



The 46900A Power Electronics Training System consists of 28 experimental modules, a three-phase squirrel cage motor, load, control and measuring devices. It includes single-phase rectifiers, three-phase rectifiers, DC choppers, inverters and application experiments.

Features

The 46900A is the combination of power, electronics, and control. It has wide applications of solid-state electronics to the control and conversion of electric power. Popular circuits of power electronics contain rectifiers, choppers and inverters. The experimental modules of 46900A include converter, power supply, load, control and testing modules. These experimental modules and instruments are introduced and demonstrated in the subsequent experiments.

List of Experiments

Basic Measurement and Characteristic of SCR and TRIAC (46900A1)

Providing Panels & Motors - 69700, 47124, 47127, 47146, 47149, 47150, 47156-47159

Name of the Experiments

- Exp-1 : Three-Phase source voltage measurement
- Exp-2 : Digital storage oscilloscope and differential amplifier
- Exp-3 : SCR characteristic and measurement
- Exp-4 : TRIAC characteristic and measurement

Single-Phase Rectifiers and AC Voltage Controller AC-DC, AC-AC (46900A2)

Providing Panels & Motors - 69700, 47121, 47123-47129, 47131, 47143/2nos., 47144, 47145/2nos., 47149, 47150, 47156-47159

Name of the Experiments

- Exp-1 : Trigger pulse measurement
- Exp-2 : Single-Phase Half-Wave uncontrolled rectifier
- Exp-3 : Single-Phase Full-Wave uncontrolled rectifier
- Exp-4 : Single-Phase Half-Wave controlled rectifier
- Exp-5 : Single-Phase Full-Wave controlled rectifier
- Exp-6 : Symmetrical Single-Phase Full-Wave Semi-Controlled rectifier
- Exp-7 : Asymmetrical Single-Phase Full-Wave Semi-Controlled rectifier
- Exp-8 : Single-Phase Semi-Controlled AC voltage controller
- Exp-8 : Single-Phase Full-Controlled AC voltage controller

Three-Phase Rectifiers and AC Voltage Controller AC-DC, AC-AC (46900A3)

Providing Panels & Motors - 69700, 47121, 47123-47129, 47131, 47143/3nos., 47144, 47145/3nos., 47149, 47150, 47156-47159

Name of the Experiments

- Exp-1 : Three-Phase Half-Wave uncontrolled rectifier
- Exp-2 : Three-Phase Full-Wave uncontrolled rectifier
- Exp-3 : Three-Phase Half-Wave controlled rectifier

Note: Specifications are subject to change.

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Exp-4 : Three-Phase Full-Wave Semi-Controlled rectifier
Exp-5 : Three-Phase Full-Wave Full-Controlled rectifier
Exp-6 : Three-Phase Full-Wave Semi-Controlled AC voltage controller
Exp-7 : Three-Phase Full-Wave Full-Controlled AC voltage controller

DC Choppers DC-DC (46900A4)

Providing Panels & Motors - 69700, 47121, 47123-47125, 47127, 47129, 47131, 47137, 47138, 47141, 47144, 47147-47159, 69315

Name of the Experiments

Exp-1 : IGBT characteristic measurement
Exp-2 : DC PWM controller
Exp-3 : Single-Quadrant DC chopper
Exp-4 : Two-Quadrant DC chopper
Exp-5 : Four-Quadrant DC chopper
Exp-6 : SCR DC chopper

Inverters AC-DC-AC (46900A5)

Providing Panels & Motors - 69700, 47121, 47123-47125, 47127, 47129, 47131, 47137, 47139-47142, 47144, 47149-47152, 47153-47159, 69316

Name of the Experiments

Exp-1 : Single-Phase PWM controller
Exp-2 : Single-Phase inverter
Exp-3 : Three-Phase PWM controller
Exp-4 : Three-Phase inverter

Applications of Power Electronics (46900A6)

