	CIRCULAR SAW SETTING APPARATUS	1	SET	1				
FU - 22 *	BAND SAW SETTING MACHINE	1	SET	1				
FU - 23 *	MAGNETIC QUICK SETTING DEVICES FOR PLANET KNIVES	1	SET	1				
FU - 24 *	WELDING EQUIPMENT FOR BAND SAW	1	SET	1				
FU - 25 *	MEASURE DEVICE	1	SET	1				
FU - 26 *	SAW DUST EXTRACTOR FANS	1	SET	1				
FU - 27 *	COMPRESSOR	1	UNIT	1				
FU - 28 *	ELECTRIC PLANERS PORTABLE	2	UNIT	2				
FU - 29 *	ELECTRIC PLANERS PORTABLE	2	UNIT	2				
FU - 30	ROUTER BIT	10	PCS	10				
FU - 30-1	SINGLE FLUTE	10	PCS	10				
FU - 30-2	DOUBLE FLUTE	10	PCS	10				
FU - 30-3	VEINING FLUTE	10	PCS	10				
FU - 30-4	CORE BOX BIT	10	PCS	10				
FU - 30-5	HINGE MORTICE	10	PCS	10				
FU - 30-6	V GROUP BIT	10	PCS	10				
FU - 30-7	DOVTAIL BIT	10	PCS	10				
FU - 30-8	OGEE BIT	10	PCS	10				
FU - 30-9	REBATE BIT	10	PCS	10				
FU - 30-10	BEANDING BIT	10	PCS	10				
FU - 30-11	CHAMFER OVER BIT	10	PCS	10				
FU - 30-12	CURVE BIT	10	PCS	10				
FU - 30-13	ROUNDING OVER BIT	10	PCS	10				
FU - 30-14	ROMAN OGEE BIT	10	PCS	10				
FU - 31	HAMMER CROSS PIEN	2	PCS	2				
FU - 32	CLAW HAMMER	20	PCS	20				

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
FU - 33	WARRINGTON HAMMER	20	PCS	20				
FU - 34	WOOD MALLET	20	PCS	20				
FU - 35	RATCHET	20	PCS	20				
FU - 36	NAIL SET	5	SET	5				
FU - 37	CENTER PUNCH	10	PCS	10				
FU - 38	SCREW DRIVER SET	10	PCS	10				
FU - 39	SAW FILE	10	PCS	10				
FU - 40	BEVEL SLIDING	20	PCS	20				
FU - 41	COMPASS	20	PCS	20				
FU - 42	CARPENTER'S PINCER	20	PCS	20				
FU - 43	HAND DRILL	10	PCS	10				
FU - 44	COMBINATION SQUARE	20	PCS	20				
FU - 45	SASH CLAMP	10	PCS	10				
FU - 46	T CLAMP	10	PCS	10				
FU - 47	C CLAMP	20	PCS	20				
FU - 48	CORNER CLAMP	20	PCS	20				
FU - 49	SAW SETTER	5	PCS	5				
FU - 50	OIL STONE	20	PCS	20				
FU - 51	MITRE BOX	2	PCS	2				
FU - 52	ENGINEER'S PLIER	20	PCS	20				
FU - 53	DOWELLING JIG	2	PCS	2				
FU - 54	MORTIGE CHISEL	20	PCS	20				
FU - 55	FIRMER	20	PCS	20				
FU - 56	CHISEL PARING	20	PCS	20				
FU - 57	MARKING KNIFE	20	PCS	20				
FU - 58	PANEL SAW	20	PCS	20				
FU - 59	CROSS CUT SAW	20	PCS	20				
FU - 60	RIP SAW	20	PCS	20				
FU - 61	BACK SAW	20	PCS	20				
FU - 62	FRAME SAW	20	PCS	20				
FU - 63	CAPING SAW	20	PCS	20				
FU - 64	HOLE SAW	5	PCS	5				
FU - 65	KEY HOLE SAW	20	PCS	20				
FU - 66	COUNTER SINK	20	PCS	20				
FU - 67	RUNGER BIT	20	PCS	20				
FU - 68	EXPANSIVE BIT	5	PCS	5				
FU - 69	SPOKE SHAVE	20	PCS	20				
FU - 70	GLASS CUTTER	5	PCS	5				
FU - 71	MORTICE GAUGE	20	PCS	20				
FU - 72	SPRAY PAINTING	2	SET	2				
FU - 73	MEASURING TAPE	20	PCS	20				
FU - 74	WISE FOR WOOD WORKING	20	PCS	20				
FU - 75	BLOCK PLANE	20	PCS	20				
FU - 76	JACK PLANE	20	PCS	20				
FU - 77	SMOOTHING PLANE	20	PCS	20				
FU - 78	JOINTER PLANE	20	PCS	20				
FU - 79	POWER BORE BIT	10	PCS	10				
FU - 80	DOWEL BIT	10	PCS	10				
FU - 81	SPIRAL RATCHET SCREW DRIVER	10	PCS	10				
FU - 82	HAND ROUTER	5	PCS	5				
FU - 83	COMBINATION PLANE	5	PCS	5				
FU - 84	PLOUGH PLANE	5	PCS	5				
FU - 85	COMPASS PLANE	5	PCS	5				
FU - 86	SHOULDER PLANE	5	PCS	5				

