

Schedule of rates for the Chapter 1.0

Drilling of Tube wells

Item No.	In Place of	Unit	Rate	Read as	Unit	Rate
	Description of item			Description of item		
1.10 Heavy Duty Tubewell of size 350 mm X 200 mm NB						
1	N.B. :- (b) For Siliguri Sub-Divn./ Alipurduar Sub-Division/ Malbazar Sub-Division / Chopra Block (under Uttar Dinajpur District) / Birbhum District / Purulia District / Bankura District / Paschim Medinipur District (except Ghatal, Daspur I & II Block), the above rates shall be enhanced by 10%.			N.B. :- (b) For Siliguri Sub-Divn./ Alipurduar Sub-Division/ Malbazar Sub-Division / <i>Tufanganj Sub-Division (under Cooch Behar Dist .)</i> /Chopra Block (under Uttar Dinajpur District) / Birbhum District / Purulia District / Bankura District / Paschim Medinipur District (except Ghatal, Daspur I & II Block), the above rates shall be enhanced by 10%.		
1.20 Medium Duty Tubewell of size 250 mm X 150 mm NB						
	N.B. :- (b) For Siliguri Sub-Divn./ Alipurduar Sub-Division/ Malbazar Sub-Division / Chopra Block (under Uttar Dinajpur District) / Birbhum District / Purulia District / Bankura District / Paschim Medinipur District (except Ghatal, Daspur I & II Block), the above rates shall be enhanced by 10%.			N.B. :- (b) For Siliguri Sub-Divn./ Alipurduar Sub-Division/ Malbazar Sub-Division / <i>Tufanganj Sub-Division (under Cooch Behar Dist .)</i> /Chopra Block (under Uttar Dinajpur District) / Birbhum District / Purulia District / Bankura District / Paschim Medinipur District (except Ghatal, Daspur I & II Block), the above rates shall be enhanced by 10%.		
1.30 Exploratory cum production wells (HDTW of size 350 mm × 200 mm NB dia. ERW M.S. Pipe & MDTW of size 250 mm x 150 mm NB/DN dia. ERW M.S. Pipe / P.V.C Pipe).						
	N.B. :- (a) For Siliguri Sub-Divn./ Alipurduar Sub-Division/ Malbazar Sub-Division/ Chopra Block (under Uttar Dinajpur District)/ Birbhum District/ Purulia District/ Bankura District / Paschim Midnapore District (except Ghatal, Daspur-I and II Block), the above rates shall be enhanced by 10%.			N.B. :- (a) For Siliguri Sub-Divn./ Alipurduar Sub-Division/ Malbazar Sub-Division / <i>Tufanganj Sub-Division (under Cooch Behar Dist .)</i> /Chopra Block (under Uttar Dinajpur District) / Birbhum District / Purulia District / Bankura District / Paschim Medinipur District (except Ghatal, Daspur I & II Block), the above rates shall be enhanced by 10%.		


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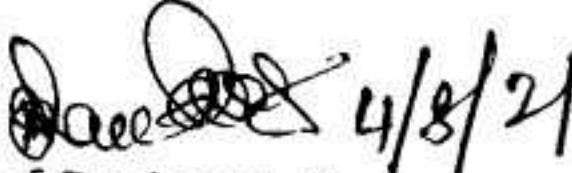
Item No.	In Place of	Unit	Rate	Read as	Unit	Rate
	Description of item			Description of item		
1.40 Light Duty Tubewell of size 150 mm × 80/100 mm Nominal Bore / Nominal Diamater.						
	N.B. :- (b) (i) For Siliguri Sub-Divn./Alipurduar Sub-Division / Malbazar Sub-Division /Jalpaiguri Sub-Division the above rates shall be enhanced by 20%.			N.B. :- (b) (i) For Siliguri Sub-Divn./Alipurduar Sub-Division / Malbazar Sub-Division /Jalpaiguri Sub-Division/ <i>Tufanganj Sub-Division (under Cooch Behar Dist.)</i> the above rates shall be enhanced by 20%.		
1.50 Shallow Tubewell of size 80 mm dia. Fitted with Electrical / Diesel Engine Pump Sets.						
	N.B. :- (b) (i) For Siliguri Sub-Divn./Alipurduar Sub-Division / Malbazar Sub-Division /Jalpaiguri Sub-Division the above rates shall be enhanced by 20%.			N.B. :- (b) (i) For Siliguri Sub-Divn./Alipurduar Sub-Division / Malbazar Sub-Division /Jalpaiguri Sub-Division/ <i>Tufanganj Sub-Division (under Cooch Behar Dist.)</i> the above rates shall be enhanced by 20%.		


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Schedule of rates for the chapter 7.0
Repair of Steel Barge and other similar nature of works

Item No.	Description of item	Unit	Basic Rate in Rs.
1	Shifting of barge to a suitable working site or place from the R.L.I. site and blocking of the barge by area clearance, earth cutting, winching, jacking, planking, block fixing and un-jacking and placing of the R.L.I. site including tools and plants for blocking.		
	(a) Twin Hull Barge (16'-6" × 9'-0" × 3'-0")	Each	4,973.00
	(b) Small Hatch Barge (22'-0" × 10'-0" × 4'-6")	Each	5,328.00
	(c) Pump Barge/Big Hatch Barge (35'-0" × 13'-0" × 5'-6")	Each	6,719.00
2	Removing the pump set installed on the barge from the foundation including disconnection, removal of suction and delivery assemblies from the barge to a secured place and re-fitting of the same properly after the maintenance of the barge.	Per set	1,446.00
3	Opening, straightening and refitting of plates, angles, purlines, trusses, bollard, expanded metal/ B.R.C. net, winch etc. as required and as per direction of Engineer-in-Charge.		
	(a) Twin Hull Barge (16'-6" × 9'-0" × 3'-0")	Each	1,084.00
	(b) Small Hatch Barge (22'-0" × 10'-0" × 4'-6")	Each	1,084.00
	(c) Pump Barge/Big Hatch Barge (35'-0" × 13'-0" × 5'-6")	Each	1,628.00
4	Patch/Doubling works complete with M.S. plate including welding, gas cutting, fitting, fixing complete.		
	(a) Cost of 5 mm M.S. plate including wastage due to cutting, including labour charges for straightening fitting, fixing in position.	Sqm	3,503.00
	(b) Gas cutting to required size upto 8 mm thick M.S. plate, M.S. channel, angle etc. including labour charges, hire charges for all tools and plants.	Metre	234.00
	(c) Electric welding charges upto 8 mm M.S. plate, M.S. channel etc. and other member of the barge including hiring charges of all tools and plants.	Metre	547.00
5	Supply, fitting, fixing complete :		
	(a) Galvanised corrugated iron sheet work (excluding the supporting frame work) fitted and fixed with 10 mm. dia J or L hook-bolts, limpet and bitumen washers and putty complete with 150 mm. end lap and one corrugation minimum side lap, with 0.60 mm thick in roof. (Payment to be made on area of finished work) (GCI sheet to be supplied by contractor)	Sqm	984.00
	(b) Galvanised iron sheet ridging fitted with necessary bolts, screws, washers etc complete. (225 mm end lapping) with 0.60 mm sheets, 300 mm lapping each way.	Metre	562.00
6	Supplying, fitting and fixing of I.R.C. net (75 mm × 25 mm × 10 swg) with nuts and bolts of the barge including gas cutting etc.	Sqm	397.00
7	Supplying 1.5 mm (16 SWG) M.S. sheet fitted and fixed on one or both faces of M.S. bar etc. with point welding not more than 150 mm apart complete in all respect and including cost of labour and materials as per direction of Engineer-in-Charge.	Sqm	1,496.00


