

ITEM No.	SYMBOLS	DESCRIPTION	ITEM No.	SYMBOLS	DESCRIPTION	ITEM No.	SYMBOLS	DESCRIPTION
1		DIRECT CURRENT	23		MOTOR, GENERAL SYMBOL	44		CONTACTOR WITH AUTOMATIC RELEASE
2		ALTERNATING CURRENT	24		INDUCTION MOTOR, THREE PHASE SQUIRREL CAGE	45		CONTACTOR (CONTACT OPEN IN THE UNOPERATED POSITION)(N.O)
3	2M - 220/110V	DIRECT CURRENT THREE CONDUCTORS INCLUDING MID. WIRE, 220V(110V BETWEEN EACH OUTER CONDUCTOR & MID. WIRE)	25		INDUCTION MOTOR, SINGLE - PHASE, SQUIRREL CAGE - LEADS OF SPLIT PHASE BROUGHT OUT	46		CONTACTOR (CONTACT CLOSED IN THE UNOPERATED POSITION)(N.C)
4	3~50Hz400V/230V	3 - PHASE AC. WITH NEUTRAL, 50Hz 400V/230V BETWEEN PHASE & NEUTRAL	26		INDUCTION MOTOR, THREE PHASE WITH WOUND ROTOR.	47		MAKE CONTACT
5		TRANSFORMER WITH TWO WINDINGS	27		GENERATOR, GENERAL SYMBOL	48		BREAK CONTACT
6		TRANSFORMER WITH THREE WINDINGS	28		THREE PHASE, SYNCHRONOUS GENERATOR, PERMANENT MAGNET	49		CHANGE-OVER BREAK BEFORE MAKE CONTACT
7		PULSE OR CURRENT TRANSFORMER WITH ONE PERMANENT WINDING AND THREE THREADED WINDINGS	29		THREE PHASE, SYNCHRONOUS GENERATOR, PERMANENT MAGNET	50		CHANGE OVER MAKE CONTACT BEFORE BREAK CONTACT
8		AUTOTRANSFORMER	30		SYNCHRONOUS GENERATOR THREE PHASE, STAR-CONNECTED WITH NEUTRAL BROUGHT OUT	51		TWO-WAY CONTACT WITH CENTER-OFF POSITION
9		AUTOTRANSFORMER, THREE PHASE, CONNECTION STAR	31		A.C. SERIES MOTOR, SINGLE	52		MAKE CONTACT DELAYED WHEN CLOSING
10		CHOKE, REACTOR	32		A.C. SERIES MOTOR THREE-PHASE	53		BREAK CONTACT DELAYED WHEN RECLOSING
11		CURRENT TRANSFORMER PULSE TRANSFORMER	33		SYNCHRONOUS MOTOR SINGLE PHASE	54		MAKE CONTACT DELAYED WHEN CLOSING & OPENING
12		CURRENT TRANSFORMER WITH TWO CORES AND TWO SECONDARY WINDING	34		FUSE, GENERAL SYMBOL	55		SELF OPERATING THERMAL SWITCH, BREAK CONTACT
13		THREE PHASE TRANSFORMER CONNECTION STAR-ZIGZAG	35		FUSE ISOLATOR (FUSE-DISCONNECTOR)	56		TEMPERATURE SENSITIVE SWITCH, MAKE CONTACT(N.O)
14		THREE-PHASE TRANSFORMER WITH FOUR TAPPINGS, CONNECTION STAR-STAR	36		FUSE SWITCH	57		TEMPERATURE SENSITIVE SWITCH, BREAK CONTACT(N.C)
15		THREE-PHASE TRANSFORMER CONNECTION STAR-DELTA	37		FUSE SWITCH-DISCONNECTOR (ON-LOAD ISOLATING FUSE SWITCH)	58		PUSH-BUTTON SWITCH (NON LOCKING)
16		THREE-PHASE WINDING-T	38		CONNECTING LINK, CLOSED	59		PULL-SWITCH (NON LOCKING)
17		THREE PHASE WINDING V(60°)	39		CONNECTING LINK, OPEN	60		TURN-SWITCH (NON LOCKING)
18		3-PHASE DELTA WINDING	40		CONNECTING LINK, CHANGE OVER	61		TRIPLE-POLE LOAD BREAK SWITCH
19		3-PHASE WINDING, STAR	41		DISCONNECTOR (ISOLATOR)	62		TRIPLE POLE ISOLATOR
20		3-PHASE WINDING, STAR, WITH NEUTRAL BROUGHT OUT	42		CIRCUIT BREAKER	63		TRIPLE CIRCUIT BREAKER
21		3-PHASE WINDING, ZIGZAG OR INTERCONNECTED STAR	43		SWITCH-DISCONNECTOR (ON-LOAD ISOLATING SWITCH)	64		RESISTOR, GENERAL SYMBOL
22		3-PHASE WINDING, OPEN DELTA				65		VARIABLE RESISTOR ADJUSTABLE RESISTOR

NOTES			
1- I.E.C. 617 HAS BEEN USED TO COMPLETE THIS DRAWING.			
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REV	DESCRIPTION	DATE	
IRANIAN PETROLEUM STANDARDS			
NO REVISION PERMITTED UNLESS APPROVED BY STANDARD ORGANIZATION			
REFERENCE DRAWING ELECTRICAL SYMBOLS, ABBREVIATIONS, DEVICE No. AND GENERAL NOTES "CATEGORY 100"			
DATE	DRAWING No.	SHEET	REV.
	IPS - D - EL - 101	1	12

ITEM No.	SYMBOLS	DESCRIPTION	ITEM No.	SYMBOLS	DESCRIPTION	ITEM No.	SYMBOLS	DESCRIPTION	NOTES
71		HEATING ELEMENT	97		VOLTMETER	124		OPERATING BY TURNING	1- IEC 617 HAS BEEN USED TO COMPLETE THIS DRAWING.
72		THERMOCOUPLE, SHOWN WITH POLARITY SYMBOLS	98		POWER FACTOR METER	125		OPERATING BY KEY	
73		LIGHTNING ARRESTER OR SURGE ARRESTER	99		FREQUENCY METER	126		KEY OPERATED SWITCH	
			100		TACHOMETER	127		OPERATED BY THERMAL ACTUATOR	
74		OPERATING DEVICE GENERAL SYMBOL	101		THERMOMETER OR PYROMETER	128			
75		OPERATING DEVICE WITH TWO SEPARATE WINDINGS	102		PHASEMETER	129			
76		RELAY COIL OF A HIGH SPEED RELAY (FAST OPERATING & FAST RELEASING)	103		VARMETER	130			
77		RELAY COIL OF A SLOW RELEASING RELAY	104		DIFFERENTIAL VOLTMETER	131			
78		RELAY COIL OF A SLOW OPERATING RELAY	105		MAXIMUM DEMAND INDICATOR ACTUATED BY AN INTEGRATING METER	132			
79		RELAY COIL OF A SLOW OPERATING AND SLOW RELEASING RELAY	106		SYNCHRONOSCOPE	133			
80		RELAY COIL OF POLARIZED RELAY	107		RECORDING WATTMETER	134			
81		ACTUATING DEVICE OF A THERMAL RELAY	108		CONDUCTOR, GROUP OF CONDUCTOR	135			
82		INVERTER	109		FLEXIBLE CONDUCTOR	136			
83		RECTIFIER	110		JUNCTION OF CONDUCTORS	137			
84		RECTIFIER/INVERTER	111		PROTECTIVE CONDUCTOR	138			
85		D.C. CONVERTER	112		NEUTRAL CONDUCTOR	139			
86		SEMICONDUCTOR DIODE	113		COMBINED PROTECTIVE AND NEUTRAL CONDUCTOR	140			
87		THYRISTOR, GENERAL SYMBOL	114		THREE PHASE WIRING WITH CONDUVCTOR AND PROTECTIVE	141			
88		RECTIFIER IN FULL WAVE BRIDGE CONNECTION	115		WIRING GOING UPWARDS	142			
89		LIGHT EMITTING DIODE (LED)	116		WIRING GOING DOWNWARDS	143			
90		BIDIRECTIONAL DIODE. (DIAC)	117		U/G CONDUCTOR	144			
91		VAR-HOUR METER	118		U/G CABLE, GROUP OF CONDUCTOR	145			
92		WATT-HOUR METER	119		CONTROL BY FLUID LEVEL	146			
93		WATT-HOUR METER - MEASURING ENERGY TRANSMITTED IN ONE DIRECTION ONLY	120		MANNUALLY OPERATED CONTROL (GENERAL CASE)	147			
94		WATT-HOUR METER - MEASURING ENERGY FLOW FROM THE BUSBARS	121		OPERATED BY PNEUMATIC OR HYDRAULIC CONTROL, SINGLE ACTING	148			
95		WATT-HOUR METER - MEASURING ENERGY FLOW TOWARDS THE BUSBARS	122		OPERATING BY ELECTRIC MOTOR	149			
96		AMMETER	123		OPERATING BY PULLING	150			