Providing Panels & Motors - 69700, 47121, 47122, 47124, 47127, 47128, 47130, 47132-47136, 47147, 47149-47150, 47156-47159

Name of the Experiments

Exp-1 : Power MOSFET characteristic measurement
Exp-2 : Buck switching power supply
Exp-3 : Boost switching power supply
Exp-4 : Buck-Boost switching power supply
Exp-5 : Flyback switching power supply
Exp-6 : Electronic ballast

Panels Provided

Panel Name	Order Code	Qty
01. DC Power Supply (15V/2A)	47121	1no.
02. DC Power Supply (0-40V/6A)	47122	1no.
03. Reference Variable Generator	47123	1no.
04. Differential Amplifier	47124	1no.
05. Current Transducer	47125	1no.
06. Three Phase Angle Controller	47126	1no.
07. R.M.S. Meter	47127	1no.
08. Power Meter (0.3W-30KW)	47128	1no.
09. Resistor Load Unit	47129	1no.
10. Resistor Load	47130	1no.
11. Inductive Load Unit	47131	1no.
12. Flyback Switching Power Supply	47132	1no.
13. Boost Switching Power Supply	47133	1no.
14. Buck Switching Power Supply	47134	1no.
15. Buck-Boost Switching Power Supply Unit	47135	1no.
16. Electronic Ballast Fluorescent Lamp	47136	1no.
17. IGBT Drive Set	47137	1no.
18. DC PWM Generator	47138	1no.
19. Single Phase PWM Controller	47139	1no.
20. Three Phase PWM Controller	47140	1no.
21. Three Phase Rectifier & Filter	47141	1no.

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22. Universal Inverter 3x230V	47142	1no.
23. Power Diode Set	47143	1no.
24. Fuse Set	47144	1no.
25. Thyristor (800V/10A)	47145	1no.
26. SCR/TRIAC Set	47146	1no.
27. MOSFET/ IGBT Set	47147	1no.
28. SCR DC Chopper Set	47148	1no.
29. Isolating Transformer	47149	1no.
30. System Transformer	47150	1no.
31. Magnetic Powder Brake Unit	47151	1no.
32. Brake Controller	47152	1no.
33. Coupling	47153	1no.
34. Coupling Guard	47154	1no.
35. Shaft End Guard	47155	1no.
36. Connecting Leads Set	47156	1no.
37. Safety Bridging Plugs Set	47157	
38. Safety bridge plug	47157A	1no.
39. Safety bridge plug	47157B	1no.
40. Laboratory Table	47158	1no.
41. Connecting Lead Holder	47159	1no.
42. Aluminium Trainer Rack	69700	1no.