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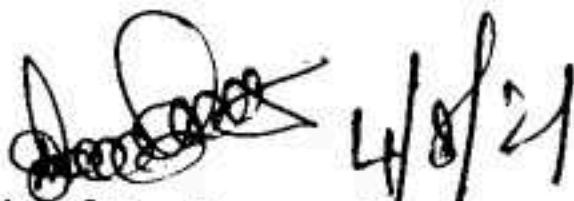
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Item No.	Description of item	Unit	Basic Rate in Rs.
8	(a) Supplying, fitting & fixing of M.S. angle (Size : 45 mm × 45 mm × 6 mm) including gas cutting etc.	Metre	316.00
	(b) Supplying, fitting & fixing of M.S. angle (Size : 50 mm × 50 mm × 6 mm) including gas cutting etc.	Metre	343.00
	(c) Supplying, fitting & fixing of 75 mm (NB) M.S. Pipe including gas cutting and welding as fender of Barge.	Metre	1,695.00
	(d) Supplying, fitting & fixing of 25 mm G. I. Pipe for tie rod of the Barge.	Metre	531.00
9	Supplying, fitting & fixing of M.S. flat bar 40 mm × 6 mm for straightening the B.R.C. net including gas cutting etc.	Metre	176.00
10	Supplying, fitting & fixing bolts with nuts & washers (i) 10 to 16 mm dia. a) Length upto 75 mm	Kg.	176.00
11	(a) Supplying, fitting and fixing of M.S. channel (Size: 75 mm × 40 mm × 6 mm) for base of manhole cover including gas cutting.	Metre	449.00
	(b) Drilling charges 12 mm dia hole for manhole cover plate and M.S. channel base.	Each	11.00
	(c) Supplying, fitting and fixing of (1/16)" thickness rubber insertion sheet with 12 nos. drilling hole for water tight arrangement of manhole cover.	Each	67.00
12	Chipping, scraping, wire brushing and cleaning of the painted surface for keel, hull, frame, superstructure deck, fender both inside and outside as per direction of the Engineer-in-Charge.		
	(a) Twin hull barge (total area 240 m ² approx.)	Each	1,446.00
	(b) Small hatch barge (total area 255 m ² approx.)	Each	1,808.00
	(c) Pump/Big hatch barge (total area 650 m ² approx.)	Each	2,713.00
13	a) Cost of Doors (6'-0" × 3'-0") by point welding with B.R.C. net (75 mm × 25 mm × 10 SWG), 49 mm × 6 mm M.S. flat bar, 6" hinges- 4 pcs. 10" hasp bolts - 2 nos. etc. complete as per direction of Engineer-in-Charge.	Each	3,055.00
	b) Supplying, fitting & fixing complete of 1" dia. M.S. rod for plate welding of M.S. plate of the burge	Metre	272.00
14	PAINTINGS :		
	(a) Priming one coat on steel or other metal surface with synthetic oil bound primer of approved quality including smoothening surfaces by sand papering etc.	Sqm	41.00
	(b) Painting with best quality synthetic enamel paint of approved make and brand including smoothening surface by sand papering etc. including using of approved putty etc. on the surface, if necessary :		
	On steel or other metal surface :		
	a) With super gloss (hi-gloss) -		
	i) One coat (with any shade except white)	Sqm	73.00
	ii) Two coats (with any shade except white)	Sqm	113.00
	b) With other than hi-gloss of approved quality		
	i) One coat (with any shade except white)	Sqm	66.00
	ii) Two coats (with any shade except white)	Sqm	103.00
(c) Painting with superior quality aluminium paint of approved make and brand including smoothening surface by sand papering etc. on steel surface :			
i) One coat	Sqm	48.00	
ii) Two coats	Sqm	82.00	

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Item No.	Description of item	Unit	Basic Rate in Rs.
	(d) Painting One Coat on Steel work with Zinc Phosphate PRIMER of approved make and brand (Minimum Dry Film Thickness [DFT] 50 micron) at all locations prepared and applied as per manufacturer's specifications including smoothening surfaces by sand papering etc. [On steel surface]	Sqm	39.00
	(e) Painting with Acrylic Polyurethane paint Two coat of approved make and brand (Minimum Dry Film Thickness [DFT] 100 micron) at all locations prepared and applied as per manufacturer's specifications. [On steel surface]	Sqm	115.00
	(f) Painting with Coal Tar Epoxy paint Two coat of approved make and brand (Minimum Dry Film Thickness [DFT] 200 micron) at all locations prepared and applied as per manufacturer's specifications. [On steel surface]	Sqm	131.00
15	Transportation charges for carrying of all the materials, working devices etc. upto the scheme and back.	Each.	8,147.00
16	M.S. structural works with hollow sections (square or rectangular shape) conforming to IS: 806-1957 & IS:1161-1958) connected to one another with bracket, gusset, cleat as per design, drawing & direction of Engineer-in-Charge complete including cutting to requisite shape & size, fabrication including metal arc welding conforming to IS: 816-1956 & IS: 9595 using electrodes of approved make and brand conforming to IS:814-1957, haulage, hoisting and erection all complete. The rate includes the cost of all M.S. Hollow section, all consumables such as electrodes, gas and hire charges of all tools and plants and labour required for execution and all incidental chages (such as electricity, labour insurance) etc. complete. Payment to be made on the basis of calculated weight of structural memebtrs of MS Holow Section as specified in relevent IS code in finished work. Payment for gusset, bracket, cleat may be made by adding the actual weight of such items with weight of finished structural members. The rates are considered for a hight of erection 8 m. / 2nd floor level from the ground. Add 1.5 % extra over the rate for each additional floor or 4m. beyond the initial 8 m. or part thereof. For other Structural works	MT	Latest PWD Bldg works SOR of Govt. of W. B. to be followed


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Schedule of rates for the chapter 10.00
Earth work in excavation for WDS / WHS / RESERVOIR / SFMIS etc

Item No.	Description of item	Unit	Basic Rate in Rs.
1	Excavation in ordinary soil / mixed soil i.e. clay mixed with moorum, kankar, pebbles / silt dry or moist / slushy silt / sticky soil for WDS / WHS / RESERVOIR / SFMIS etc with hydraulic excavator or any other means including cutting and loading in tippers, trimming bottom and side slopes in accordance with requirement of lines, grades and cross section and transporting to embankment/ disposal site within all lifts and lead upto 1000 m including spreading, levelling disposed spoils at disposed area. (mode of measurement: pre work and post work)	Cu.M.	85.00
2	Excavation in gravel / moorum / kankar / compact moorum / very much weathered rock / sticky soil mixed with moorum or ghooting for WDS / WHS / RESERVOIR / SFMIS etc. with hydraulic excavator or any other means including cutting and loading in tippers, trimming bottom and side slopes in accordance with requirement of lines, grades and cross section and transporting to embankment/ disposal site within all lifts and lead upto 1000 m including spreading, levelling disposed spoils at disposed area. (mode of measurement: pre work and post work)	Cu.M.	98.00
3	Excavation in soft weather rock / soft laterite rocks for WDS / WHS / RESERVOIR / SFMIS etc. with hydraulic excavator or any other means including cutting and loading in tippers, trimming bottom and side slopes in accordance with requirement of lines, grades and cross section and transporting to embankment/ disposal site within all lifts and lead upto 1000 m including spreading, levelling disposed spoils at disposed area. (mode of measurement: pre work and post work)	Cu.M.	117.00
4	Extra rate for each 250 metre or part thereof above the initial lead of 1.0 km on items no 1, 2 & 3	Cu.M.	3.00
5	Extra rate where land is to be arranged by the contractor on items no 1, 2 & 3 for disposal of spoils.	Cu.M.	11.00


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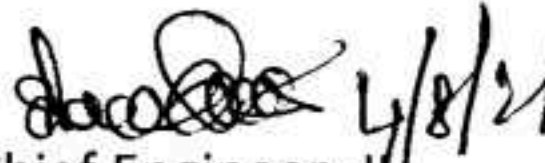
Schedule of rates for the chapter 11.00
Micro Irrigation system (Sprinklar and Drip)

Item No	Description of Item	Unit	Basic Rate in Rs.
Valves			
1	Supplying , fitting and fixing of By -Pass Assembly of approved make and quality all complete as per direction of Engineer in- Charge.		
i	G.I. BYPASS & ARV M/F 1.5"X1.5X1"	Nos	542.00
3	Supplying, fitting and fixing of CI Non Return Valve as per IS:5312		
i	C.I Non-Return valve -1.5"	Nos	3399.00
ii	C.I Non-Return valve -2.0"	Nos	3762.00
4	Supplying, fitting and fixing of PVC Non Return Valve as per IS:10805		
ii	PVC Non Return Valve 40 mm	Nos	411.00
iii	PVC Non Return Valve 50 mm	Nos	520.00
iv	PVC Non Return Valve 63 mm	Nos	620.00
5	Supplying , fitting and fixing of Air Release Cum Vacuum Breaker Valve of approved make and quality all complete as per direction of Engineer-in-Charge.		
iii	PVC AIR RELEASE VALVE MINI1 "	Nos	148.00
vi	PVC AIR RELEASE VALVE 1.5 "	Nos	569.00
6	Supplying, fitting and fixing of G.M. Gate Valvel Throttle Valve as per IS:778.		
i	BUTTERFLY VALVE C.I. 40 MM -1.5"	Nos	2479.00
ii	BUTTERFLY VALVE C.I. 50 MM - 2"	Nos	2500.00
vi	BUTTERFLY VALVE C.I. 65 MM -2.5"	Nos	3531.00
7	Supplying , fitting and fixing of PVC Control Valve of approved make and quality all complete as per direction of Engineer-in-Charge.		
v	PVC Control Valve 63 mm	Nos	524.00
vi	PVC Control Valve 75 mm	Nos	699.00
8	Supplying , fitting and fixing of PVC Flush Valve of approved make and quality all complete as per direction of Engineer-in-charge		
iii	Flush Valve 63 mm	Nos	107.00
iv	Flush Valve 75 mm	Nos	122.00
Filtration & Fertigation			
2	Supplying, fitting and fixing of Sand Filter - Manual as per IS:14606		
i	Sand Filter 10m ³ /hr-M Single	Nos	12693.00
ii	Sand Filter 20m ³ /hr-M Single	Nos	16524.00
iii	Sand Filter 25 m ³ /hr-M, 2" Single With M.MF	Nos	16865.00
3	Screen Filter (IS:12785-1994)		
3.1	Supplying, fitting and fixing of Screen Filter Plastic Body as per IS:12785		
ii	Screen Filter 12m ³ /hr, 1.5"	Nos	2064.00
iii	Screen Filter 20-25m ³ /hr, 2"	Nos	3270.00
4	Fertigation Unit		