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DATE	DRAWING No.	SHEET	REV.
	IPS - D - EL - 101	2	12

ITEM No.	SYMBOLS	DESCRIPTION	ITEM No.	SYMBOLS	DESCRIPTION	ITEM No.	SYMBOLS	DESCRIPTION
151		SWITCH, GENERAL SYMBOL	178		FLOODLIGHT	205		CLOCK, GENERAL SYMBOL
152		SWITCH WITH PILOT LIGHT	179		LIGHTING OUTLET POSITION SHOWN WITH WIRING	206		OPERATED BY ELECTRIC CLOCK
153		SWITCH, SINGLE POLE	180		LIGHTING OUTLET ON WALL SHOWN WITH WIRING RUNNING TO THE LEFT	207		TIME SWITCH
154		SWITCH, TWO POLE	181		SELF - CONTAINED EMERGENCY LIGHTING LUMINAIRE	208		HORN
155		MULTIPOSITION SWITCH, SINGLE POLE	182		DISTRIBUTION CENTRE, GENERAL SYMBOL	209		BELL
156		2 WAY SWITCH, SINGLE POLE	183		DISTRIBUTION BOARD OUTDOOR TYPE (SEE NOTE 1)	210		SIREN
157		INTERMEDIATE SWITCH	184		DISTRIBUTION BOARD INDOOR TYPE (SEE NOTE 1)	211		BUZZER
158		PUSH BUTTON	185		CONTROL CABLE NUMBER	212		LOUDSPEAKER
159		PUSH BUTTON WITH INDICATOR LAMP	186		POWER CABLE NUMBER	213		AMPLIFIER, GENERAL SYMBOL
160		SOCKET OUTLET (TELECOMMUNICATIONS), GENERAL SYMBOL	187		CABLE AND BOX /GLAND W/P	214		TELEPHONE SET WITH DIAL
161		SOCKET OUTLET, SINGLE PHASE	188		CABLE AND BOX/GLAND F/P	215		MAGNESIUM PROTECTIVE ANODE
162		SOCKET OUTLET POWER WITH SINGLE POLE SWITCH	189		CONDUIT ENTRY	216		ANTENNA, GENERAL SYMBOL
163		SOCKET OUTLET (POWER) WITH PROTECTIVE CONTACT	190		CABLE TERMINATION	217		EARTH (GROUND) GENERAL SYMBOL
164		SOCKET OUTLET 3 PHASE	191		LOOPING IN BOX WITH 1,2,3 & 4 HOLES	218		PROTECTIVE GROUND/EARTH
165		PLUG AND SOCKET DEVICE	192		STEEL BOX FOR FLUSH ACCESSORIES	219		FRAME OR CHASSIS
166		SOCKET OUTLET, 110V. AC.	193		JUNCTION BOX, TERMINAL, SMALL PATTERN	220		
167		SOCKET OUTLET, 24V. AC.	194		JUNCTION BOX, THROUGH, SMALL PATTERN	221		
168		FAN, SHOWN WITH WIRING	195		JUNCTION BOX, TEE, SMALL PATTERN	222		
169		FAN, EXTRACTION WALL TYPE	196		JUNCTION BOX, 4 WAY, SMALL PATTERN	223		
170		FAN, CEILING TYPE	197		JUNCTION BOX, ANGLE, SMALL PATTERN	224		
171		CEILING ROSE ON JUNCTION BOX WALL MOUNTED	198		JUNCTION BOX, WITH DOMED COVER, SMALL PATTERN	225		
172		JUNCTION BOX, LARGE PATTERN RECTANGULAR, 1,2,3 & 4 WAY	199		CEILING ROSE ON JUNCTION BOX CEILING MOUNTED	226		
173		INCANDESCENT LTG. FITTING (GENERAL) SPECIFIED BY A-B-C ABBREVIATIONS	200			227		
174		FLUORESCENT LTG. FITTING (GENERAL) SPECIFIED BY A-B-C ABBREVIATIONS	201			228		
175		LAMP OR SIGNAL LAMP, GENERAL SYMBOL	202			229		
176		SIGNAL LAMP, FLASHING TYPE	203			230		
177		PROJECTOR, GENERAL SYMBOL	204			231		

NOTES

1- I.E.C. 617 HAS BEEN USED TO COMPLETE THIS DRAWING.

2- THE ASTERISK CAN BE REPLACED BY:

- TP = TELEPHONE
- M = MICROPHONE
- * A = LOUD SPEAKER
- TV = TELEVISION
- TX = TELEX
- Fm = FREQUENCY MODULATION


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	IPS - D - EL - 101	3 / 12	

ITEM No.	SYMBOLS	DESCRIPTION	ITEM No.	SYMBOLS	DESCRIPTION	ITEM No.	SYMBOLS	DESCRIPTION	NOTES
232		COPPER, EARTH WIRE, MAIN LOOP	259		PHOTOELECTRIC CELL	286			<p>1- ABBREVIATIONS AS BELOW:</p> <p>A { FLP=FLAME PROOF EX=EXPLOSIONPROOF WP=WATER PROOF L=LOUVRE PR=PRISMATIC DIFFUSER PLS=PLASTIC DIFFUSER REF=REFLETORE PRG=PROCELAIN GLASS BLK=BULKHEAD WLG=WELLGLASS</p> <p>B (WATT) { 2x40 3x40 2x20 4x20 2x65 32+40 1x60 2x100 ETC.</p> <p>C { Wm=WALL MOUNTED Fm=FLUSH MOUNTED Sm=SURFACE MOUNTED</p>
233		OVERHEAD LINE ON TOWERS	260		PUSH BUTTON STATION START-STOP W/P.	287			
234		U/G CABLE THROUGH BOX	261		PUSH BUTTON STATION START-STOP FLP.	288			
235		U/G CABLE TEE BOX	262		PUSH BUTTON STATION START-STOP WITH AMMETER W/P.	289			
236		STEEL CONDUIT CONCEALED IN WALLS / CEILING OR SURFACE MOUNTED AS SHOWN	263		PUSH BUTTON STATION START-STOP WITH AMMETER FLP.	290			
237		STEEL CONDUIT CONCEALED IN FLOOR	264		PUSH BUTTON STATION EMERGENCY STOP,W/P.	291			
238		CADWELD JOINT ON STRIP	265		PUSH BUTTON STATION EMERGENCY STOP,FLP.	292			
239		CADWELD CONNECTION BW TYPE	266			293			
240		COPPER, EARTH WIRE, BRANCH	267			294			
241		LIGHTING AND SMALL POWER CABLE TRAY	268			295			
242		BUSBAR	269			296			
243			270			297			
244			271			298			
245			272			299			
246			273			300			
247			274			301			
248			275			302			
249			276			303			
250			277			304			
251			278			305			
252			279			306			
253			280			307			
254			281			308			
255			282			309			
256			283			310			
257			284			311			
258			285			312			