CODE NO.	DESCRIPTION	TOTAL Q'TY	UNIT	PAKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI
FU - 87	WOOD TURNING CHISEL	2	PCS	2				
FU - 88	ELECTRIC HAND PLANNER	2	PCS	2				
FU - 89	AIR COMPRESSOR	1	SET	1				
FU - 90	TOOLS CABINET	4	PCS	4				
FU - 91	SLOT MORTISING	1	UNIT	1				
FU - 92	ROUN TENONING	1	UNIT	1				
FU - 93	END CUTTING MOLDING BORING	1	UNIT	1				
FU - 94	TEMPLATE SHAPING	1	UNIT	1				
FU - 95	DOUBLE SIDED CUT-OFF MOULDING BORING	1	UNIT	1				

REMARK

* New Addition Equipment
Code Number Has Change

CODE NO.	DISCRIPTION	TOTAL QTY	UNIT	PAKAN BARU	TJ.P1 KANS	TANGE KANG	PASAR REBO	SINGO SARI
1	2	3	4	5	6	7	8	9
	INDUSTRIAL ELECTRONIC INSTRUMENTATION							
IE - 1	FLOW CONTROL TRAINER	4 1/2	SET				2 1/2	2
IE - 2	TEMPERATURE CONTROL TRAINER	4	SET				2	2
IE - 3	LIQUID LEVEL CONTROL TRAINER	4	SET				2	2
IE - 4	FLOW AND LIQUID LEVEL CONTROL TRAINER	4	SET				2	2
IE - 5	AIR CONTROL TRAINER	4	SET				2	2
IE - 6	OIL PRESSURE CIRCUIT TRAINER	4	SET				2	2
IE - 7	PROGRAMABLE CONTROLLER	10	SET				5	5
IE - 8	PERSONAL COMPUTER (HARDISK 100 MB, KEYBOARD, MONITOR MODEM, MOUSE)	25	SET				13	13
IE - 9	LAN MANAGER 11 HOST	4	SET				2	2
IE - 10	PRINTER	16	SET				8	8
IE - 11	X - Y PLOTTER	4	SET				2	2
IE - 12	TRAINING MICROKOMPUTER SET	20	SET				10	10
IE - 13	INVERTER MOTOR CONTROL UNIT	20	SET				10	10
IE - 14	DC SERVO UNIT	20	SET				10	10
IE - 15	AC SERVO UNIT	20	SET				10	10
IE - 16	POSITIONING CONTROL UNIT	20	SET				10	10
IE - 17	IC TROUBLE SHOOTING KIT	20	SET				10	10
IE - 18	TEST BOARD FOR CIRCUIT	20	SET				10	10
IE - 19	ELECTRONIC CIRCUIT	20	SET				10	10
IE - 20	LOGIC CIRCUIT TRAINER	20	SET				10	10
IE - 21	PULSE CIRCUIT TRAINER	20	SET				10	10
IE - 22	SEMICONDUCTOR TRAINER	20	SET				10	10
IE - 23	ELECTRONIC COUNTER TRAINER	20	SET				10	10
IE - 24	ROBOTIC TRAINER ARM-800	4	SET				2	2
IE - 25	INTEC IMULATOR	20	SET				10	10
IE - 26	DC POWER SUPPLY MULTIOUTPUT	20	SET				10	10
IE - 27	DC POWER SUPPLY 0-40V/1-5A	12	SET				6	6
IE - 28	DC POWER SUPPLY TWO OUTPUT	20	SET				10	10
IE - 29	OSCILLOSCOPE 4 TRCLEY	20	SET				10	10
IE - 30	DIGITAL STORAGE SCOPE 100 MHZ	20	SET				10	10