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Item No	Description of Item	Unit	Basic Rate in Rs.
4.2	Supplying, fitting and fixing of Ventury Manifold Metal of approved make and quality all complete as per direction of Engineer in Charge		
	i Manifold GI + GMV 1.5" x 3/4"	Nos	3182.00
	ii Manifold GI + GMV 2" x 3/4"	Nos	3258.00
	iii Manifold GI + GMV 2.5" x 3/4"	Nos	4959.00
4.3	Supplying , fitting and fixing of Fertigation Tank of approved make and quality all complete as per direction of Engineer in Charge.		
	i 30 LITER FERTIGATION EQUIPMENT	Nos	4999.00
	ii 60 LITER FERTIGATION EQUIPMENT	Nos	6843.00
	uPVC Pipe for Agriculture		
1	Supplying, fitting and fixing of Socketed PVC Pipe 6 meter as per IS:4985		
	vi PVC pipe 63 mm x 04 kgf/cm2	Metre	122.00
	ix PVC pipe 75 mm x 04 kgf/cm2	Metre	174.00
	xii PVC pipe 90 mm x 04 kgf/cm2	Metre	244.00
2	Quick Connect Pipe (Non-Metal Coupler Type), as per 15-14151 Part 1, 6 cm long	Metre	142.00
	PVC Fittings		
5	SUPPLYING, FITTINGS & FIXING OF PVC HD-END CAP (PLAIN) AS PER IS 7834 (HIGH DENSITY)		
	vi HD-End Cap (Plain) 63 mm	Nos	118.00
	Drip and Accessories		
1	Supplying, fittings & Fixing of Drip Lateral Class - 2 (LLDPE) as per 15:12786		
	ii Tube OD 16mm CI2	Metre	16.00
5	Supplying , fittings & Fixing of Non Pressure Companseting (NPC) Emitting Pipe (LLDPE) as per IS 13488		
5.2	16 mm (00), 0.8 to 4.0 lph, Class 2 IS 13488		
	v 16mm 60cm cl2 npc	Metre	15.00
	vi 16mm 90cm cl2 npc	Metre	15.00
7	Supplying, fittings & Fixing of Poly Joiners as per IS 8008		
	x Lateral HD-End Stop "8" Shape 16 mm	Nos	3.00
	Portable & Semi Permanent Sprinkler		
1	Supplying, Fittings & Fixing of Quick Connect Pipe (Metal Latch Type),as per IS -14151		
	i HDPE Pipes with Quick Release Coupler(Pipe of Class II; 3.2 kg / cm2 IS:14151 Part I 63 mm diameter & 6m long	Nos	762.00
	ii HDPE Pipes with Quick Release Coupler(Pipe of Class I; 2.5 kg / cm2 IS:14151 Part I 75 mm diameter & 6m long	Nos	1022.00
	iii HDPE Pipes with Quick Release Coupler (Pipe of Class I; 2.5 kg / cm2 IS:14151 Part I) 90 mm diameter & 6 m long	Nos	1205.00
2	Supplying , Fittings & Fixing of Quick Connect Service Saddle (Metal Latch) as per IS 14151		
	i QRC HDPE 63 mm Service Saddle IS:14151Part II	Nos	435.00
	iii QRC HDPE 90mm Service Saddle IS: 14151 Part II	Nos	674.00


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Item No	Description of Item	Unit	Basic Rate in Rs.
3	Supplying , Fittings & Fixing of Quick Connect Tee (Metal Latch)as per IS -14151		
i	QRC HDPE Bend with Coupler 90 degree (63 mm) IS:14151 Part II	Nos	280.00
ii	QRC HDPE Bend with Coupler 90 degree (75 mm) IS:14151 Part II	Nos	344.00
iii	QRC HDPE Bend with Coupler 90 degree (90 mm) IS:14151 Part II	Nos	625.00
4	Supplying , Fittings & Fixing of Quick Connect Tee (Metal Latch)as per IS - 14151		
i	QRC HDPE Tee with Coupler (63mm) IS14151 Part II	Nos	412.00
ii	QRC HDPE Tee with Coupler (75mm) IS14151 Part II	Nos	505.00
iii	QRC HDPE Tee with Coupler (90mm) IS14151 Part II	Nos	812.00
5	Supplying , Fittings & Fixing of Quick Connect Tee (Metal Latch)as per IS -14151		
i	QRC HDPE End Plug (63mm) IS: 14151 Part II	Nos	118.00
iii	QRC HDPE End Plug (90mm) IS: 14151 Part II	Nos	257.00
6	Supplying, Fittings & Fixing of Metal Impact Sprinkler as per IS 12232		
i	QRC HDPE Pump Connecting Nipple 63 mm IS: 14151 Part II	Nos	243.00
ii	QRC HDPE Pump Connecting Nipple 75 mm IS: 14151 Part II	Nos	343.00
iii	QRC HDPE Pump Connecting Nipple 90 mm IS: 14151 Part II	Nos	917.00
iv	QRC HDPE Pump Connecting Nipple 50 mm IS: 14151 Part II	Nos	360.00
7	Supplying, Fittings & Fixing of Metal Impact Sprinkler as per IS 12232		
i	Metal Impact Sprinkler as per IS 12232 : Sprinkler Nozzles Full Circle (1.7 to 2.8 Kg/cm ²) ,12 to 18m radius of throw, 2050 LPH Discharge IS 12232 Part 1	Nos	691.00
8	Supplying , Fittings & Fixing of Quick Connect End Riser of approved make and quality all complete as per direction of Engineer in charge		
ii	GI Riser Pipe upto 3/4" diameter x 100 cm long	Nos	197.00


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Schedule of rates for the chapter 12.00

SOLAR PHOTOVOLTAIC INSTALLATION FOR WATER PUMPING SYSTEM


For 2 HP, 3 HP & 5 HP Off-Grid Solar Water Pumping System (Surface Pump-Motor Set / Submersible Pump-Motor Set)

Item No	Description of Item	Unit	Basic Rate in Rs.
1	Solar Module: Supply , transport , installation and commissioning of ISI marked as per IS 14286 and IEC 61853(1), 61730(1&2), 61710 certified Solar Module of Multicrystalline/Monocrystalline/ Monocrystalline PERC/bifacial cell with min. efficiency of 15% and fill factor more than 70%, laminated between sheet of -Ethylene Vinyl Acetate (EVA) and high transmissivity 3.2/4.0 mm tempered glass , framed in anodized aluminium frame . The power output of individual PV modules used in the PV array, under STC, should be a minimum of 300 Watt peak, with adequate provision for measurement tolerances. Modules supplied with the SPV system should have warranty for output wattage, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years. Necessary test certificate also to be supplied.		
	a) For 2 HP Off-grid Solar Water Pumping System with Monocrystalline/ Monocrystalline PERC/bifacial SPV modules - 2250- 2400 Wp.	Wp	32.29
	b) For 3 HP Off-grid Solar Water Pumping System with Monocrystalline/ Monocrystalline PERC/bifacial SPV modules - 3200-3300 Wp.	Wp	32.29
	c) For 5 HP Off-grid Solar Water Pumping System with Monocrystalline/ Monocrystalline PERC/bifacial SPV modules - 5600-5700 Wp.	Wp	32.29
	d) For 2 HP Off-grid Solar Water Pumping System with Polycrystalline SPV modules - 2250- 2400 Wp.	Wp	29.66
	e) For 3 HP Off-grid Solar Water Pumping System with Polycrystalline SPV modules - 3200-3300 Wp.	Wp	29.66
	f) For 5 HP Off-grid Solar Water Pumping System with Polycrystalline SPV modules - 5500 - 5600 Wp.	Wp	29.66
2	Module Mounting Structure (For 2HP, 3HP and 5HP Solar Water Pumping System): Supply , transportation & installation of G.I manual tracking structure made of MS hollow sections, pipes, plates, angles etc as per IS 1161/1239, 1079/2062, to hold min 300 Wp SPV Module as per drawing and specification of MNRE . The steel structure is to be protected with minimum 80 micron galvanisation(hot dip) and provided with dual axis manual tracking arrangement three times in a day and seasonal tilting are to be regulated to face the sun optimally. The weight of the Module Mounting Structure holding 4 Modules should not be less than 165Kg, holding 5/6 Modules should not be less than 235 Kg and holding 7/8 Modules should not be less than 265 Kg.	Kg	205.00