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	IPS - D - EL - 101	4	12

ABBREVIATION		ABBREVIATION		ABBREVIATION		ABBREVIATION	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
A	AMPERE	FL	FULL LOAD	N	NEUTRAL	SW	SWITCH
AC	ALTERNATING CURRENT	FLP	FLAMEPROOF	NC	NORMALLY CLOSED	SWA	STEEL WIRE ARMoured
ACB	AIR CIRCUIT BREAKER	GCT	GAS COMBUSTION TURBINE	NO	NORMALLY OPEN	T	TELEPHONE
ALC	AUTOMATIC LOAD CONTROL	GEN	GENERATOR	OCB	OIL CIRCUIT BREAKER	TB	TERMINAL BOARD
ALR	ALARM RELAY	GPR	GROUND PROTECTION RELAY	OD	OUTSIDE DIAMETER	TM	THERMOSTAT
AM	AMPERE METER	Hz	HERTZ	O/H	OVERHEAD LINE	TR	TRANSFORMER
AN	ANNUNCIATOR	HP	HORSEPOWER	ONAF	OIL NATURAL AIR FORCED	T.PH.	THREE PHASE
AS	AMMETER SWITCH	HF	HIGH FREQUENCY	ONAN	OIL NATURAL AIR NATURAL	U/G	UNDER GROUND
AUX	AUXILIARY	HV	HIGH VOLTAGE	OFAF	OIL FORCED, AIR FORCED	V	VOLT
BAT	BATTERY	ID	INSIDE DIAMETER INTERNAL DIAMETER	PABX	PRIVATE AUTOMATIC BRANCH EXCHANGE	VA	VOLTAMPERE
C	COIL	IP	DEGREE OF PROTECTION BY ENCLOSURE	PB	PUSH BUTTON	VAR	VOLTAMPERE REACTIVE
C/O	CHANGE OVER	I/SW	ISOLATING SWITCH	PEC	PHOTOELECTRIC CELL	VC	VACUUM CONTACTOR
CT	CURRENT TRANSFORMER	J/B	JUNCTION BOX	PE	POLYETHYLENE	VCB	VACUUM CIRCUIT BREAKER
CB	CIRCUIT BREAKER	KA	KILOAMPERE	PF	POWER FACTOR	VM	VOLTMETER
CLR	CURRENT LIMITING RESISTOR	KV	KILOVOLT	PH	PHASE	VS	VOLTMETER SWITCH
CR	CURRENT RELAY	KW	KILOWATT	PL	PILOT LAMP	VT	VOLTAGE TRANSFORMER
CS	CONTROL SWITCH	KWH	KILOWATT - HOUR	PT	POTENTIAL TRANSFORMER	W	WATT
DB	DISTRIBUTION BOARD	KHz	KILOHERTZ	PVC	POLYVINYL CHLORIDE	WM	WATTMETER
DC	DIRECT CURRENT	KVA	KILOVOLT - AMPERE	R	ELECTRICAL RESISTANCE	XLPE	CROSSLINKED POLYETHYLENE
DP	DOUBLE POLE	KVAH	KILOVOLT - AMPERE - HOUR	RF	RADIO FREQUENCY		
DPR	DIRECTION POWER RELAY	KVAR	KILOVAR	RL	RELAY		
DOL	DIRECT ON LINE	K _T	KILOHM	RT	RESET		
DFR	DIFFERENTIAL RELAY	LF	LOW FREQUENCY	SCADA	SUPPERVISORY CONTROL AND DATA ACQUISITION		
DPDT	DOUBLE POLE DOUBLE THROW	LV	LOW VOLTAGE	SCR	SHORT CIRCUIT RATIO OF SILICON - CONTROLLED RECTIFIER		
DPST	DOUBLE POLE,SINGLE THROW	LX	LUX	SD	SHUT - DOWN		
E	EARTH	M	MOTOR	SF	SWITCH FUSE		
EF	EARTH FAULT	MCB	MINIATURE CIRCUIT BREAKER	SF ₆	SULFUR HEXAFLUORIDE		
EX	EXPLOSIONPROOF	MCC	MOTOR CONTROL CENTER	S.PH.	SINGLE PHASE		
EMG	EMERGENCY	MCCB	MOULDED CASE CIRCUIT BREAKER	SP	SINGLE POLE OR STOP		
EPR	ETHYLENE - PROPYLENE RUBBER	MOV	MOTOR OPERATED VALVE	SPDT	SINGLE POLE DOUBLE THROW		
ESD	EMERGENCY SHUT - DOWN	MV	MEDIUM VOLTAGE	SPN	SINGLE POLE & NEUTRAL		
F.F.L.	FINISHED FLOOR LEVEL	MVA	MEGAVOLTAMPERE	ST	START		

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	IPS - D - EL - 101	5 / 12


ANSI DEVICE No.	DESCRIPTION	IEC SYMBOL	ANSI DEVICE No.	DESCRIPTION	IEC SYMBOL	ANSI DEVICE No.	DESCRIPTION	IEC SYMBOL	NOTES
1	MASTER ELEMENT		34	MASTER SEQUENCE DEVICE		67	AC DIRECTIONAL OVERCURRENT RELAY		1- THE ANSI DEVICE No. IS APPROVED TO BE USED IN ELECTRICAL DRAWINGS. THE IEC PROPOSED SYMBOLS ARE GIVEN FOR INFORMATION. (REFER TO IEC 617)
2	TIME-DELAY STARTING OR CLOSING RELAY		35	BRUSH-OPERATING OR SLIP-RING SHORT-CIRCUITING DEVICE		68	BLOCKING RELAY		
3	CHECKING OR INTERLOCKING RELAY		36	POLARITY OR POLARIZING VOLTAGE DEVICE		69	PERMISSIVE CONTROL DEVICE		
4	MASTER CONTACTOR		37	UNDERCURRENT OR UNDERPOWER RELAY		70	RHEOSTAT		
5	STOPPING DEVICE		38	BEARING PROTECTIVE DEVICE		71	LEVEL SWITCH		
6	STARTING CIRCUIT BREAKER		39	MECHANICAL CONDITION MONITOR		72	DC CIRCUIT BREAKER		
7	ANODE CIRCUIT BREAKER		40	FIELD RELAY		73	LOAD-RESISTOR CONTACTOR		
8	CONTROL POWER DISCONNECTING DEVICE		41	FIELD CIRCUIT BREAKER		74	ALARM RELAY		
9	REVERSING DEVICE		42	RUNNING CIRCUIT BREAKER		75	POSITION CHANGING MECHANISM		
10	UNIT SEQUENCE SWITCH		43	MANUAL TRANSFER OR SELECTOR DEVICE		76	DC OVERCURRENT RELAY		
11	MULTIFUNCTION DEVICE		44	UNIT SEQUENCE STARTING RELAY		77	TELEMETERING DEVICE		
12	OVERSPEED DEVICE		45	ATMOSPHERIC CONDITION MONITOR		78	PHASE-ANGLE MEASURING OR OUT-OF-STEP PROTECTIVE RELAY		
13	SYNCHRONOUS-SPEED DEVICE		46	REVERSE-PHASE OR PHASE-BALANCE CURRENT RELAY		79	AC RECLOSING RELAY		
14	UNDERSPEED DEVICE		47	PHASE-SEQUENCE OR PHASE-BALANCE VOLTAGE RELAY		80	FLOW SWITCH		
15	SPEED OR FREQUENCY MATCHING DEVICE		48	INCOMPLETE SEQUENCE RELAY		81	FREQUENCY RELAY		
16	RESERVED FOR FUTURE APPLICATION		49	MACHINE OR TRANSFORMER THERMAL RELAY		82	DC RECLOSING RELAY		
17	SHUNTING OR DISCHARGE SWITCH		50	INSTANTANEOUS OVERCURRENT OR RATE-OF-RISE RELAY		83	AUTOMATIC SELECTIVE CONTROL OR TRANSFER RELAY		
18	ACCELERATING OR DECELERATING DEVICE		51	AC TIME OVERCURRENT RELAY		84	OPERATING MECHANISM		
19	STARTING-TO-RUNNING TRANSITION CONTACTOR		52	AC CIRCUIT BREAKER		85	CARRIER OR PILOT-WIRE RECEIVER RELAY		
20	ELECTRICALLY OPERATED VALVE		53	EXCITER OR DC GENERATOR RELAY		86	LOCKOUT RELAY		
21	DISTANCE RELAY		54	TURNING GEAR ENGAGING DEVICE		87	DIFFERENTIAL PROTECTIVE RELAY		
22	EQUALIZER CIRCUIT BREAKER		55	POWER FACTOR RELAY		88	AUXILIARY MOTOR OR MOTOR GENERATOR		
23	TEMPERATURE CONTROL DEVICE		56	FIELD APPLICATION RELAY		89	LINE SWITCH (DISCONNECTING SWITCH)		
24	VOLTS PER HERTZ RELAY		57	SHORT-CIRCUITING OR GROUNDING DEVICE		90	REGULATING DEVICE		
25	SYNCHRONIZING OR SYNCHRONISM CHECK DEVICE		58	RECTIFICATION FAILURE RELAY		91	VOLTAGE DIRECTIONAL RELAY		
26	APPARATUS THERMAL DEVICE		59	OVERVOLTAGE RELAY		92	VOLTAGE AND POWER DIRECTIONAL RELAY		
27	UNDERVOLTAGE RELAY		60	VOLTAGE OR CURRENT BALANCE RELAY		93	FIELD-CHANGING CONTACTOR		
28	FLAME DETECTOR		61	DENSITY SWITCH OR SENSOR		94	TRIPPING OR TRIP-FREE RELAY		
29	ISOLATING CONTACTOR		62	TIME-DELAY STOPPING OR OPENING RELAY		95	USED ONLY FOR SPECIFIC APPLICATION		
30	ANNUNCIATOR RELAY		63	PRESSURE SWITCH		96	USED ONLY FOR SPECIFIC APPLICATION		
31	SEPARATE EXCITATION DEVICE		64	GROUND DETECTOR RELAY		97	USED ONLY FOR SPECIFIC APPLICATION		
32	DIRECTIONAL POWER RELAY		65	GOVERNOR		98	USED ONLY FOR SPECIFIC APPLICATION		
33	POSITION SWITCH		66	NOTCHING OR JOGGING DEVICE		99	USED ONLY FOR SPECIFIC APPLICATION		