CODE NO.	DESCRIPTION	TOTAL QTY.	UNIT	PAKAN BANGUN	TOLOK NAMA	TANGKAL	PASAR	SINGGAL
1	2	3	4	5	6	7	8	9
IE - 31	PULSE GENERATOR	20	SET				10	10
IE - 32	AF ATTENUATOR	20	SET				10	10
IE - 33	FUNCTION GENERATOR	20	SET				10	10
IE - 34	LOGIC ANALYZER 22 CHANNEL	4	SET				2	2
IE - 35	DIGITAL MULTIMETER	20	SET				10	10
IE - 36	ANALOG MULTIMETER HICKY 3020	20	SET				10	10
IE - 37	UNIVERSAL COUNTER	12	SET				6	6
IE - 38	IC CHECKER	12	SET				6	6
IE - 39	LOGIC COMPARATOR	16	SET				8	8
IE - 40	CIRCUIT TESTER	12	SET				6	6
IE - 41	DIGITAL TESTER	20	SET				10	10
IE - 42	ANALOG CAPACITANCE METER	8	SET				4	4
IE - 43	VARIABLE TRANSFORMER SA	10	SET				5	5
IE - 44	DC AMPERE METER 01 - 3A	20	SET				10	10
IE - 45	DC AMPERE METER 1 - 30A	20	SET				10	10
IE - 46	DC VOLT METER 00 - 10 V	20	SET				10	10
IE - 47	DC VOLT METER 0 - 100 V	12	SET				6	6
IE - 48	AC VOLT METER 300 - 750 V	20	SET				10	10
IE - 49	AC VOLT METER 15 - 30 V	20	SET				10	10
IE - 50	AC AMPERE 5 - 25 A	20	SET				10	10
IE - 51	3 PHASE POWER METER	12	SET				6	6
IE - 52	SINGLE PHASE POWER METER	12	SET				6	6
IE - 53	GALVANO METER	6	SET				4	4
IE - 54	STANDARD CELL	8	SET				4	4
IE - 55	BRIDGE	6	SET				4	4
IE - 56	ADJUSTABLE RESISTOR	20	SET				10	10
IE - 57	AUTOMATIC LCR METER	12	SET				6	6
IE - 58	FREQUENCY COUNTER	20	SET				10	10
IE - 59	AC ELECTRONIC VOLT METER	20	SET				10	10
IE - 60	MILLI VOLT METER	20	SET				10	10
IE - 61	MILLI AMPERE METER	20	SET				10	10
IE - 62	LUX METER	20	SET				10	10
IE - 63	AUTOMATIC POWER TESTER	20	SET				10	10
IE - 64	DC SWITCHING POWER SUPPLY	20	SET				10	10
	30 / 10 A	20	SET				10	10