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Item No	Description of Item	Unit	Basic Rate in Rs.
3	Power conditioning unit with IP54 enclosure : Supply , transport , installation and commissioning of IP 54 protected enclosed Inverter Unit qualifying IEC 61683-Efficiency measurement and IEC 60068-2-Environment Standard , safety standard suitable for 3 Phase A.C. motor, IGBT based high voltage switching inverter with MPPT technology, to take care of the variation of Sun light and will be suitably mounted inside the metal enclosure. Inverter should have protection against Dry run, Over current, Under current, Over voltage, Under voltage, Short circuit etc. System should be able to run at low sunshine and minimum 7 to 8 hours a day run should be possible during normal sunshine.condition. Inverter should have option to auto start for any short trip off due to low light/ cloudy situation except for dry run. Inverter should be provided with a display to show the various parameter by the user such as Voltage, Current, Solar panel DC voltage, Inverter IGBT temperature, Out put AC voltage, Output frequency, Pump flow (direct or calculated method), Irradiation etc . The system should store the data at a set interval, be capable to transfer it to external storage device and support communication of its operational parameters and logs over Modbus protocol . It should also monitor and save total run time, total water pumped etc . There should be provision for interfacing GPRS based data transmission.		
	a) For 2 HP capacity Pump-motor set	Set	32097.00
	b) For 3 HP capacity Pump-motor set	Set	40250.00
	c) For 5 HP capacity Pump-motor set	Set	56882.00
4	Cable and Accessories : Supplying, fitting and fixings of UV rated Copper Cable laid inside HDPE conduit and other accessories as per followings with necessary connection with the Solar PV Module, MPPT etc. i. 4.0 Sq mm single core multi studs - 5m(for 2HP) & 20m(for 3/5 HP) ii. Lugs, HDPE Pipe, Flexible Pipe, Saddle, Cable tie etc		
	a) For 2 HP per structure	Each	1134.00
	b) For 3 HP per structure	Each	2558.00
	c) For 5 HP per structure	Each	2558.00
5	Earthing: Earthing with 50 mm dia GI pipe 3.64 mm thick x 3.04 Mts. long and 1 x 4 SWG GI (Hot Dip) wire (4 Mts. long), 13 mm dia x 80 mm long GI bolts, double nuts, double washers incl. S & F 15 mm dia GI pipe protection (1 Mts. long) to be filled with bitumen partly under the ground level and partly above ground level driven to an average depth of 3.65 Mts. below the ground level as below: By ISI-Medium GI pipe including excavation of soil for installation of Earth Electrode and filling & ramming and connecting to individual structure to earth electrode including S&F 20 mm x 3 mm galvanised (Hot Dip) MS flat on wall/floor with GI saddles as required and connection to equipments incl. drilling holes, with bolts, nuts, washers etc.	Each Set	3631.00
6	a) Lighting System at Scheme: (with lighting Pole) : Dusk to dawn lighting arrangement of at 4 mts height above ground level, with Hot dip galvanised 80 mm x 50 mm , medium duty pipe, with 12 V, 15Ah 2-in-1 Lithium ion/ Ferro- Phosphate battery with in-built 7-11 watt LED lamp , 50 Wp solar panel to cover the scheme area. The lighting system should be warranted for 5years from the date of installation.	Set	21690.00
	b) Lighting System at Scheme: (Mounted on Pump House wall) : Dusk to dawn lighting arrangement fitted with 40mm G.I pipe properly clamped on pump house wall, with 12 V, 15Ah, 2-in-1 Lithium ion/ Ferro- Phosphate battery with in-built 7-11 watt LED lamp , 50 Wp solar panel to cover the scheme area. The lighting system should be warranted for 5years from the date of installation.	Set	14495.00


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Item No	Description of Item	Unit	Basic Rate in Rs.
7a	Lightning protection (Pole mounted): Lightning protection with 3" X 1.5" G.I pipe of 3 m + 0.75 mts height with base flange in proper RCC foundation and S & F Lightning Conductor Air Terminal made of 20 mm dia 1000 mm long GI pipe (ISI Medium) having five discharge prongs of 4 SWG GI (Hot Dip) wire at top duly soldered with 7/16 stranded GI (Hot Dip) wire and 85 mm dia 6 mm thick GI base plate at bottom incl. necessary holes etc. Earthing with 65 mm dia GI pipe (Medium) 3.0 Mts. long and 1 x 19/10 stranded GI (Hot Dip) wire (4 Mts. long), 20 mm dia x 125 mm long galvanized bolt, double nuts, double washers including socketing at both ends of stranded GI (Hot Dip) wire by crimping sockets/ thimbles and S & F 65 mm dia GI pipe (ISI-Medium) protection (3 Mts. long) to be filled with bitumen partly under the ground level and partly above ground level to an average depth of 3.65 Mts. (Provision of one lightning protection for each structure)	Each	11818.00
7b	Lightning protection (Pole mounted): Lightning protection with 3" X 1.5" G.I pipe of 5m + 1 m height with base flange in proper RCC foundation and S & F Lightning Conductor Air Terminal made of 20 mm dia 1000 mm long GI pipe (ISI Medium) having five discharge prongs of 4 SWG GI (Hot Dip) wire at top duly soldered with 7/16 stranded GI (Hot Dip) wire and 85 mm dia 6 mm thick GI base plate at bottom incl. necessary holes etc. Earthing with 65 mm dia GI pipe (Medium) 3.0 Mts. long and 1 x 19/10 stranded GI (Hot Dip) wire (4 Mts. long), 20 mm dia x 125 mm long galvanized bolt, double nuts, double washers including socketing at both ends of stranded GI (Hot Dip) wire by crimping sockets/ thimbles and S & F 65 mm dia GI pipe (ISI-Medium) protection (3 Mts. long) to be filled with bitumen partly under the ground level and partly above ground level to an average depth of 3.65 Mts. including connection to earth electrodes with 25 X 6mm G.I strip. (Provision of one lightning protection for each scheme as per drawing)	Each	14714.00
8	Supply and installation of 3 phase electromotor pump-motor set suitable for Solar operation covering 5 years warranty for the following conditions including loading, unloading, transportation etc.:-		
	a) 2 HP ISI marked as per IS 9079 surface mounted Monoblock Pump-motor set with 2.60 - 2.78 Lps discharge at 26 mts. total head suitable for 2.0 Ha CCA Sprinkler / Drip operation with foot valve, required quantity of flexible suction pipe(15m), clamps, bend, footvalves and all other accessories to complete connection of suction and delivery side .	Set	28284.00
	b) 3 HP ISI marked 3 phase surface mounted Monoblock Pump-motor having discharge at required head as below:-		
	i) Surface Pump-motor set for STW, ISI marked as per IS: 9079 with discharge of 6.50-7.14 Lps at 16 mts. total head with foot valve, required quantity of flexible suction pipe(15m), clamps, bend, footvalves and all other accessories to complete connection of suction and delivery side .	Set	33626.00
	ii) Surface mounted Monoblock Pump-motor set, ISI marked as per IS: 9079 with 3.8 Lps discharge at 28 mts. total head suitable for 3.0 Ha CCA Sprinkler / Drip operation with foot valve, required quantity of flexible suction pipe(15m), clamps, bend, footvalves and all other accessories to complete connection of suction and delivery side .	Set	34954.00
	iii) Open well submersible pump set ISI marked as per IS: 14220 for PDW with discharge of 6.50-7.14 Lps at 18 mts. total head with foot valve, required quantity of flexible delivery pipe(15m), clamps, bend, footvalves and all other accessories to complete connection of suction and delivery side .	Set	32339.00
	c) 5 HP ISI marked 3 phase Pump-Motor set having discharge at required head as below:-		
	i) Monoblock Surface Pump-motor set ISI marked as per IS: 9079 for mini RLI scheme with discharge of 13.8 Lps at 18 mts. total head with 100/80 mm dia. reinforced PVC suction pipe (20m) and delivery pipe(10mts), foot valve, nipple, priming bend Cable and all other required accessories to complete connection of suction and delivery side .	Set	59336.00
	ii) Open well submersible pump set ISI marked as per IS: 14220 for PDW with discharge of 13.8 Lps at 18 mts. total head with 100/80 mm dia. reinforced PVC delivery pipe(15mts), foot valve, nipple, priming bend Cable and all other required accessories to complete connection of suction and delivery side .	Set	45580.00