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	IPS - D - EL - 101	6 12	

WIRING

- 1- WHEN CONDUIT ENTERS FROM NON HAZARDOUS TO HAZARDOUS AREA OR VICE VERSA IT SHALL RUN THROUGH A BARRIER OR STOPPER BOX.
- 2- THE WIRES FROM BOX TO BOX SHALL BE SPLICE FREE.
- 3- METAL RACEWAYS, CABLE ARMOR, BOXES, CABLE SHEATHING, CABINETS, ELBOWS, COUPLINGS, FITTINGS, SUPPORTS AND SUPPORT HARDWARE SHALL BE OF MATERIALS SUITABLE FOR ENVIRONMENT IN WHICH THEY ARE TO BE INSTALLED.
- 4- DIRECT BURIED CONDUCTORS AND CABLES EMERGING FROM THE GROUND SHALL BE PROTECTED BY ENCLOSURES OR RACEWAYS.
- 5- METAL RACEWAYS, CABLE ARMOR, AND OTHER METAL ENCLOSURES FOR CONDUCTORS SHALL BE METALLICALLY JOINED TOGETHER INTO A CONTINUOUS ELECTRIC CONDUCTOR, AND SHALL BE SO CONNECTED TO ALL BOXES, FITTINGS, AND CABINETS AS TO PROVIDE EFFECTIVE ELECTRICAL CONTINUITY. RACEWAYS AND CABLE ASSEMBLIES SHALL BE MECHANICALLY SECURED TO BOXES, FITTINGS, CABINETS, AND OTHER ENCLOSURES.
- 6- AT LEAST 150 mm(6") OF FREE CONDUCTOR SHALL BE LEFT AT EACH OUTLET, JUNCTION, AND SWITCH POINT FOR SPLICES OR THE CONNECTION OF FIXTURES OR DEVICES.
- 7- CONDUCTORS OF CIRCUITS RATED OVER 600 VOLTS, NOMINAL, SHALL NOT OCCUPY THE SAME EQUIPMENT WIRING ENCLOSURE, CABLE, OR RACEWAY WITH CONDUCTORS OF CIRCUITS RATED 600 VOLTS, NOMINAL, OR LESS.
- 8- WHEN U/G CABLES CROSS ROADS AND PIPE RUNS THEY SHALL BE PROTECTED BY MEANS OF MILD STEEL OR CONCRETE PIPES HAVING A DIAMETER OF AT LEAST TWICE THAT OF THE CABLES TO BE PROTECTED.
- 9- WHEN CABLES RUN PARALLEL TO ROADS THE CABLES SHALL BE BURIED UNDER THE EDGE OF THE ROAD SHOULDER OUTSIDE THE ROAD LIMIT.
- 10- WIRING SYSTEM FOR EXTRA LOW VOLTAGE INSTALLATIONS SUCH AS TELEPHONE, BELL, FIRE ALARM, CLOCK SYSTEM, HOUSE CALLING SYSTEM, PAGING SYSTEM & AERIAL WIRES SHALL BE DRAWN THROUGH SEPARATE CONDUIT TUBINGS FROM THOSE OF MAINS.
- 11- NO ELECTRIC CONDUCTOR SHALL BE INSTALLED IN ANY RACEWAY, CABLE, OR CABLE TRAY THAT CONTAINS A PIPE, TUBE, OR EQUAL FOR STEAM, WATER, AIR, GAS, DRAINAGE, OR ANY SERVICE OTHER THAN ELECTRICAL.
- 12- WHERE CONDUCTORS CARRYING ALTERNATING CURRENT ARE INSTALLED IN METAL ENCLOSURES OR METAL RACEWAYS, THEY SHALL BE SO ARRANGED AS TO AVOID HEATING THE SURROUNDING METAL BY INDUCTION. TO ACCOMPLISH THIS, ALL PHASE CONDUCTORS AND, WHERE USED, THE NEUTRAL AND ALL EQUIPMENT GROUNDING CONDUCTORS SHALL BE GROUPED TOGETHER.
- 13- WHERE A SINGLE CONDUCTOR CARRYING ALTERNATING CURRENT PASSES THROUGH METAL WITH MAGNETIC PROPERTIES THE INDUCTIVE EFFECT SHALL BE MINIMIZED BY :
(1) CUTTING SLOTS IN THE METAL BETWEEN THE INDIVIDUAL HOLES THROUGH WHICH CONDUCTORS PASS, OR
(2) PASSING ALL THE CONDUCTORS IN THE CIRCUIT THROUGH AN INSULATING WALL SUFFICIENTLY LARGE FOR ALL OF THE CONDUCTORS OF THE CIRCUIT.
- 14- CONDUCTORS EXPOSED TO OILS, GREASES, VAPORS, GASES, FUMES, LIQUIDS, OR OTHER SUBSTANCES, HAVING A DELETERIOUS EFFECT UPON THE CONDUCTOR OR INSULATION, SHALL BE OF A TYPE SUITABLE FOR THE APPLICATION.
- 15- IN DAMP OR WET LOCATIONS, BOXES, CONDUIT BODIES, AND FITTINGS SHALL BE SO PLACED OR EQUIPPED AS TO PREVENT MOISTURE FROM ENTERING OR ACCUMULATING WITHIN THE BOX, CONDUIT BODY, OR FITTING. BOXES, CONDUIT BODIES, AND FITTINGS INSTALLED IN WET LOCATIONS SHALL BE LISTED FOR USE IN WET LOCATIONS.
- 16- OPENINGS THROUGH WHICH CONDUCTORS ENTER SHALL BE ADEQUATELY CLOSED.
- 17- UNUSED OPENINGS IN BOXES, CONDUIT BODIES AND FITTINGS SHALL BE EFFECTIVELY CLOSED TO AFFORD PROTECTION SUBSTANTIALLY EQUIVALENT TO THAT OF THE WALL OF THE BOX, CONDUIT BODY OR FITTING. METAL PLUGS OR PLATES USED WITH NONMETALLIC BOXES, CONDUIT BODIES OR FITTINGS SHALL BE RECESSED AT LEAST 6.35mm (1/4") FROM THE OUTER SURFACE.
- 18- METAL BOXES, CONDUIT BODIES, AND FITTINGS SHALL BE CORROSION-RESISTANT OR SHALL BE WELL GALVANIZED, ENAMELED, OR OTHERWISE PROPERLY COATED INSIDE AND OUT TO PREVENT CORROSION.
- 19- FERROUS OR NONFERROUS METAL CONDUIT, ELBOWS, COUPLINGS, AND FITTINGS MAY BE PERMITTED TO BE INSTALLED IN CONCRETE, IN DIRECT CONTACT WITH THE EARTH, OR IN AREAS SUBJECT TO SEVERE CORROSIVE INFLUENCES WHERE PROTECTED BY CORROSION PROTECTION AND JUDGED SUITABLE FOR THE CONDITION.
- 20- ALL SUPPORTS, BOLTS, STRAPS, SCREWS, etc. SHALL BE OF CORROSION RESISTANT MATERIAL OR PROTECTED AGAINST CORROSION BY CORROSION-RESISTANT MATERIAL.