CODE NO.	DESCRIPTION	TOTAL QTY	UNIT	PAKAN BARU	TOLSI NAKS	TANGE SANG	PASAR PESD	SINGG SARI
1	2	3	4	5	6	7	8	9
IE - 65	DC SWITCHING POWER SUPPLY : 5 V / 7A	20	SET				10	10
IE - 66	EPROM PROGRAMMERS	4	SET				2	2
IE - 67	EPROM ERASERS	4	SET				2	2
IE - 69	PCB FABRICATION : PCB PROCESSING, Etching AND : WASHING TANKS	4	SET				2	2
	: PCB PROCESSING CHEMICALS	8	SET				4	4
	: PCB ERASER - CLEANER	2	GROSS				1	1
	: PCB KACK	4	SET				2	2
	: PCB ETCHING TRAYS AND TONGS	6	SET				4	4
	: PCB ARTWORK TOOLS	40	SET				20	20
	: PCB PHOTO RESIST BOARDS	4	GROSS				2	2
IE - 69	U.V. EXPOSURE UNIT	4	SET				2	2
IE - 70	PCB DRILL 12000 RPM AND STAND	4	SET				2	2
IE - 71	PROXIMITY AND SENSOR TRAINER	4	SET				2	2
IE - 72	SOLDER FUME EXTRACTOR	4	SET				2	2
IE - 73	EXECUTIVE STYLE TOOL CASE	8	SET				4	4
IE - 74	EMERGENCY SPOTLIGHT	8	SET				4	4
IE - 75	TASK LIGHTING 15 WATT	8	SET				4	4
IE - 76	HEAVY DUTY EXTENSION CABLE	8	SET				4	4
IE - 77	FREE STANDING OR WALL MOUNTED	20	SET				10	10
IE - 78	TOLLSET	40	SET				20	20
IE - 79	AIR CONDITION 2 HP	2	SET				4	4
IE - 80	COMPUTER DESK	4	SET				2	2
IE - 81	ELECTRONIC WORK BENCH : 100 CM X 190 CM X 75 CM	20	UNIT				10	10
IE - 82	CUP BOARD FOR INSTRUMENT : 170 CM X 150 CM X 50 CM	8	UNIT				4	4
IE - 83	RACK 170 CM X 120 CM X 50 CM	8	UNIT				4	4
IE - 84	FILING CABINET	6	UNIT				4	4
IE - 85	COMPONENT RACK FURNABLE BOARD	4	SET				2	2
IE - 86	COMPONENT KIT (OPAMP, EPROM, : DIGITAL IC, TRANSISTOR, 9100A, : RESISTOR, CAPASITOR)	20	SET				10	10

CODE NO.	DESCRIPTION	TOTAL QTY	UNIT	PAYAN BARU	TU.F1 NAME	TANEE BARU	PASAR FEBE	SINCE BARU
1	2	3	4	5	6	7	8	9
IE - 87	SOLDERING POWER UNIT 24AC/50W	40	SET				20	20
IE - 88	SOLDERING IRON THERMOMETER	40	SET				20	20
IE - 89	BENCH MAGNIFIER (125 MM LENS, FLUORESCENT)	4	SET				2	2
IE - 90	PORTABLE POWER DRILLS 2 SPEED (10 MM AND CASE)	4	SET				2	2
IE - 91	TRANPARANCY FOR INDUSTRIAL ELECTRONIC AND INSTRUMENTATION	4	SET				2	2
IE - 92	VIDEO TAPE RECORDER AND TELEVISION (VHS, MULTISYSTEM 20 INCH)	4	SET				2	2
IE - 93	VIDEO INTERFACING KIT	4	SET				2	2
IE - 94	OHF INFOCUS SYSTEM AND TROLEY	2	SET				1	1
IE - 95	CARD DIAGNOSTIC KICKSTART II	10	SET				5	5
IE - 96	SOFTWARE PC DIAGNOSTIC INTEL 80386, 80486 BASIC (2-80 COMPUTER), C-280 COMPILER, 280 ASSEMBLER	20	SET				10	10
IE - 97	VIDEO LIBRARY COMPUTER IN CONTROL BASIC PRACTICAL ELECTRONICS MICROPROCESSOR FUNDAMENTALS	6	SET				3	3
IE - 98	TECHNICAL LIBRARY TTL IC, CMOSIC, OP-AMP IC INTRINCALLY SAFE INSTRUMENTATION A GUIDE AUTHOR KOPIN BARGIDE JONES INSTRUMENT TECHN NOLOGY SERIES VOL 1,2,3,4,5 INDUSTRIAL CONTROL HANDEBOOK VOL 1 AUTOCAD : E.A PARK	20	SET				10	10
IE - 99	3 1/2, 5 1/4 FLOPPY DISC	10	BOX				5	5
IE -100	PHOTO COPY MACHINE	2	SET				2	2