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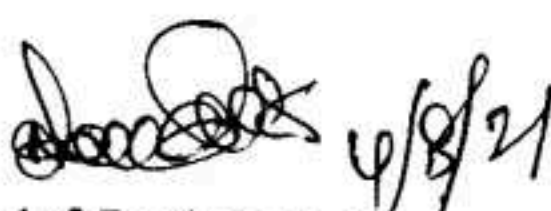
Item No	Description of Item	Unit	Basic Rate in Rs.
	iii) Submersible Pump-motor set for LDTW ISI marked as per IS: 8034 with discharge of 7.5 Lps-5.83 Lps at 30 mts.-35 mts. total head with cable(3m), cover plate, Socket, Flanged Nipple, Rubber Insertion, Nuts& bolts and all other accessories including transportation of Bend, Column Pipes, cable, sluice valve, lay flat hose pipe etc. from Deptt. Store to site within 100km.	Set	37878.00
	iv) Monoblock surface Pump-Motor set ISI marked as per IS: 9079 for Drip & Sprinkler irrigation with discharge of 5.80 Lps at 35 mts. total head with PVC reinforced suction pipe(20m) & deliver pipe(10m), foot valve, nipple, priming bend, Cable and all other required accessories. to complete connection of suction and delivery side of the sprinkler system.	Set	53533.00
9	Testing and commissioning of scheme after completion of all work	Item	2000.00
10	Comprehensive maintenance charges for 4 years beyond 1 year warranty period (which cover monthly inspection, Yearly training to WUA, to attend breakdown within 3 days and to keep the scheme in operation without lapse of time)		
	a) For 2 HP surface pump	Wp	4.00
	b) For 3 HP surface pump	Wp	4.00
	c) For 5 HP both for Submersible & Surface pump	Wp	3.00
	Note:1 Total comprehensive maintenance charge is to be withheld in addition to Security Deposit . Security Deposit will be released after expiry of warranty period of 1 year & Comprehensive maintenance charges will be released @ i) Rs 1.00 for 2 HP, ii) Rs.1.00 for 3 HP, iii) Rs.0.75 for 5 HP Submersible & Surface per Wp per year at the end of each maintenance period i.e.at the end of 2nd year, 3rd year, 4th year, 5th year. In case the "Bidder" does not provide service during the warranty & comprehensive maintenance period, the amount so held up will be forfeited		
11	Remote monitoring for 5 years: Supply & installation of GSM/GPRS based Data Transmitter or Modem and to provide remote monitoring service to transmit the parameters to central server from the Solar pumping System with time stamp at user-defined interval and report generation at the buyer end.	Item	21850.00
	Insurance @ 2% for Item No. 1, 4, 7a/7b, and 9 for a period of 5 years.	Item	
12	Note:2 Ist year's Insurance charge is to be paid on production of Original Receipt of premium payment. Remaining 4 years Insurance payment is to be withheld which will be released during 2nd, 3rd , 4th & 5th year on production of Original Receipt of premium payment.		
	Note: (i) Extra rate for difficult/Reverine Areas connected by river route and/or ferry crossing as applicable as per current PWD Schedule of Rates (Building Works) for item no. 2 (ii) Extra rate for transportation @ 2% for item no. 1 & 2 as applicable for the district of Malda, Uttar Dinajpur, Dakshin Dinajpur , Jalpaiguri, Cooch Behar and Alipurduar.		

Add: GST, Labour Cess & Contingency as per provision of the SOR of WRI&DD.

N.B. 1.0: For preparation of estimate, the maximum Watt peak(Wp) as specified in Sl.no.1 shall be taken into consideration, while payment shall be made as per actual Watt peak installed.

N.B. 2.0: Suitable and stable reinforced cement concrete foundation for module mounting structure shall be constructed as per approved drawing and for preparation of estimate of foundation current PWD SOR should be followed.

(For this structure extra rate for difficult/Reverine Areas connected by river route and/or ferry crossing as applicable as per current PWD Schedule of Rates (Building Works)



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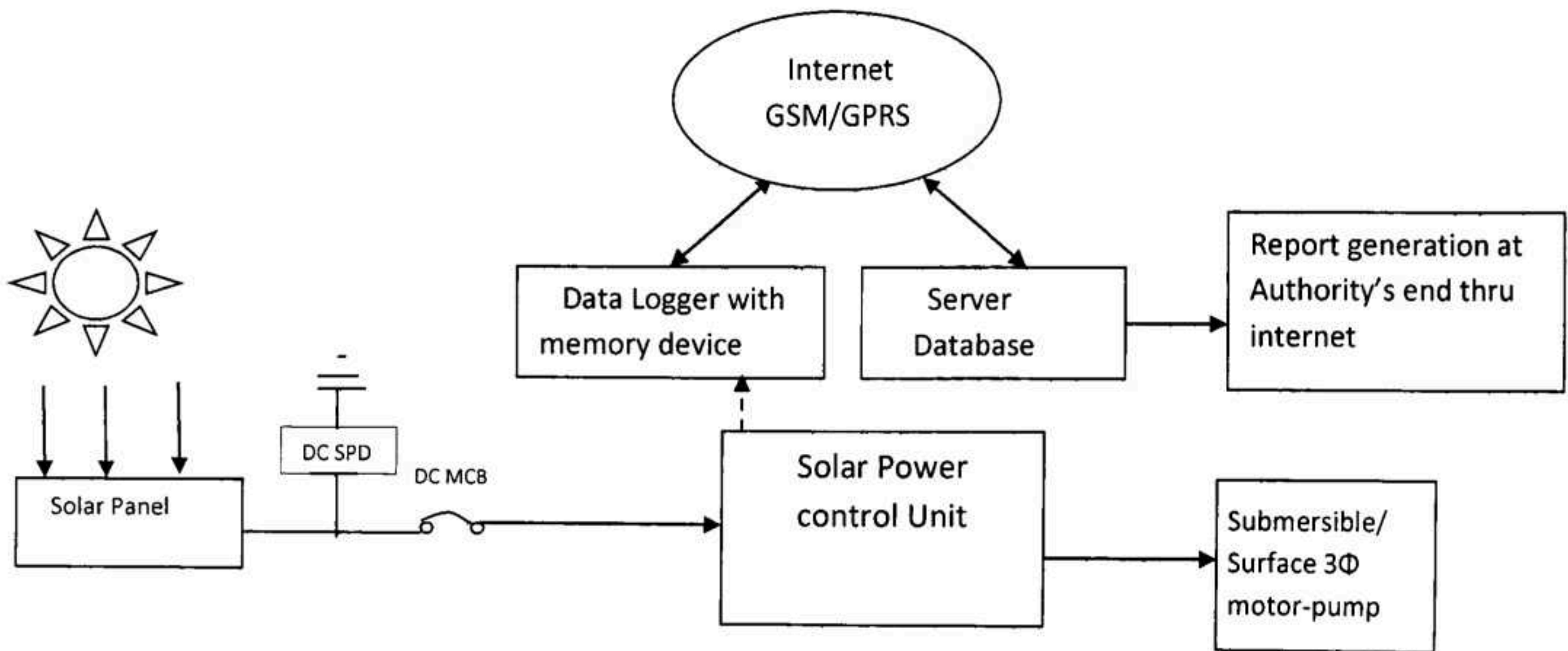
TECHNICAL SPECIFICATION

SUPPLY INSTALLATION OF SOLAR IRRIGATION PUMPING SYSTEM USING DUAL-AXIS MANUAL TRACKING WITH SEASONAL TILTING SYSTEM INCLUDING SUPPLY OF ALL MATERIALS FOR COMMISSIONING 2/3/5 HP SCHEME and COMPREHENSIVE MAINTENANCE FOR 5 YEARS.

Broad objective of the project is supply water for irrigation through electrically operated Surface mounted / Submersible electromotor pump sets, which will be driven by solar power.

The data logger will store specified parameters and transfer them on-line to a central server and display through a web application. Remote monitoring through internet without any necessity to visit the site would be an added requirement.

For effective use of the solar panel, it is essential to tilt the system at an interval to maximize solar power availability.



1.0 General

1.1 SPV Water Pumping System set uses the irradiance available through SPV array. The SPV array produces DC power, which can be utilized to drive a DC or an AC pump set using pump controller.

1.2 **A SPV Water Pumping system typically consists of:**

1.2.1 Pump Set

Pump set may be of any one of the following types:

- i) Mono-set pump;
- ii) Open well submersible pump;
- iii) Submersible pump;

1.2.2 Motor

The motor of the pump set consists of:

- i) AC Induction Motor.

1.2.3 SPV Controller

Pump Controller converts the DC voltage of the SPV array into a suitable DC or AC, single or multi-phase power and also include equipment for MPPT, protection devices and remote monitoring (optional).