Motor Provided

01. DC Permanent-Magnet Machine	69315	1no.
01. Three-Phase Squirrel Cage Motor	69316	1no.

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 <p>DC POWER SUPPLY (15V/2A) Order Code - 47121</p> <ol style="list-style-type: none"> 1. Short circuit & over temperature protection 2. Over current indicator : LED 3. Over temperature indicator : LED 4. Rated output : $\pm 15V/2A$ 5. Power indicator : LED 6. Operation power supply : AC 220V, 50/60Hz 	 <p>CURRENT TRANSDUCER Order Code - 47125</p> <ol style="list-style-type: none"> 1. Hall current sensor 2. Measuring frequency (Max.) : 200KHz 3. Current measuring : <ol style="list-style-type: none"> a. Input : 20Ap, output 10V b. Input : 5Ap, output 10V c. Input : 1Ap, output 10V 4. Over current indicator 5. Operation power supply : AC 220V, 50/60Hz
 <p>DC POWER SUPPLY (0-40V/6A) Order Code - 47122</p> <ol style="list-style-type: none"> 1. Input voltage : 220V AC, 50/60Hz 2. 2 output voltage : 0~20V, 0~40V DC 3. Rated current : 0~20V/6A, 0~40V/6A 4. Overload protection 	 <p>THREE PHASE ANGLE CONTROLLER Order Code - 47126</p> <ol style="list-style-type: none"> 1. Pulse output : Electric isolation, directly drives up to 6 thyristors 2. Trigger angle : 0~180 3. Control input signal : 0~10V DC 4. Rectification angle : 0~90 adjustable 5. Convert angle : 0~180 adjustable 6. Mode select : Single pulse & continuous pulse 7. Operation power supply : $\pm 15V$ 220V, 50/60Hz
 <p>REFERENCE VARIABLE GENERATOR Order Code - 47123</p> <ol style="list-style-type: none"> 1. Vc range : 0V~ +10V, -10V~+10V 2. Linear scale : 0~100% 3. 7-segment display for displaying the value of output control voltage Vc 4. Operation power supply : $\pm 15V$ 	 <p>R.M.S. METER Order Code - 47127</p> <ol style="list-style-type: none"> 1. Measuring range : <ol style="list-style-type: none"> a. Current: 0.1/0.3/1/3/10/30 A b. Voltage : 3/10/30/100/300/1000V 2. 3 Measuring types : <ol style="list-style-type: none"> a. RMS AC+DC : Total RMS value b. RMS AC : Ripple RMS value c. AV AC+DC : Arithmetic mean value 3. Overload protection 4. \pm Value indicator : LED 5. Accuracy : 2%. Full scale 6. Operation power supply : AC 220V, 50/60Hz
 <p>DIFFERENTIAL AMPLIFIER Order Code - 47124</p> <ol style="list-style-type: none"> 1. 4 Channels output and input 2. Measuring voltage (Max.) : 700Vp 3. Output voltage (Max.) : 10Vp 4. Measuring frequency (Max.) : 200KHz 5. Input voltage range : 500V, 100V, 10V 6. Output voltage range : 10V 7. Output terminal : common ground, 3 types <ol style="list-style-type: none"> a. 2 BNC sockets for oscilloscope, switching switch to selected measuring channel (A/B, C/D) b. 4 mm terminal for module connection 8. Operation power supply : AC 220V, 50/60Hz 	 <p>RESISTOR LOAD UNIT Order Code - 47129</p> <ol style="list-style-type: none"> 1. Bench top type 2. 3 load resistors, each one 100Ω 3. Rated current : 2.5A 4. Rated power : 625W

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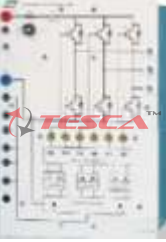