NOTES

REV		DATE	
REV	DESCRIPTION	DATE	
 IRANIAN PETROLEUM STANDARDS			
NO REVISION PERMITTED UNLESS APPROVED BY STANDARD ORGANIZATION			
REFERENCE DRAWING ELECTRICAL SYMBOLS, ABBREVIATIONS, DEVICE No. AND GENERAL NOTES "CATEGORY 100"			
DATE	DRAWING No.	SHEET	REV.
	IPS - D - EL - 101	7 12	

LIGHTING


- 21- (a) LIGHTING FIXTURES INSTALLED IN WET OR DAMP LOCATIONS SHALL BE SO INSTALLED THAT WATER CAN NOT ENTER OR ACCUMULATE IN WIRING COMPARTMENTS, LAMP HOLDERS OR OTHER ELECTRICAL PARTS.
(b) LIGHTING FIXTURES INSTALLED IN CORROSIVE LOCATIONS SHALL BE OF A TYPE SUITABLE FOR SUCH LOCATIONS.
- 22- RECEPTACLES INSTALLED FOR THE ATTACHMENT OF PORTABLE CHORDS SHALL BE RATED AT NOT LESS THAN 15 AMPERES, 125 VOLT OR 15 AMPERS, 250 VOLT.
- 23- ALL BELL PUSHES TO BE FIXED AT 120cm ABOVE F. F. L. EXCEPT THOSE INDICATED OTHERWISE.
- 24- IN OFFICE BUILDING, ALL SOCKET OUTLETS TO BE FIXED AT 30cm. ABOVE FINISHED FLOOR LEVEL EXCEPT THOSE INDICATED OTHERWISE.
- 25- WHERE MORE THAN ONE SWITCH OR SOCKET OR BELL PUSHES ARE SITUATED NEARBY THEY SHALL BE FIXED AS NEAR EACHOTHER AS POSSIBLE.
- 26- SWITCHES SITUATED NEAR DOOR SHALL HAVE A DISTANCE OF APPROXIMATELY 10 cm FROM DOOR FRAME TO SWITCH CENTER.
- 27- SWITCH FUSE (BELOW DISTRIBUTION BOX) TO BE INSTALLED AT 180-200cm. ABOVE FINISHED FLOOR LEVEL.
- 28- DISTRIBUTION FUSE BOX INSIDE THE BUILDING TO BE INSTALLED AT 200-220 cm. ABOVE FINISHED FLOOR LEVEL.
- 29- ALL FUSES ON DISTRIBUTION BOX SHALL HAVE LABELS INDICATING CIRCUIT AND RATINGS.
- 30- GENERAL LOCATION OF EMERGENCY LIGHTINGS SHALL PROVIDE SAFE SHUT DOWN OF PLANT & ACCESS WAY LIGHTING FOR PERSONNEL.
- 31- FIXTURES SHALL BE SO CONSTRUCTED, OR INSTALLED, OR EQUIPPED WITH SHADES OR GUARDS THAT COMBUSTIBLE MATERIAL WILL NOT BE SUBJECTED TO TEMPERATURES IN EXCESS OF 90°C
- 32- THE FOLLOWING ABBREVIATIONS ARE USED FOR TYPE OF FIXTURE MOUNTING IN DRAWINGS:

REF. MARK	REF. MARK	APPLICATION
C	CEILING MOUNTED	UNDER PIPERACK, PLATFORMS & CEILINGS
P	PENDANT MOUNTED	UNDER PIPERACK
B	BRACKET MOUNTED	UNDER PIPERACK
S	STAND MOUNTED	PLATFORM WALKWAY
G1,G2	POLE MOUNTED WITH FOUNDATION	GRADE
F	FLUSH MOUNTED	WALLS OR CEILINGS
W	WALL MOUNTED	WALLS

GROUNDING & LIGHTNING

- 33- EVERY EARTHING LEAD SHALL BE PROTECTED WHERE NECESSARY AGAINST MECHANICAL DAMAGE.
- 34- CONDUCTIVE MATERIALS ENCLOSING ELECTRICAL CONDUCTORS OR EQUIPMENT OR FORMING PART OF SUCH EQUIPMENT, ARE GROUNDED TO LIMIT THE VOLTAGE TO GROUND ON THESE MATERIALS AND TO FACILITATE OVERCURRENT DEVICE OPERATION IN CASE OF GROUND FAULTS.
- 35- THE PATH TO GROUND FROM CIRCUITS, EQUIPMENT, AND CONDUCTOR ENCLOSURES SHALL :
(1) BE PERMANENT AND CONTINUOUS.
(2) HAVE CAPACITY TO CONDUCT SAFELY ANY FAULT CURRENT LIKELY TO BE IMPOSED ON IT ; AND
(3) HAVE SUFFICIENTLY LOW IMPEDANCE TO LIMIT THE VOLTAGE TO GROUND AND TO FACILITATE THE OPERATION OF THE CIRCUIT PROTECTIVE DEVICES IN THE CIRCUIT. THE EARTH SHALL NOT BE USED AS THE SOLE EQUIPMENT GROUNDING CONDUCTOR.
- 36- THE MATERIAL SELECTED FOR GROUNDING ELECTRODE SHALL BE RESISTANT TO ANY CORROSIVE CONDITION EXISTING AT THE INSTALLATION OR SHALL BE SUITABLY PROTECTED AGAINST CORROSION.
- 37- THE CONNECTION OF A GROUNDING ELECTRODE CONDUCTOR TO A GROUNDING CONDUCTOR SHALL BE ACCESSIBLE AND MADE IN A MANNER THAT WILL ASSURE A PERMANENT AND EFFECTIVE GROUND.
- 38- GROUNDING CONDUCTORS AND BONDING JUMPERS SHALL BE CONNECTED BY EXOTHERMIC WELDING, PRESSURE CONNECTORS, CLAMPS, OR OTHER SUITABLE MEANS. CONNECTION DEVICES OF FITTINGS THAT DEPEND SOLELY ON SOLDER SHALL NOT BE USED.
- 39- NONCONDUCTIVE COATINGS (SUCH AS PAINT LACQUER, AND ENAMEL) ON EQUIPMENT TO BE GROUNDED SHALL BE REMOVED FROM THREADS AND OTHER CONTACT SURFACES TO ASSURE GOOD ELECTRICAL CONTINUITY.
- 40- METAL RACEWAYS, BOXES, CABINETS, CABLE ARMOR, AND FITTINGS SHALL BE GROUNDED.
- 41- IN MULTIWIRE CIRCUITS THE CONTINUITY OF A GROUNDED CONDUCTOR SHALL NOT BE DEPENDENT UPON DEVICE CONNECTIONS, SUCH AS LAMP HOLDERS, RECEPTACLES, ETC. WHERE THE REMOVAL OF SUCH DEVICES WOULD INTERRUPT THE CONTINUITY.
- 42- GROUNDING IMPEDANCE SHALL BE ONE OHM OR SMALLER.
- 43- IF THE EARTH RESISTANCE EXCEED THE ABOVE MENTIONED LIMIT, MORE EARTH POLES SHALL BE DRIVEN IN GROUND AND CONNECTED TO THE CIRCUIT.