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- 1.2.4 Provision for remote monitoring for the pumps must be made in the pump controller through an integral arrangement having following basic functions:
- Controller must be assigned with a unique serial number and its live status must be observed remotely on online portal through login credentials.
 - Live status must indicate whether controller is ON/ OFF
 - The parameter i.e. the water output, water flow rate, in fault condition, array input voltage/ current, power and motor frequency should be logged at an interval of 10 minutes
 - Controller must have a back up to store the data locally (at least for 1 year)

2.1 Solar Photo Voltaic (SPV) Array:

The **Solar Modules** should be **ISI marked** as per **IS 14286** and the specification of the components should fulfill the followings.

Cells	: Polycrystalline or Mono crystalline or Mono PERC
Glazing	: Low-iron, high-transparency tempered glass (3.2/4.0mm thick) with an antireflection surface treatment
Back sheet	: Polyvinyl fluoride film (e.g. Tedlar)
Encapsulation	: The PV modules shall have suitable encapsulation and sealing arrangements to protect the silicon cells from environment. The encapsulation arrangement shall ensure complete moisture proofing for the entire life of PV modules.
Frame	: The PV module frame shall be made corrosion resistant anodized aluminium, which shall be electrolytically compatible with the structural material used for mounting the PV modules.

2.2 Standards & Certifications: All SPV modules should have following certifications (read with latest amendments)

Sr.no.	Applicable Standards	Description
a)	IEC 61215/IS 14286	Design qualification and type of approval for crystalline silicon Terrestrial photovoltaic Modules
b)	IEC 61853-1/ IS 16170-1	Photovoltaic (PV) module performance testing and energy rating-Irradiance and temperature performance measurements and power rating
c)	IS/ IEC 61730-1,2	Photovoltaic (PV) Module safety Qualifications
d)	IEC 61701:	Salt Mist Corrosion Testing of Photovoltaic (PV) Modules

2.2.1 SPV arrays contain specified number of same capacity, type and specification modules connected in series or parallel to obtain the required voltage or current output. The SPV water pumping system should be operated with a PV array minimum capacity in the range of 900 Watts peak to 9000 Watts peak, measured under Standard Test Conditions (STC). Sufficient number of modules in series and parallel could be used to obtain the required voltage or current output. The power output of individual PV modules used in the PV array, under STC, should be a minimum of **300 Watts peak**, with adequate provision for measurement tolerances. Use of PV modules with higher power output is preferred.

2.2.2 Modules supplied with the SPV water pumping systems shall have certificate as per IS 14286/IEC 61215 specifications or equivalent National or International/ Standards. STC performance data supplied with the modules shall not be more than one year old.

2.2.3 Modules must qualify to IS/IEC 61730 Part I and II for safety qualification testing.

2.2.4 The minimum module efficiency should be minimum 15 percent and fill factor shall be more than 70 percent.

2.2.5 Modules must qualify to IEC TS 62804-1:2015 for the detection of potential-induced degradation - Part 1: Crystalline silicon (Mandatory in case the SPV array voltage is more than 600 V DC)



- 2.2.6 In case the SPV water pumping systems are intended for use in coastal areas the solar modules must qualify to IEC TS 61701:2011 for salt mist corrosion test.
- 2.2.7 The name plate shall conform the IS 14286/IEC 61215
- 2.2.8 Module to Module wattage mismatch in the SPV array mismatch shall be within ± 3 percent.
- 2.2.9 Variation in overall SPV array wattage from the specified wattages shall be within zero percent to +10 percent.
- 2.2.10 The PV Modules must be warranted for output wattage, which should not be less than 90% of the rated wattage at the end of 10 years and 80% of the rated wattage at the end of 25 years.
- 2.2.11 The terminal box on the module should be IP 65 protected have a provision for "Opening" for replacing the cable, if required.
- 2.2.12 **RFID Tag**
Each PV module must use a RF identification tag (RFID), mandatorily placed inside the module laminate, which must contain the following information:
- Name of the manufacturer of PV Module
 - Model No
 - Serial No.
 - Month and year of the manufacture (separately for solar cells and module)
 - Country of origin (separately for solar cells and module)
 - I-V curve for the module
 - Peak Wattage of the module P_m , I_m , V_m and FF for the module
 - Date and year of obtaining IEC PV module qualification certificate
 - Name of the test lab issuing IEC certificate
 - Other relevant information on traceability of solar cells and module as per ISO 9000 series.
 - A distinctive serial number shall be engraved on the frame of the module or screen printed on the tedlar sheet of the module. Content of the RFID tag in printed form must be supplied as a part of documentation.
- 2.2.13 Modules only with the same rating and manufacturer shall be connected to any single inverter.

3.1 PV System Capacity

The AC and DC Capacity of the PV system shall be based on the pump connection capacity as follows:

Sl.no.	Sanctioned load	Min. AC Inverter capacity	Min. DC (PV Module Capacity)
	HP	KW	KWp@STC
1.	2HP	2.5	2.500
2.	3HP	4.5	3.200
3.	5HP	7.5	5.500

4.1 Motor-Pump Set

- 4.1.1 The SPV water pumping systems may use any of the following types of motor pump sets:
- Surface mounted motor-pump set
 - Submersible motor-pump set
 - Floating motor-pump set
 - Any other type of motor pump set after approval from TIA/EIC.
- 4.1.2 The "Motor-Pump Set" should have a capacity in the range of 1 HP to 10 HP and should have the following features:
- The mono block AC centrifugal motor pump set with the impeller mounted directly on the motor shaft and with appropriate mechanical seals which ensures zero leakage.

- b) The motor of the capacity ranging from 1 HP to 10 HP should be AC. The suction and delivery head will depend on the site specific condition of the field.
- c) Submersible pumps could also be used according to the dynamic head of the site at which the pump is to be used.

4.1.3 The motor pumpset should have a 5 years warranty and therefore, it is essential that the construction of the motor and pump should be made using parts which have a much higher durability and do not need replacement or corrode for at least 5 years of operation after installation.

4.1.4 The suction/ delivery end shall consist of flexible PVC pipe of appropriate size, electric cables, floating assembly, civil work and other fittings required to install the Motor Pump set. Flexible PVC pipe shall be as per IS 15265 (read with latest amendment). However, the column pipe, flat cable, sluice valve for submersible pump shall be supplied departmentally.

4.2 Submersible Motor and Pump Set:

i) 5 HP for LDTW schemes with 150mm housing Bore

Wet type water filled totally enclosed water lubricated submersible pump set with following specifications:

Motor & Pump should be **ISI marked** as per relevant IS. (motor as per IS: 9283/1995 read with latest amendments and PUMP as per IS: 8034/2002, read with latest amendments).

Motor: Submersible type **3 phase AC** Squirrel Cage Induction Motor of **5 HP** capacity.

Pump: Capacity: **27- 21 Cum./ hour** discharge at **30 - 35 m** total dynamic head.

a. The pump enclosure should be provided with specially developed mechanical seals so as to ensure zero leakage.

b. All parts of pump and motor should be made as specified in BIS.

4.2(a) i) 5 HP Open well submersible pump set for PDW

ii) 3 HP Open well submersible pump set for PDW

The equipment shall be openwell centrifugal submersible pumpset, conforming to IS:14220, read with latest amendments and must have standard **BIS certification mark**. The Motor shall have a speed of 3000 r.p.m(synchronous speed). and suitable for operation in **3 phase 230V AC(for 3HP) and 380V AC(for 5HP)** power supply system. The required parameters for Electric monoset pump is as below:

- | | |
|-----------------------|--|
| 1. Horse Power rating | : 5 HP and 3HP |
| 2. Discharge | : 13.8 lps at 18m for 5 HP
6.5-7.14 lps at 18m for 3 HP |
| 3. Delivery size | : Compatible to be fitted with 100/80mm PVC flexible pipe |

4.3 Monoblock Pump sets:

i) 5HP for Mini RLI and 8Ha Sprinkler Irrigation.

The equipment shall be surface monoset, horizontal, single stage centrifugal pump, conforming to IS:9079/2002(For Mono block) with latest amendments thereof and must have standard **BIS certification mark**. The Motor shall have a speed of 3000 r.p.m(synchronous speed). It should be screen protected drip proof, TEFC, Squirrel cage induction Motor with class 'B' insulation , suitable for operation in **3 phase 380V AC** power supply system. The required parameters for Electric monoset pump is as below:

- | | |
|-----------------------|---|
| 3. Horse Power rating | : 5 HP |
| 4. Discharge | : 13.8lps at 18m for Mini RLI
5.80 lps at 35m for Sprinkler of 5 HP |
| 5. Delivery size | : Compatible to be fitted with 100/80mm pipe for Sprinkler and 100mm for Mini RLI scheme. |

4.4 Mono block Pump sets:

- i) 3 HP for STW
- ii) 2 HP for 1.75/2.0 Ha and 3HP for 2.6/3.0 Ha Sprinkler Irrigation

The equipment shall be surface monoset, horizontal, single stage centrifugal pump, conforming to IS:9079/2002(For Mono block) with latest amendments thereof and must have **standard BIS certification** mark. The Motor shall have a speed of 3000 r.p.m(synchronous speed). It should be screen protected drip proof, TEFC, Squirrel cage induction Motor with class 'B' insulation."