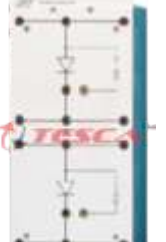
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<p>POWER METER (0.3W-30KW) Order Code - 47128</p> <ol style="list-style-type: none"> Measuring range : 0.3W~30KW <ol style="list-style-type: none"> Current:0.1/0.3/1/3/10/30 A rms Voltage:3/10/30/100/300/1000V rms Frequency range : 0~20KHz Overload protection Over current & over voltage LED indicator Reactive power \pm value indicator (QL & QC) Accuracy : 2% full scale Output terminal : Measuring full scale 100%=1V Operation power supply : AC 220V, 50/60Hz 	<p>BOOST SWITCHING POWER SUPPLY Order Code - 47133</p> <ol style="list-style-type: none"> Test point : <ol style="list-style-type: none"> Switching control IC output signal Current feedback signal Voltage feedback signal Switching power component terminal Switching frequency : $\geq 40\text{KHz}$ Input voltage : DC 10 ~ 16V Output : 60W, up to 85% efficiency Output voltage ripple : $\leq 5\%$ Output voltage regulation : $\leq 5\%$ Output voltage : DC 18V ~ 30V, adjustable Rated current : 2A Max. overload & short circuit protection Switching power component : MOSFET 
<p>RESISTOR LOAD Order Code - 47130</p> <ol style="list-style-type: none"> 2 resistors load : <ol style="list-style-type: none"> 5~50Ω/120W 10~100Ω/120W Overcurrent protection 	<p>BUCK SWITCHING POWER SUPPLY Order Code - 47134</p> <ol style="list-style-type: none"> Test point : <ol style="list-style-type: none"> Switching control IC output signal Current feedback signal Voltage feedback signal Switching power component terminal Switching frequency : $\geq 40\text{KHz}$ Input voltage : DC 17~ 30V Output : 45W, up to 85% efficiency Output voltage ripple : $\leq 5\%$ Output voltage regulation : $\leq 5\%$ Output voltage : DC 10V ~ 15V, adjustable Rated current : 2A Max. overload & short circuit protection Switching power component : MOSFET 
<p>INDUCTIVE LOAD UNIT Order Code - 47131</p> <ol style="list-style-type: none"> Bench top type Load indicator : 50m H x 2 / 200m H Rated current : 5A 	<p>BUCK-BOOST SWITCHING POWER SUPPLY UNIT Order Code - 47135</p> <ol style="list-style-type: none"> Test point : <ol style="list-style-type: none"> Switching control IC output signal Current feedback signal Voltage feedback signal Switching power component terminal Switching frequency : $\geq 40\text{KHz}$ Input voltage : DC 20 ~ 30V Output : 60W, up to 85% efficiency Output voltage ripple : $\leq 5\%$ Output voltage regulation : $\leq 5\%$ Output voltage : DC 25V ~ 30V, adjustable Rated current : 2A Max. overload & short circuit protection Switching power component : MOSFET 
<p>FLYBACK SWITCHING POWER SUPPLY Order Code - 47132</p> <ol style="list-style-type: none"> Test point : <ol style="list-style-type: none"> Switching control IC output signal Current feedback signal Voltage feedback signal Switching power component terminal Switching frequency up to 40KHz Converter control : Isolation feedback converter Input voltage : 95~250V AC Output : 45W, up to 80% efficiency Output voltage ripple : $\leq 5\%$ Output voltage regulation : $\leq 5\%$ Output voltage : DC 12V ~ 15V, adjustable by R18 Rated current : 2A Max. overload & short circuit protection Switching power component : MOSFET 	

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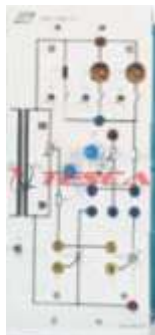



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 <p>ELECTRONIC BALLAST FLUORESCENT LAMP Order Code - 47136</p> <ol style="list-style-type: none"> 1. Switching frequency : 10KHz 2. Input voltage range : 220V AC 3. Type of lamp : 35cm long tube 10W 4. Control mode : half-bridge self-excitation feedback multivibrator 5. Output current : 2A max. with overflow and short circuit protection 6. Switching power component : BJT 220V, 50/60Hz 	 <p>THREE PHASE PWM CONTROLLER Order Code - 47140</p> <ol style="list-style-type: none"> 1. Triangular wave(carrier) generator : <ol style="list-style-type: none"> a. Amplitude : -10V~+10V b. Frequency : 5K, 10K, 20KHz 2. Sine wave signal generator 3. Multiplex 4. PWM Signal generator : 6 x TTL level 5. Square wave signal generator 6. IP input : DC 10V~+10V 7. Operation power supply : DC±15V
 <p>IGBT DRIVE SET Order Code - 47137</p> <ol style="list-style-type: none"> 1. Input voltage : DC 20~300V 2. Output voltage : 20~300Vp 3. Drive circuit : Photo couple and drive circuit 4. Output device: IGBT, 800V/60A 5. Current protector 	 <p>THREE PHASE RECTIFIER & FILTER Order Code - 47141</p> <ol style="list-style-type: none"> 1. Power input : 1Ø or 3Ø, 20~220V AC 2. With Inductor & capacitor filter circuit 3. Surge protection in voltage circuit 4. Output voltage : 28~310V DC (max.)/ 10A (max.)
 <p>DC PWM GENERATOR Order Code - 47138</p> <ol style="list-style-type: none"> 1. Triangular wave(carrier) generator : <ol style="list-style-type: none"> a. Amplitude : 0~10V or -10V~+10V b. Frequency : 1K, 10K, 15KHz 2. PWM signal generator : 2 x PWM control signal 3. IP input : DC -10V~+10V 4. Operation power supply : DC±15V 	 <p>UNIVERSAL INVERTER 3X230V Order Code - 47142</p> <ol style="list-style-type: none"> 1. 6 x TTL level signal input : > 2.5µS, for interlock & dead time control 2. Power input : 1Ø or 3Ø AC 20~220V 3. With photo-couple, isolation and main circuit 4. Output power component : IGBT 800V/50A 5. With adjustable overcurrent protection circuit 6. Output capacity : 220V/ 1.5KV 7. Operation power supply : AC 220V, 50/60Hz
 <p>SINGLE PHASE PWM CONTROLLER Order Code - 47139</p> <ol style="list-style-type: none"> 1. Triangular wave(carrier) generator : <ol style="list-style-type: none"> a. Amplitude : -10V~+10V b. Frequency : 1K, 5K, 15KHz 2. Sine wave signal generator 3. Multiplex 4. PWM Signal generator : 2 x TTL level 5. Square wave signal generator 6. IP input : DC 0V~+10V 7. Operation power supply : DC±15V 	 <p>POWER DIODE SET Order Code - 47143</p> <ol style="list-style-type: none"> 1. Rated Voltage : 1200V 2. Rated Current : 40A