CODE NO	DESCRIPTION	TOTAL Q'TY	UNIT	PEKAN BARU	TJ. PINANG	TANGE RANG	PASAR REBO	SINGO SARI	No PRORITY
	LANGUAGE LABORATORY								
LA-1 1	LANGUAGE LABORATORY TRAINING TRAINING EQUIPMENT FOR 20 TRA NESS & 1 TRAINER (SONY)	1	SET		1				1
LA - 2	VIDEO TELEVISI SET	1	SET		1				10
LA - 3	VIDEO LASER DISK PLAYER	1	PCS		1				5
LA - 4	MULTY MEDIA COMPUTER SET	1	SET		1				9
LA - 5	VIDEO AND TV TROLLY	3	PCS		3				11
LA - 6	CONCAVE WITHE BOARD	1	PCS		1				12
LA - 7	JAPANESE LANGUAGE TRAINING TAPE	1	SET		1				3
LA - 8	ENGLISH LANGUAGE TRAINING TAPE	1	SET		1				2
LA - 9	JAPANESE LANGUAGE LASER DISK	1	SET		1				7
LA - 10	ENGLISH LANGUAGE LASER DISK	1	SET		1				6
LA - 11	CHINESE LANGUAGE LASER DISK	1	SET						8
LA - 12	CHINESE LANGUAGE TRAINING TAPE	1	SET						4

Appendix - 6 List of Existing Equipment

(1) Pekanbaru V.T.C.

- 1) Machine Shop
- 2) Arc Welding
- 3) Refrigeration Repair and Service
- 4) Automotive Repair and Service
- 5) Furniture

(2) Tanjung Pinang V.T.C.

- 1) Machine Shop
- 2) Arc Welding
- 3) Refrigeration Repair and Service
- 4) Automotive Repair and Service

(3) Tangerang V.T.C.

- 1) Machine Shop
- 2) Arc Welding

(4) Pasar Rebo V.T.C.

- 1) Industrial Electronics and Instrumentation

(5) Singosari V.T.C.

- 1) Industrial Electronics and Instrumentation

(1) Pekanbaru V.T.C.

1) Machine Shop

No.	EQUIPMENT	Q'TY
1	Center Lathe	9
2	Milling Machine	2
3	Shaping Machine	2
4	Drilling Machine	3
5	Power Hack Saw	2

2) Arc Welding

No.	EQUIPMENT	Q'TY
1	Welding Transformer	4
2	Gas Welding Machine	4
3	MIG Welding Machine	1
4	TIG Welding Machine	1
5	Spot Welding Machine	1
6	DC Welding Generator	1
7	Electrode Drive	1

3) Refrigeration Repair and Service

No.	EQUIPMENT	Q'TY
1	Air Conditioner for Automotive	
2	Central Type Air Conditioner	
3	Cold Storage Box	
4	Freezer / Refrigerator	
5	Split Type A/C	
6	A/C Training Set	
7	Gas Cutting, Welding Set	
8	Air Compressor	
9	Iron Cutter	
10	Refregerator	
11	Vacuum Pump	
12	Manifold Charger	
13	Bending Machine	
14	Electric Drill	

4) Automotive Repair and Service

No.	EQUIPMENT	Q'TY
1	Air Compressor Stationary Type	
2	Mounted Drill Press Bench	
3	Brake Drum Adjusting Lache	
4	Battery Charger	
5	Hydraulic Floor Crane	
6	Press	
7	Floor Type Lift	
8	Electrical Arc Welder	
9	Hydraulic Jack	
10	Transmission Jack	
11	Distribution Test Bench	
12	Electronic Engine Analyzer	
13	Cooling System Tester	
14	Spark Plug Cleaner & Tester	
15	Brake Tester	
16	Wheel Alignment Tester	

5) Furniture

No.	EQUIPMENT	Q'TY
1	Bench Saw	1
2	Cross Cut Saw	1
3	Surface Thickneser	1
4	Portable Planner	1
5	Spindle Moulder	1
6	Mortiser	1
7	Band Saw	1
8	Wood Lathe	1
9	Wood Press	1
10	Belt Sander	1
11	Pedestal Grinder	1
12	Bench Drilling Machine	1
13	Dust Collector	1
14	Portable Belt Sander	1
15	Saw Sharpener	1

(2) Tanjung Pinang V.T.C.