The required parameters for Electric monoset pump is as below:

1. Horse Power rating :3 H.P and 2 HP
2. Discharge :6.5 - 7.14lps at 16m for STW with 3 HP Pumpset.
:2.6-2.78 lps at 26m total head for sprinkler irrigation with 2 HP pumpset.
and
:3.80 lps at 28m total head for sprinkler irrigation with 3 HP pumpset.
3. Delivery size :Compatible to be fitted with 65/80mm pipe.

4.5 PERFORMANCE REQUIREMENTS

4.5.1 Under the "Average Daily Solar Radiation" condition of 6.5 KWh /m². on the surface of PV array (i.e. coplanar with the PV Modules) on a clear sunny day with three times tracking of SPV panel, the minimum water output from a Solar PV Water Pumping System at different "Total Dynamic Heads" should be as specified below :

Daily minimum discharge requirement for different type of installations:

Type of structures	LDTW					STW	PDW	Mini RLI
Motor capacity	5 HP (Submersible)					3 HP (Surface Monoblock)	5 HP (Open well submersible)	5 HP x 2nos (Surface Monoblock)
Total dynamic head	22.5m	25m	30m	35m	40m	16m	15m	18m
Minimum water output / Day	205000 LPD	185000 LPD	160000 LPD	135000 LPD	120000 LPD	1,50,000 LPD	3,00,000 LPD	4,50,000 LPD

Daily minimum discharge requirement for Sprinkler Irrigation:

Type of structure	Solar Powered Sprinkler Irrigation For- 4 Ha	Solar Powered Sprinkler Irrigation For- 1.75-2.0 Ha	Solar Powered Sprinkler Irrigation For- 2.6 -3.0 Ha
Motor capacity	5HP (Monoblock)	2 HP (Monoblock)	3 HP (Monoblock)
Total dynamic head	35m	26m	28m
Minimum water output / Day	120000-125000 LPD	55000 LPD	75000 LPD
Operating pressure of sprinkler	1.4 /2.0 kg/cm ²	1.4-2.0 kg/cm ²	1.4-2.0 kg/cm ²
Spray diameter	26-28m	26-28m	26-28m
No. of operating sprinkler at any point of time	12nos	05 nos	08 nos

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- 4.5.2 The SPV Water Pumping Systems shall be guaranteed for their performance of the nominal volume rate of flow and the nominal head at the guaranteed duty point as specified in 7.1 under the "Average Daily Solar Radiation" condition of 7.15 KWh/m² on the surface of SPV array (i.e. coplanar with the Photo Voltaic (PV) Modules). The actual duration of pumping of water on a particular day and the quantity of water pumped could vary depending on the solar intensity, location, season, etc.
- 4.5.3 Solar Photo Voltaic Water Pumping Systems shall be guaranteed by the manufacturer against the defects in material and workmanship under normal use and service for a period of at least 60 months from the date of commissioning.
- 4.5.4 Sufficient spares for trouble free operation during the Warrantee period should be made available as and when required.
- 4.5.5 The motor pump-set used in SPV Water Pumping Systems shall be securely marked with the following parameters declared by the manufacturer:
- Manufacturer's name, logo or trade-mark;
 - Model, size and SI No of pump-set;
 - Motor Rating (kW / HP);
 - Total head, m, at the guaranteed duty point;
 - Capacity (LPD) at guaranteed head;
 - Operating head range, m;
 - Maximum Current (A);
 - Voltage Range (V) and;
 - Type - AC or DC Pump set; &
 - Photo Voltaic (PV) Array Rating in Watts peak (Wp)

5.1 Module Mounting Structures and Tracking System

Applicable Standards & Certifications (read with latest amendments):

Sr.no.	Applicable Standards	Description
a)	IS - 2062	Hot Rolled Medium and High Tensile Structural Steel .
b)	IS - 1161	Steel Tubes for Structural Purposes.
c)	IS - 808	DIMENSIONS FOR HOT ROLLED STEEL BEAM, COLUMN, CHANNEL AND ANGLE SECTIONS
d)	IS - 5624	FOUNDATION BOLTS
e)	IS - 1079	HOT ROLLED CARBON STEEL SHEET AND STRIP
f)	IS - 4759	Hot-dip zinc coatings on structural steel and other allied products
g)	IS - 7215	Tolerances for fabrication of steel structures.
h)	IS- 822	CODE OF PROCEDURE FOR INSPECTION OF WELDS
i)	ER 70S-6	General purpose welding wire for fabrication of mild steel

5.1.1 The PV modules should be mounted on metallic structures as per drawing, to withstand high wind velocities up to 150 km per hour. The raw material used and process for manufacturing of module mounting structure including welding of joints should conform to applicable IS. The module mounting structure should be hot dip galvanized according to IS 4759. Zinc content in working area of the hot dip galvanizing bath should not be less than 99.5% by mass.

5.1.2 To enhance the performance of SPV water pumping systems arrangement for seasonal tilt angle adjustment and three times manual tracking in a day has been provided in the drawing which should be strictly followed.

5.1.3 The general hardware for structure fitment should be either SS 304 or 8.8 grade. Modules should be locked with antitheft bolts of SS 304 Grade. Foundation should be constructed with foundation bolt as per drawing.

5.1.4 Detail of Module Mounting Structure and specification for different capacity of SPV pumps is mentioned below in subsequent clauses. The MS sections should be at least as per Bill of Materials attached. These are indicative of minimum standards and an Implementing Agency may specify higher standards.

The no. of structures should be as follows:

- For 2 HP – 1 no Standard MMS of 6 Modules or 8 Modules.



- 2) For 3 HP - Combination of standard MMS of 4 Modules and 6 Modules or 1 no. MMS of 8 module
- 3) For 5 HP - Combination of two standard MMS of 8 Modules .

OR

Combination of three standard MMS of 6 Modules .

The weight of each structure should not be less than

- 1) 165 Kgs- For 4 module structure.
- 2) 235Kgs – For 5/6 module structure.
- 3) 265Kgs- For 7/8 module structure.

5.2 Foundation for MMS

R.C.C foundation for holding MMS should be as per drawing and procedure for RCC foundation is to followed as detailed in later part of the technical specification.

6.1 SPV Controller

Standards & Certifications: All SPV controllers should comply with the following IEC/ BIS standard (read with latest amendments).

Sr.no.	Applicable Standards	Description
a)	IS 16221-1,2 / IEC 62109-1,2	Safety of power converters for use in photovoltaic power systems
b)	IEC 62891	Overall efficiency of grid connected photovoltaic inverters
c)	IEC 61683	Photovoltaic Systems –Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)
d)	IEC 600682(1,2,14,27,30,64)	Environmental testing of PV system –Power Conditioners and inverters
e)	IEC 60529	Degree of protection provided by the enclosure
f)	IS/IEC 60947(1,2,3),	General Requirements for connectors, switches, circuit breakers(AC/DC)
g)	IEC 60255-27:2013	Measuring relays and protection equipment - Part 27: Product safety requirements
h)	IEC 60269-6	Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems
i)	IEC 61643-11/IS 15086-5	Low voltage surge and protection devices, requirements and test methods
j)	IEC 62093	Balance-of-system components for photovoltaic systems - Design qualification natural environments

- 6.1.1 Maximum Power Point Tracker (MPPT) shall be included to optimally use the power available from the SPV array and maximize the water discharge. The MPPT unit shall conform to IEC 62093 Static MPPT efficiency should be equal or more than 98% during operation of 10 to 100% of rated STC PV power, and average MPPT tracking efficiency in the dynamic condition should be greater than 97 % with hot and cold profiles when feeding the water pumping loads, so as to maintain MPPT irrespective of variation in solar energy or irradiance.
- 6.1.2 The SPV Controller must have IP (65) protection or shall be housed in a cabinet having at least IP (65) protection.
- 6.1.3 **Adequate protections shall be provided in the SPV Controller to protect the solar powered pump set against the following:**
 - a) Dry running;
 - b) Open circuit;
 - c) Accidental output short circuit;
 - d) Under voltage;
 - e) Reverse polarity;
 - f) SPD to arrest high current surge; and
 - g) Lightning.