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 <p>FUSE SET Order Code - 47144</p> <ol style="list-style-type: none"> 1. Module Design 2. 3 x D - Type fuses, 500V/6A 	 <p>SCR DC CHOPPER SET Order Code - 47148</p> <ol style="list-style-type: none"> 1. Operating voltage : $\pm 15V$, 0.4A 2. Input voltage range : 50V~300VDC 3. Maximum output current : 5A 4. Chopping frequency range : 220~280Hz 5. Minimum duty cycle : 0.1 6. Maximum duty cycle : 0.8 7. External input : DC 0V~10V
 <p>THYRISTOR (800V/10A) Order Code - 47145</p> <ol style="list-style-type: none"> 1. Rated voltage : 800V 2. Rated current : 10A 3. With RC surge buffer protection circuit 	 <p>ISOLATING TRANSFORMER Order Code - 47149</p> <ol style="list-style-type: none"> 1. Benchtop type 2. Output voltage : 3\emptyset, 4W, Y type connected, 110/164/190/220V line-to-line voltage output 3. Rated capacity : 1.5KVA 4. Input : AC, 3\emptyset, 220V, 50/60Hz
 <p>SCR/TRIAC SET Order Code - 47146</p> <ol style="list-style-type: none"> 1. SCR : 800V/16A 2. TRIAC : 600V/12A 3. Load lamp : 2 x 24V/10W (with switch) 4. Load inductor : 1 x 50m H/1A (with switch) 5. With current/voltage transfer measurement 6. With trigger control adjustable 7. Operation power supply : AC 220V, 50/60Hz 	 <p>SYSTEM TRANSFORMER Order Code - 47150</p> <ol style="list-style-type: none"> 1. Rated power : 1.5KVA 2. Primary : Depend on the local line voltage 3. Secondary : AC, 3\emptyset, 220V 4. Frequency : 50/60Hz <ul style="list-style-type: none"> • 3-phase power (source) is required while operating this system. • The System Transformer 47150 must be included if 3-phase 220V is not available.
 <p>MOSFET/IGBT SET Order Code - 47147</p> <ol style="list-style-type: none"> 1. IGBT : 800V/50A 2. MOSFET : 100V/48A 3. Load lamp : 2 x 24V/10W (with switch) 4. Load inductor : 1 x 50mH/1A (with switch) 5. With current/voltage transfer measurement 6. With trigger control adjustable 7. With external signal input 8. Operation power supply : DC+15V 	 <p>MAGNETIC POWDER BRAKE UNIT Order Code - 47151</p> <ol style="list-style-type: none"> 1. Power supply : 110/220V AC 2. Type : Forced air-cooling magnetic powder brake 3. Braking torque : 0.999 kg-m (9.999 N-m), max. 4. Speed sensing : Photoelectric type, 60 pulse /rev. 5. Torque sensing : Strain-gauge torque transducer, torsion bar 6. Temperature sensing : Thermal switch 7. Base unit : Integral, aluminum alloy 8. Connecting to controller via the dedicated cable 9. Cooling fan : 12V DC/0.29A 10. Analog DC output : <ol style="list-style-type: none"> a. Torque output (1V / 1 kg-m) b. Speed output (1V / 1000 rpm) c. Power output (1V / 1 KW)