1) Machine Shop

No.	EQUIPMENT	Q'TY
1	Center Lathe	4
2	Shaping Machine	1
3	Milling Machine	1
4	Pillar Drill	1
5	Bench Drill	2
6	Electric Drill	2
7	Hand Drill	1
8	Pedestal Grinder	1
9	Hand Grinder	1
10	Bench Grinder	2
11	Portable Grinder	2
12	Power hack saw	1
13	Pipe Threading Machine	1
14	Bending Machine	1
15	Acetyline Generator	2
16	Blacksmith Forge	1
17	Welding Transformer	1
18	Bench Shear	1
19	Table Shearing Machine	1
20	Fanforge	1
21	Test Pump	1

2) Arc Welding

No.	EQUIPMENT	Q'TY
1	Hand Drill	1
2	Hand Grinder	1
3	Portable Grinder	1
4	Welding Transformer	1
5	Welding Machine with Generator	1
6	Welding and Cutting Torch	2

3) Refrigeration Repair and Service

No.	EQUIPMENT	Q' TY
1	Tube Bender	
2	Tube Cutter	
3	Manifold Charger	
4	Vacuum Pump	
5	Air Conditioner	
6	Freezer	

4) Automotive Repair and Service

No.	EQUIPMENT	Q' TY
1	Engine	
2	Injection Pump Tester	
3	Nozzle Tester	
4	Drill	
5	Grinder	
6	Air Compressor	
7	Portable Crane	
8	Hydraulic Jack	
9	Hydraulic Press	
10	Battery Charger	

(3) Tangerang V.T.C.

1) Machine Shop

No.	EQUIPMENT	Q'TY
1	Center Lathe	9
2	Shaping Machine	2
3	Milling Machine	2
4	Column Drilling Machine	2
5	Electric Drill	2
6	Hand Drill	4
7	Pedestal Grinder	2
8	Power Hack Saw	2
9	Pipe Threading Machine	2
10	Bending Machine	2

2) Arc Welding

No.	EQUIPMENT	Q'TY
1	Acetylene Generator	4
2	Welding Transformer	2
3	Welding & Cutting Torch Set	2
4	Hand Grinder	2
5	Portable Grinder	1
6	Bench Shear	2
7	Shearing Machine	2

(4) Pasar Rebo V.T.C.

1) Industrial Electronics and Instrumentation

No.	EQUIPMENT	Q'TY
1	Oscilloscope	
2	PAL Pattern Generator	
3	Frequency Counter	
4	Function Generator	
5	DC Power Supply	
6	TV Set	
7	Digital Multimeter	
8	Oscilloscope	
9	Electronic Voltmeter	
10	Multimeter	
11	FM Signal Generator	
12	HV DC Regurator	
13	LV DC Regulator	
14	AC Mili-volt meter	
15	AF Signal Generator	
16	X-Y Recorder	
17	Radio training Unit	
18	TV Training Unit	
19	Telephone Set	
20	Micro Computer	

(5) Singosari V.T.C.

1) Industrial Electronics and Instrumentation

No.	EQUIPMENT	Q'TY
1	Electronic Multimeter	
2	Oscilloscope	
3	Signal Generator	
4	AC Low Voltage Stabilizer	
5	DC High Voltage Power Supply	
6	Milli Volt Meter	
7	Universal LCR Bridge	
8	Digital Tester	
9	Digital Trainer	
10	TV Set	
11	Telephone Set	
12	Micro Computer	
13	X-Y Recorder	
14	Colour Camera System	
15	Radio Trainer Unit	
16	Television Training Unit	