NOTES

C			
B			
A			
REV	DESCRIPTION	DATE	
 IRANIAN PETROLEUM STANDARDS			
NO REVISION PERMITTED UNLESS APPROVED BY STANDARD ORGANIZATION			
REFERENCE DRAWING ELECTRICAL SYMBOLS, ABBREVIATIONS, DEVICE No. AND GENERAL NOTES "CATEGORY 100"			
DATE	DRAWING No.	SHEET	REV.
	IPS - D - EL - 101	8	12

GROUNDING & LIGHTNING (Cont'd)

- 44- EARTH CONDUCTORS SHALL BE PROTECTED AGAINST MECHANICAL DAMAGE AND CORROSION WHEN EMERGING FROM TRENCH AT GROUND LEVEL.
- 45- A MINIMUM OF TWO EARTH ELECTRODES SHOULD BE PROVIDED FOR EACH EARTHING SYSTEM.
- 46- IN SUBSTATION FOR NON-CURRENT CARRYING PARTS OF EQUIPMENT SUCH AS: TRANSFORMER AND REGULATOR CASES, FRAMES AND STRUCTURES, OPERATING HANDLES OF DISCONNECT SWITCHES, CABINETS, CONDUITS, CABLE SHEATHS, etc. INDIVIDUAL GROUNDING BRANCHES SHOULD BE USED.
- 47- THE MATERIALS OF WHICH PROTECTION SYSTEMS ARE MADE SHALL BE RESISTANT TO CORROSION OR SHALL BE ACCEPTABLY PROTECTED AGAINST CORROSION.
- 48- NO COMBINATION OF MATERIALS SHALL BE USED THAT FORMS AN ELECTROLYTIC CELL OF SUCH NATURE THAT IN THE PRESENCE OF MOISTURE CORROSION IS ACCELERATED.
- 49- PRECAUTIONS SHALL BE TAKEN TO PROVIDE AGAINST ANY TENDENCY TOWARDS DETERIORATION DUE TO LOCAL CONDITIONS.
- 50- ANY PART OF A LIGHTNING PROTECTION SYSTEM THAT IS SUBJECT TO MECHANICAL DAMAGE OR DISPLACEMENT SHALL BE PROTECTED WITH A PROTECTIVE MOLDING OR COVERING. IF METAL PIPE OR TUBING IS USED AROUND THE CONDUCTOR, THE CONDUCTOR SHALL BE ELECTRICALLY CONNECTED TO THE PIPE OR TUBING AT BOTH ENDS.
- 51- AIR TERMINALS SHALL BE PROVIDED FOR ALL PARTS OF A STRUCTURE THAT ARE LIKELY TO BE DAMAGED BY DIRECT LIGHTNING FLASHES. METAL PARTS OF A STRUCTURE THAT ARE EXPOSED TO DIRECT LIGHTNING FLASHES AND THOSE HAVE A METAL THICKNESS OF 4.8mm OR GREATER ONLY REQUIRE CONNECTION TO THE LIGHTNING PROTECTION SYSTEM. SUCH CONNECTIONS SHALL PROVIDE A TWO-WAY PATH TO GROUND AS IS REQUIRED FOR AIR TERMINALS.
- 52- AIR TERMINALS SHALL NOT BE REQUIRED FOR THOSE PART OF STRUCTURE LOCATED WITHIN A ZONE OF PROTECTION.
- 53- NO BENDS OF A CONDUCTOR SHALL FORM AN INCLUDED ANGLE OF LESS THAN 90 DEGREE, NOR SHALL IT HAVE A RADIUS OF BEND LESS THAN 203mm(8").
- 54- AT LEAST TWO DOWN CONDUCTORS SHALL BE PROVIDED ON ANY KIND OF STRUCTURE, INCLUDING STACKS. STRUCTURES EXCEEDING 76m IN PERIMETER SHALL HAVE A DOWN CONDUCTOR FOR EVERY 30m OF PERIMETER OR FRACTION THERE OF.
- 55- EACH DOWN CONDUCTOR SHALL TERMINATE AT A GROUND TERMINAL. GROUND RODS SHALL BE NOT LESS THAN 12.7mm(1/2") IN DIAMETER AND 2.4m(8') LONG.


HEAT TRACING

- 56- FOR SPECIFIC INSTALLATION DETAILS REFER TO MANUFACTURER RECOMMENDATIONS.
- 57- HEAT TRACING DEVICES SHOULD BE SUITABLE FOR CLASS OF HAZARD IN CLASSIFIED AREAS.
- 58- HEATING ELEMENTS AND ASSEMBLIES, WHERE INSTALLED ON FLEXIBLE PIPELINES, SHALL HAVE A FLEXURAL CAPABILITY COMPATIBLE WITH THE PIPELINE.
- 59- ALL ACCESSIBLE EXTERNAL SURFACES OF THE PIPELINE AND/OR VESSEL BEING HEATED SHALL BE PHYSICALLY GUARDED, ISOLATED, OR THERMALLY INSULATED (WITH WEATHERPROOF JACKET FOR OUTSIDE INSTALLATIONS) TO PROTECT AGAINST CONTACT BY PERSONNEL IN THE AREA.

MISCELENEUOUS

- 60- TELEPHONE SOCKET OUTLETS TO BE INDIVIDUALLY WIRED TO TELEPHONE DISTRIBUTION BOX (IN RELEVANT FLOORS).
- 61- TELEPHONE, BELL AND AERIAL WIRES SHALL BE DRAWN THROUGH SEPERATE CONDUIT CIRCUIT FROM THOSE OF MAINS.
- 62- BATTERY LOCATION SHALL CONFORM (a) AND (b) BELOW
 (a) PROVISION SHALL BE MADE FOR SUFFICIENT DIFFUSION AND VENTILATION OF THE GASES FROM THE BATTERY TO PREVENT THE ACCUMULATION OF AN EXPLOSIVE MIXTURE.
 (b) GUARDING OF LIVE PARTS SHALL CONFORM WITH THE FOLLOWINGS:
 b-1) EXCEPT AS ELSEWHERE REQUIRED OR PERMITTED, LIVE PARTS OF ELECTRIC EQUIPMENT OPERATING AT 50 VOLTS OR MORE SHALL BE GUARDED AGAINST ACCIDENTAL CONTACT BY APPROVED ENCLOSURES OR BY ANY OF THE FOLLOWING:
 - BY LOCATION IN A ROOM, VAULT,OR SIMILAR ENCLOSURES THAT IS ACCESSIBLE ONLY TO QUALIFIED PERSONS.
 - BY SUITABLE PERMANENT, SUBSTANTIAL PARTITIONS OR SCREENS SO ARRANGED THAT ONLY QUALIFIED PERSONS WILL HAVE ACCESS TO THE SPACE WITHIN REACH OF THE LIVE PARTS. ANY OPENINGS IN SUCH PARTITIONS OR SCREENS SHALL BE SO SIZED AND LOCATED THAT PERSONS ARE NOT LIKELY TO COME INTO ACCIDENTAL CONTACT WITH THE LIVE PARTS OR TO BRING CONDUCTING OBJECTS INTO CONTACT WITH THEM.
 - BY LOCATION ON A SUITABLE BALCONY, GALLERY, OR PLATFORM SO ELEVATED AND ARRANGED AS TO EXCLUDE UNQUALIFIED PERSONS.
 - BY ELEVATION OF 2440mm, OR MORE ABOVE THE FLOOR OR OTHER WORKING SURFACE.
 b-2) IN LOCATIONS WHERE ELECTRIC EQUIPMENT WOULD BE EXPOSED TO PHYSICAL DAMAGE,ENCLOSURES OR GUARDS SHALL BE SO ARRANGED AND OF SUCH STRENGTH AS TO PREVENT SUCH DAMAGE.
 b-3) ENTRANCES TO ROOMS AND OTHER GUARDED LOCATIONS CONTAINING EXPOSED LIVE PARTS SHALL BE MARKED WITH CONSPICUOUS WARNING SIGNS FORBIDDING UNQUALIFIED PERSONS TO ENTER.
- 63- NO APPLIANCES AND NO LAMPS OTHER THAN THOSE SPECIFIED AS REQUIRED FOR EMERGENCY USE, SHALL BE SUPPLIED BY EMERGENCY LIGHTING CIRCUIT.
- 64- EMERGENCY ILLUMINATION SHALL INCLUDE ALL REQUIRED MEANS OF EGRESS LIGHTING, ILLUMINATED EXIT SIGNALS, AND ALL OTHER LIGHTS SPECIFIED AS NECESSARY TO PROVIDE REQUIRED ILLUMINATION.
 EMERGENCY LIGHTING SYSTEM SHALL BE SO DESIGNED AND INSTALLED THAT THE FAILURE OF ANY INDIVIDUAL LIGHTING ELEMENT, SUCH AS THE BURNING OUT OF A LIGHT BULB, CANNOT LEAVE IN TOTAL DARKNESS ANY SPACE WHICH REQUIRES EMERGENCY ILLUMINATION.
- 65- ALL PULL BOXES, JUNCTION BOXES, CONDUIT BODIES, AND FITTINGS SHALL BE PROVIDED WITH COVERS COMPATIBLE WITH THE BOX, CONDUIT BODY OR FITTING CONSTRUCTION AND SUITABLE FOR THE CONDITION OF USE.