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 <p>Brake Controller Order Code - 47152</p> <ol style="list-style-type: none"> Power Supply : 110/220 V AC Connecting to magnetic powder brake unit via dedicated cable 4-digit 7-segment LED Display : 2 sets <ol style="list-style-type: none"> Display speed (S), torque (T) and power (P) of the motor under test Display control voltage (V) and current (I) applied to magnetic powder brake unit LCD character display (20x2) & Buttons for command control of entry and display LCD graphic display (128x64) Graphically display characteristics of brake and motor Display range : <ol style="list-style-type: none"> Torque : 0 ~ 0.999 kg-m or 0 ~ 9.999 N-m Speed : 0 ~ 9999 rpm Power : 0 ~ 9.999 KW Voltage : 0 ~ 24 V Current : 0 ~ 0.999 A Control mode : <ol style="list-style-type: none"> Open-loop control mode Manual loading and unloading power to brake automatic loading and unloading power to brake selectable initial power W_i and max power W_m : 0 ~ 0.999 kg-m Selectable loading time : 1 ~ 15 sec Closed-loop control mode Constant-torque mode Constant-speed mode Fault detection and indication <ol style="list-style-type: none"> MAIN indicator for controller fault BRAKE indicator for brake fault MOTOR indicator for motor fault Communicating with PC through RS-232 (Standard) or RS-485 (Option) port Dedicated hardware and software allow processing and displaying data on PC such as full-screen displaying, tracing, recording, printing motor speed, motor torque, motor power, brake voltage and brake current. 	<p>THREE-PHASE SQUIRREL CAGE MOTOR Order Code - 69316</p> <ol style="list-style-type: none"> Rated voltage : Δ 220 Vac , 50/60 Hz Rated current : 1.4 A Rated speed : 1670 rpm(60 Hz);1420 rpm(50 Hz) Rated power : 0.3 KW Power factor : 0.82 
 <p>DC PERMANENT-MAGNET MACHINE Order Code - 69315</p> <ol style="list-style-type: none"> This machine can be as motor and generator operation. Ratings for motor operation <ol style="list-style-type: none"> Rated voltage : 180 Vdc Rated current : 2.7 A Rated speed : 2500 rpm Rated power : 0.4 KW 	<p>ALUMINIUM TRAINER RACK Order Code - 69700</p> <p>Aluminium trainer rack madeup aluminium profile size 40x40mm, foldable and light in weight 10 panel setup can be interchange conveniently to perform experiments. Dimention Length 1100x Hieght 1000x Depth 350mm.</p> 
	<p>COUPLING Order Code - 47153</p> <ol style="list-style-type: none"> Material : Rubber Coupling sleeve for mechanical connection between two electrical machines 
	<p>COUPLING GUARD Order Code - 47154</p> <ol style="list-style-type: none"> Material : Plate coating A guard attachable for contact-proof with electrical machines rotating parts 
	<p>SHAFT END GUARD Order Code - 47155</p> <ol style="list-style-type: none"> Material : Plate coating A guard attachable to avoid contact with electrical machines rotating parts 
	<p>CONNECTING LEADS SET Order Code - 47156</p> <ol style="list-style-type: none"> 4mm safety plugs with leads Max. rating current : 19A Consists of : <ol style="list-style-type: none"> Connecting leads (25cm), Red/Black/Yellow/Blue/White Connecting leads (50cm), Red/Black/Yellow/Blue/White/Green Connecting leads (100cm), Red/Yellow/Blue/White/Green Connecting leads (150cm), Red/Yellow/Blue/White/Black 

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 <p>SAFETY BRIDGING PLUGS SET Order Code - 47157</p> <ol style="list-style-type: none"> 1. 4mm safety bridge plugs, 19 mm spacing 2. Max. rating current : 19 A 3. Consists of : 47157A safety bridge plug 47157B safety bridge plug 	<p>CONNECTING LEAD HOLDER Order Code - 47159</p> <ol style="list-style-type: none"> 1. Mobile type with 5-foot tubular steel base and five casters 2. Height : 1400mm, iron plate suitable with 20 connecting leads slots. 
<p>LABORATORY TABLE Order Code - 47158</p> <ol style="list-style-type: none"> 1. Dimension (mm) : 1800(W) x 900(D) x 780(H)mm, 5% 	

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Overview of Equipment Required

SN	Order Code	Name of Item	46900A						Total
			A1	A2	A3	A4	A5	A6	
1	47121	DC Power Supply (15V/2A)		1	1	1	1	1	1
2	47122	DC Power Supply (0-40V/6A)						1	1
3	47123	Reference Variable Generator		1	1	1	1		1
4	47124	Differential Amplifier	1	1	1	1	1	1	1
5	47125	Current Transducer		1	1	1	1		1
6	47126	Three Phase Angle Controller		1	1				1
7	47127	R.M.S. Meter	1	1	1	1	1	1	1
8	47128	Power Meter (0.3W-30KW)		1				1	1
9	47129	Resistor Load Unit		1	1	1	1		1
10	47130	Resistor Load						1	1
11	47131	Inductive Load Unit		1	1	1	1		1
12	47132	Flyback Switching Power Supply						1	1
13	47133	Boost Switching Power Supply						1	1
14	47134	Buck Switching Power Supply						1	1
15	47135	Buck-Boost Switching Power Supply Unit						1	1
16	47136	Electronic Ballast Fluorescent Lamp						1	1
17	47137	IGBT Drive Set				1	1		1
18	47138	DC PWM Generator				1			1
19	47139	Single Phase PWM Controller					1		1
20	47140	Three Phase PWM Controller					1		1
21	47141	Three Phase Rectifier & Filter				1	1		1
22	47142	Universal Inverter 3x230V					1		1
23	47143	Power Diode Set		2	3				3
24	47144	Fuse Set		1	1	1	1		1
25	47145	Thyristor (800V/10A)		2	3				3
26	47146	SCR/TRIAC Set	1						1
27	47147	MOSFET/ IGBT Set				1		1	1
28	47148	SCR DC Chopper Set				1			1
29	47149	Isolating Transformer	1	1	1	1	1	1	1
30	47150	System Transformer	1	1	1	1	1	1	1
31	47151	Magnetic Powder Brake Unit				1	1		1
32	47152	Brake Controller				1	1		1
33	69315	DC Permanent-Magnet Machine				1			1
34	69316	Three-Phase Squirrel Cage Motor					1		1
35	69700	Aluminium Trolley Rack	1	1	1	1	1	1	1
36	47153	Coupling				1	1		1
37	47154	Coupling Guard				1	1		1
38	47155	Shaft End Guard				1	1		1
39	47156	Connecting Leads Set	1	1	1	1	1	1	1
40	47157	Safety Bridging Plugs Set	1	1	1	1	1	1	1
41	47158	Laboratory Table	1	1	1	1	1	1	1
42	47159	Connecting Lead Holder	1	1	1	1	1	1	1

Note: Specifications are subject to change.

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