NOTES

REV	DESCRIPTION	DATE	
C			
B			
A			
IRANIAN PETROLEUM STANDARDS 			
NO REVISION PERMITTED UNLESS APPROVED BY STANDARD ORGANIZATION			
REFERENCE DRAWING ELECTRICAL SYMBOLS, ABBREVIATIONS, DEVICE No. AND GENERAL NOTES "CATEGORY 100"			
DATE	DRAWING No.	SHEET	REV.
	IPS - D - EL - 101	9 12	

GROUNDING & LIGHTNING (Cont'd)

- 66- JUNCTION, PULL AND OUTLET BOXES SHALL BE SO INSTALLED THAT THE WIRING CONTAINED IN THEM CAN BE RENDERED ACCESSIBLE WITHOUT REMOVING ANY PART OF THE BUILDING OR IN UNDERGROUND CIRCUITS WITHOUT EXCAVATING SIDEWALKS, PAVING, EARTH, OR OTHER SUBSTANCE THAT IS TO BE USED TO ESTABLISH THE FINISHED GRADE.
- 67- ALL SWITCHES AND CIRCUIT BREAKERS USED AS SWITCHES SHALL BE SO LOCATED THAT THEY MAY BE OPERATED FROM A READILY ACCESSIBLE PLACE. THEY SHALL BE SO INSTALLED THAT THE CENTER OF THE GRIP OF THE OPERATING HANDLE OF THE SWITCH OR CIRCUIT BREAKER, WHEN IN ITS HIGHEST POSITION, WILL NOT BE MORE THAN 1750mm. ABOVE THE FLOOR OR WORKING PLATFORM.
- 68- WHERE A SWITCHBOARD IS IN A WET LOCATION OR OUTSIDE OF A BUILDING, IT SHALL BE ENCLOSED IN A WEATHERPROOF ENCLOSURE.
- 69- A SPACE OF 914mm(3 FEET)OR MORE SHALL BE PROVIDED BETWEEN THE TOP OF ANY SWITCHBOARD AND ANY COMBUSTIBLE CEILING.
- 70- ALL SECTIONS OF ELECTRIC STEEL POLES ARE TO BE OF ONE SOLID LENGTH OF TUBE, UNDER NO CIRCUMSTANCES ANY OF THEM SHALL BE MADE & WELDED FROM TWO OR MORE PIECES.
- 71- a) TERMINAL OF MOTORS AND CONTROLLERS SHALL BE SUITABLY MARKED OR COLORED WHERE NECESSARY TO INDICATE THE PROPER CONNECTIONS.
 b) MOTOR CONTROLLERS AND TERMINALS OF CONTROL CIRCUIT DEVICES SHALL BE CONNECTED WITH COPPER CONDUCTORS UNLESS IDENTIFIED FOR USE WITH A DIFFERENT CONDUCTOR.
 c) CONTROL CIRCUIT DEVICES WITH SCREW-TYPE PRESSURE TERMINALS USED WITH NO. 14 AWG (2 mm²) OR SMALLER COPPER CONDUCTORS SHALL BE TORQUED TO A MINIMUM OF 0.79 N-M UNLESS IDENTIFIED FOR A DIFFERENT TORQUE VALUE.
- 72- ANY PIPE OR DUCT SYSTEM FOREIGN TO THE ELECTRICAL INSTALLATION SHALL NOT ENTER OR PASS THROUGH A TRANSFORMER VAULT. PIPING OR OTHER FACILITIES PROVIDED FOR VAULT FIRE PROTECTION OR FOR TRANSFORMER COOLING, SHALL NOT BE CONSIDERED FOREIGN TO THE ELECTRICAL INSTALLATION.
- 73- IN WALLS OR CEILINGS OF CONCRETE, TILE, OR OTHER NONCOMBUSTIBLE MATERIAL, BOXES AND FITTINGS SHALL BE SO INSTALLED THAT THE FRONT EDGE OF THE BOX OR FITTING WILL NOT SET BACK OF THE FINISHED SURFACE MORE THAN 6.35mm. (1/4").

NOTES

C		
B		
A		
REV	DESCRIPTION	DATE

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REFERENCE DRAWING
 ELECTRICAL SYMBOLS, ABBREVIATIONS,
 DEVICE No. AND GENERAL NOTES
 "CATEGORY 100"

DATE	DRAWING No.	SHEET	REV.
	IPS - D - EL - 101	10 12	

CABLE CAPACITIES OF CONDUIT AND TRUNKING

points to be considered :

A NUMBER OF VARIABLE FACTORS AFFECT ANY ATTEMPT TO ARRIVE AT A STANDARD METHODE OF ASSESSING THE CAPACITY OF CONDUIT OR TRUNKING.

SOME OF THESE ARE:

- REASONABLE CARE(OF DRAWING-IN).
- ACCEPTABLE USE OF THE SPACE AVAILABLE.
- TOLERANCE IN CABLE SIZES.
- TOLERANCE IN CONDUIT AND TRUNKING.

THE FOLLOWING TABLES CAN ONLY GIVE GUIDANCE OF THE MAXIMUM NUMBER OF CABLES WHICH SHOULD BE DRAWN IN. THE SIZES SHOULD ENSURE AN EASY PULL WITH LOW RISK OF DAMAGE TO THE CABLES.

ONLY THE EASE OF DRAWING-IN IS TAKEN INTO ACCOUNT. THE ELECTRICAL EFFECTS OF GROUPING IS NOT. AS THE NUMBER OF CIRCUIT INCREASES THE CURRENT-CARRYING CAPACITY OF THE CABLE DECREASES. CABLE SIZES HAVE TO BE INCREASED WITH CONSEQUENT INCREASE IN COST OF CABLE AND CONDUIT.

IT MAY THEREFORE BE MORE ATTRACTIVE ECONOMICALLY TO DIVIDE THE CIRCUITS CONCERNED BETWEEN TWO OR MORE ENCLOSURES.

THE FOLLOWING THREE CASES ARE DEALT WITH:

SINGLE-CORE P.V.C.-INSULATED CABLES.

(i) IN STRAIGHT RUNS OF CONDUIT NOT EXCEEDING 3m IN LENGTH. TABLE A & B

(ii) IN STRAIGHT RUNS OF CONDUIT EXCEEDING 3m IN LENGTH, OR IN RUNS OF ANY LENGTH INCORPORATING BENDS OR SETS. TABLE C & D

(iii) IN TRUNKING. TABLES E,F,G.

OTHER SIZES AND TYPES OF CABLE IN TRUNKING ARE DEALT WITH IN TABLE G. CONVERTIBLE TERMS HAVE BEEN DEVISED TO ENABLE THE SPACE IN THE SYSTEM TO BE MATCHED TO AN EQUIVALENT GROUP OF CABLES.

FOR CABLES AND/OR CONDUITS, NOT COVERED BY THIS APPENDIX ADVICE ON THE NUMBER OF CABLES WHICH CAN BE DRAWN IN SHOULD BE OBTAINED FROM THE MANUFACTURERS.

single-core p.v.c.-insulated cables in straight runs of conduit not exceeding 3m in length.

FOR EACH CABLE IT IS INTENDED TO USE, OBTAIN THE TERM FROM TABLE A.

ADD THE CABLE TERMS TOGETHER AND COMPARE THE TOTAL WITH THE CONDUIT TERMS GIVEN IN TABLE B.

THE MINIMUM CONDUIT SIZE IS THAT HAVING A TERM EQUAL TO OR GREATER THAN THE SUM OF THE CABLE TERMS.

TABLE A

CABLE TERMS FOR USE IN CONDUIT IN SHORT STRAIGHT RUNS

TYPE OF CONDUCTOR	CONDUCTOR CROSS SECTIONAL AREA (sq.mm)	TERM
SOLID	1	22
	1.5	27
	2.5	39
STRANDED	1.5	31
	2.5	43
	4	58
	6	88
	10	146
	16	202
	25	385

TABLE B

CONDUIT TERMS FOR USE IN SHORT STRAIGHT RUNS

CONDUIT DIAMETER (mm)	TERM
16	290
20	460
25	800
32	1400
38	1900
50	3500
63	5600

single-core p.v.c.-insulated cables in straight runs of conduit exceeding 3m in length or in runs of any length incorporating bends or sets.

FOR EACH CABLE IT IS INTENDED TO USE,OBTAIN THE APPROPRIATE TERM FROM TABLE C. ADD THE CABLE TERMS TOGETHER AND COMPARE THE TOTAL WITH CONDUIT TERMS GIVEN IN TABLE "D" TAKING INTO ACCOUNT THE LENGTH OF RUN IT IS INTENDED TO USE AND THE NUMBER OF BENDS AND SETS IN THAT RUN.

THE MINIMUM CONDUIT SIZE IS THAT SIZE HAVING A TERM EQUAL TO OR GREATER THAN THE SUM OF THE CABLE TERMS. FOR THE LARGER SIZES OF CONDUIT MULTIPLICATION FACTORS ARE GIVEN RELATING THEM TO 32 DIAMETER CONDUIT.

TABLE C

CABLE TERMS FOR USE IN CONDUIT IN LONG STRAIGHT RUNS OVER 3m, OR RUNS OF ANY LENGTH INCORPORATING BENDS.

TYPE OF CONDUCTOR	CONDUCTOR CROSS SECTIONAL AREA (sq.mm)	TERM
SOLID OR STRANDED	1	16
	1.5	22
	2.5	30
	4	43
	6	58
	10	105
	16	145
	25	217

TABLE D

CONDUIT TERMS FOR RUNS INCORPORATING BENDS AND LONG STRAIGHT RUNS.

LENGTH OF RUN (m)	CONDUIT DIAMETER, (mm)																			
	16				20				25				32							
	STRAIGHT				ONE BEND				TWO BENDS				THREE BENDS				FOUR BENDS			
1	COVERED BY TABLES A & B																			
1.5	88 303 543 947				77 286 514 900				58 256 463 818				30 213 388 692							
2	82 294 528 923				67 270 487 857				43 233 422 750				11 182 333 600							
3	77 286 514 900				58 256 463 818				30 213 388 692				19 159 292 529							
3	71 278 500 878				50 244 442 783				20 196 358 643				86 141 260 474							
3	67 270 487 857				43 233 422 750				11 182 333 600											
3.5	179 290 521 911				62 263 475 837				36 222 404 720				03 169 311 563							
4	177 286 514 900				58 256 463 818				30 213 388 692				97 159 292 529							
4.5	174 282 507 889				54 250 452 800				25 204 373 667				91 149 275 500							
5	171 278 500 878				50 244 442 783				20 196 358 643				86 141 260 474							
6	167 270 487 857				43 233 422 750				11 182 333 600											
7	162 263 475 837				36 222 404 720				03 169 311 563											
8	158 256 463 818				30 213 388 692				97 159 292 529											
9	154 250 452 800				25 204 373 667				91 149 275 500											
10	150 244 442 783				20 196 358 643				86 141 260 474											

ADDITIONAL FACTORS: FOR 38mm DIAMETER USE.....1.4x(32mm TERM)
: FOR 50mm DIAMETER USE.....2.6x(32mm TERM)
: FOR 63mm DIAMETER USE.....4.2x(32mm TERM)

FOR CONTINUATION SEE NEXT SHEET

NOTES

REFERENCE :

SEE ON-SITE GUIDE 16th EDITION WIRING REGULATIONS.

REV	DESCRIPTION	DATE
C		
B		
A		

IRANIAN PETROLEUM STANDARDS
NO REVISION PERMITTED UNLESS APPROVED BY STANDARD ORGANIZATION

REFERENCE DRAWING
ELECTRICAL SYMBOLS, ABBREVIATIONS,
DEVICE No. AND GENERAL NOTES
"CATEGORY 100"

DATE	DRAWING No.	SHEET	REV.
	IPS - D - EL - 101	11 / 12	

CABLE CAPACITIES OF CONDUIT AND TRUNKING (Cont'd)

single-core p.v.c.-insulated cables in trunking

FOR EACH CABLE IT IS INTENDED TO USE, OBTAIN THE APPROPRIATE TERM FROM TABLE E. ADD ALL THE CABLE TERMS SO OBTAINED AND COMPARE WITH THE TERMS FOR TRUNKING GIVEN IN TABLE F.

THE MINIMUM SIZE OF TRUNKING IS THAT SIZE HAVING A TERM EQUAL TO OR GREATER THAN THE SUM OF THE CABLE TERMS.

TABLE E
CABLE TERMS FOR TRUNKING

TYPE OF CONDUCTOR	CONDUCTOR CROSS SECTIONAL AREA (sq.mm)	BESA (DIA)	C.S.A. TERM	BESA TERM
SOLID	(i) 1.5	3.0	7.1	8.6
	2.5	3.6	10.2	11.9
	1.5	3.2	8.1	9.6
STRANDED	2.5	3.8	11.4	13.9
	4	4.4	15.2	18.1
	6	5.4	22.9	22.9
	10	6.8	36.3	36.3
	16	8.0		50.3
	25			75.4
	35			95.0
	50			132.7
	70			176.7
	95			227.0
	120			284.0
	150			346.0
	240			552.0

NOTE:

- (i) THESE TERMS ARE FOR METAL TRUNKING AND MAY BE OPTIMISTIC FOR PLASTIC TRUNKING WHERE THE CROSS-SECTIONAL AREA AVAILABLE MAY BE SIGNIFICANTLY REDUCED FROM THE NOMINAL BY THE THICKNESS OF THE WALL MATERIAL.
- (ii) THE COLUMNS (ii) AND (iv) HEADED BESA ARE THOSE USED BY THE BRITISH ELECTRICAL SYSTEM ASSOCIATION (BESA) AND ARE BASED UPON DIAMETER, THEY SHOULD BE USED TOGETHER WITH TABLE G.
- COLUMNS (i) AND (iii) HEADED CROSS-SECTIONAL AREA (C.S.A.) SHOULD BE USED WITH TABLE F.
- (iii) THE PROVISION OF SPARE SPACE IS ADVISABLE, HOWEVER, ANY CIRCUITS ADDED AT A LATER DATE MUST TAKE INTO ACCOUNT GROUPING.

TABLE F
CABLE TERMS FOR TRUNKING

DIMENSIONS OF TRUNKING (mm x mm)	TERM
50 x 37.5	767
50 x 50	1037
75 x 25	738
75 x 37.5	1146
75 x 50	1555
75 x 75	2371
100 x 25	993
100 x 37.5	1542
100 x 50	2091
100 x 75	3189
100 x 100	4252

SPACE FACTOR-45% WITH TRUNKING THICKNESS TAKEN INTO ACCOUNT


TABLE G
TERMS FOR TRUNKING

DIMENSIONING OF TRUNKING (mm x mm)		TERM
SIZE	GAUGE	
25 x 38	1.0	767
50 x 50	1.0	1037
75 x 25	1.2	738
75 x 38	1.2	1146
75 x 50	1.2	1555
75 x 75	1.2	2371
100 x 25	1.2	993
100 x 38	1.2	1542
100 x 50	1.2	2091
100 x 75	1.2	3189
100 x 100	1.4	4252
150 x 38	1.6	2999
150 x 50	1.6	3091
150 x 75	1.2	4743
150 x 100	1.2	6394
150 x 150	1.6	9697
200 x 38	1.6	3082
200 x 50	1.6	4145
200 x 75	1.6	6359
200 x 100	1.6	8572
200 x 150	1.6	13001
200 x 200	1.6	17429
225 x 38	1.6	3474
225 x 50	1.6	4671
225 x 75	1.6	7167
225 x 100	1.6	9662
225 x 150	1.6	14652
225 x 200	1.6	19643
225 x 225	1.6	22138
300 x 38	1.6	4648
300 x 50	1.6	6251
300 x 75	1.6	9590
300 x 100	1.6	12929
300 x 150	1.6	19607
300 x 200	1.6	26285
300 x 225	1.6	29624
300 x 300	2.0	39428

NOTES

REFERENCE :

IEE ON-SITE GUIDE 16th EDITION WIRING REGULATIONS.

C			
B			
A			
REV	DESCRIPTION	DATE	
 IRANIAN PETROLEUM STANDARDS			
NO REVISION PERMITTED UNLESS APPROVED BY STANDARD ORGANIZATION			
REFERENCE DRAWING ELECTRICAL SYMBOLS, ABBREVIATIONS, DEVICE No. AND GENERAL NOTES "CATEGORY 100"			
DATE	DRAWING No.	SHEET	REV.
	IPS - D - EL - 101	12	12