- 6.1.4 A good reliable DC Circuit Breaker as per IS/IEC 60947-2 and 10KA short circuit rated ,suitable for switching DC power ON and OFF shall be provided in the SPV Controller.
- 6.1.5 DC input terminals must be in enough numbers so as each terminal is connected to dedicated single input from the PV string. Two DC inputs cannot be connected to a single input DC terminal of the inverter. If adequate number of inputs are not available in the selected inverter, then a DC junction box shall be incorporated into the design.
- 6.1.6 Solar Power controller should have built-in EMC filters .
- 6.1.7 The Power Conditioning Unit should be mounted in IP 54 protected lock and Key enclosure .
- 6.1.8 **Display:** The controller shall have local LCD (Liquid crystal display) and keypad for monitoring instantaneous parameters, event logs and data logs. Display should be simple and self-explanatory, and should indicate:
- Instantaneous DC power input
 - DC input voltage
 - DC Current
 - Instantaneous active AC power output
 - AC voltage (all the 3 phases and line)
 - AC current (all the 3 phases and line)
 - Motor frequency
 - Cumulative energy generation during entire day, for a month, year and 5 years.
- 6.1.9 The inverter shall have an RS-485 interface and support communication of its operational parameters and logs over Modbus protocol. The register mapping/memory mapping of the inverter data shall be made available by the Contractor from the inverter supplier and the Contractor/ inverter supplier shall provide full support for integration of inverter's communication data with third-party software and hardware for data logger.
- 6.1.10 **Provision for remote monitoring for the pumps must be made in the pump controller through an integral arrangement having following basic functions:**
- Controller must be assigned with a unique serial number and its live status must be observed remotely on online portal through login credentials.
 - Live status must indicate whether controller is ON/ OFF.
 - The parameter i.e. the water output, water flow rate, in fault condition, array input voltage, current, power and output voltage, current & motor frequency should be logged at an interval of 10 minutes
 - Controller must have a back up to store the data locally (at least for 1 year)
- 6.1.11 Should be windows plug and play device with Ethernet/Bluetooth/USB/Wi-Fi connectivity to configure parameters, notifications, communication interval, set points etc. or to retrieve locally stored data. Controller should have support of sufficient Internal memory/ SD card / memory card to support remote monitoring.
- 6.1.12 The controller shall be tested from MNRE approved test centres/NABL/BIS/IEC- accredited testing/ calibration laboratories.
- 6.1.13 SPV controller shall conform to the following details:

Sl.no.	Description	Desired requirement
1.	Nominal AC Output Voltage	160V(for 2HP), 230V(for 3HP) & 415V(for 5HP)±5%, 3 phase
2.	Output frequency	50 Hz +3% to - 5% Hz
3.	Characteristic of voltages	Pure sinusoidal or Filtered AC output voltage at motor terminal. No PWM pulses allowed at the motor terminal, as it generates pronounced voltage spikes. The voltage output is intended to use for the traditional induction motors based applications which are design for sinusoidal grid supply.
4.	Total Harmonic Distortion(THD) of motor terminal voltages	Below 3%.
5.	THD of motor current (in case of balance/linear motor)	Below 5%

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6.	Balance supply	Three phases should be balanced and no negative sequence components to be allowed
7.	Desired motor operation	Constant V by F or constant motor flux control
8.	Switching Devices	MOSFET/ IGBT-based
9.	Maximum Input Voltage	Not more than 1000 VDC
10.	Power Factor	0.8 lag- 0.8 lead
11.	Controller power efficiency	≥ 93%
12.	Ambient dry bulb temperature range	0 to 50° deg C
13.	Humidity	15% to 95 % non- condensing
14.	Enclosure	At least IP21 for indoor installation and at least IP54 for outdoor installation.
15.	Alarms and Protections	Output voltage low, Output frequency low/high, Low irradiance/PV power, Current overload, Peak Torque overload
16.	Communication protocol and interface	Modbus protocol over RS-485 interface

6.1.14 Controller shall be integrated with GSM/GPRS Gateway with Geo tagging(if RMS is in scope of bidder). GSM/ GPRS Charges to be included in the Costing till the end of Warranty period of the Pumping system.

6.1.15 During the warranty period, the bidder will have to maintain complete Database and submit the data to the Authority at regular interval in format will be decided in consultation with Authority.

7.1 Remote Monitoring System (RMS)

7.1.1 There will be a State Implementing Agency (SIA), which will have a common SWPS (Solar WaterPumping System) Management platform for monitoring of operation and performance of SWPS installed under different Scheme.

7.1.2 Remote Monitoring System (RMS) of SWPS should have following minimum features or modules:

- a) **Solar System Performance:** Array input voltage, current, power and output voltage, current & motor frequency, etc.
- b) **Pump Performance:** Running Hours, Water Discharge (Output) in LPS, LPD etc.
- c) **RMS Performance:** %Device Connectivity, %Data Availability, etc.
- d) **Geo Location:** Real time latitude and longitude should be captured. This is required to ensure that system is not moved from its original location.
- e) **Events and Notifications:** Faults related to Pump Operation, Solar generation, Controller/Drive faults like overload, dry run, short circuit, etc.
- f) **Consumer Management:** Name, Agriculture details, Service No. Contact Details, etc.
- g) **Asset Management:** Ratings, Serial Number, Make, Model Number of Pump, Panel and Controller, Geo Location, IMEI number (of communication module) and ICCID (of SIM).
- h) **Complaint and Ticket Management:** Complaint management system is a part of centralized monitoring software platform – State Level Solar Energy Management Platform to be operated and maintained by the State implementing agency (SIA).
- i) **Consumer Mobile Application:** Generation, Running Hours, Water Discharge, Complaint logging, etc.

7.1.3 RMS provided by all bidder, should connect to State Level Solar Energy Data Management platform, which will have interface with National Level Solar Energy Data Management platform i.e. SIA will provide server infrastructure as well as software. SIA will maintain the same. All vendors should provide SIM card of suitable ISP having maximum Signal Strength in the respective location of SWPS and ensure connectivity as well as pushing of data to centralized platform as mentioned in specifications.

7.1.4 **Communication Architecture should be as per following:**



a) Communication Connectivity:

- i. **Pump Controller Connectivity:** Communication between RMS and Pump Controller(thru data logger) should be on UART/RS485 MODBUS RTU protocol to ensure interoperability irrespective of make and manufacturer.
- ii. **Remote Connectivity:** RMS of SWPS should be using GSM/GPRS/2G/3G/4Gcellular connectivity
- iii. **Local Connectivity:** Ethernet/Bluetooth/USB/Wi-Fi connectivity to configure parameters, notifications, communication interval, set points etc. or to retrieve locally stored data.
- iv. **Sensor Connectivity:** RMS should have provision for at least two Analog/Digital inputs with 0.1% accuracy to address the requirement of local sensors connectivity if required by SIA/Consumer for applications such as irradiation, flow meter for water discharge, moisture sensor for micro irrigation, etc. Analog/digital sensor inputs will be required for integration of flow meter for water discharge, moisture sensor for micro irrigation, level sensor for overhead tank water storage etc. Only provision for Analog/digital inputs with 0.1% accuracy of Full Scale Range is required. **Sensors will not be in scope of bidder.**
- v. Option for digital Input for authentication of the door opening for theft protection with battery backup at night.(optional)
- vi. RMS should have provision to give remote On/Off command to pump through farmer mobile app. to save ground water.

b) Communication Modes:

- i. **Push Data on Event/Notification:** such as pump on, pump off, protection operated, etc.
- ii. **Push Data Periodically:** important parameters of solar pump (as mentioned above) should be pushed to central server on configurable interval. Interval should be configurable for 15 mins. However, if required, it should be possible to configure the periodic interval in multiple of 1 minute starting from 1 minute and up to 15 minutes. Further, in case of any abnormalities or event, RMS should push on event immediately.
- iii. **Command On Demand :** It should be possible to send commands via GSM or GPRS to RMS either to control pump operations or to update configuration.

c) Communication Protocol: RMS should provide data on MQTT protocol to establish communication with thousands of systems.

d) Security:

- i. Communication between RMS and Server should be secured and encrypted using TLS/SSL/X.509 certificate etc.
- ii. As a part of IoT protocol, Authentication and Authorization should be implemented using token/password mechanism
- e) Message Format: RMS should provide data in a JSON message format as required by respective SNA
- f) Data Storage: In case of unavailability of cellular network, RMS should store data locally and on availability of network it should push data to central Server. Local data storage in Internal memory/ SD card / memory card should be possible for at least one year in case of unavailability of cellular network.
- g) Configuration update over the Air of multiple parameters such as IP, APN, Data logging Interval, Set Points etc. is essential. Software updating should be possible with 2G and even without the presence of SD card. Software updating process and/or failure to update software shouldn't disrupt pumping operations

Use of indigenous components:

It will be mandatory to use indigenously manufactured solar modules with indigenous mono/multicrystalline silicon solar cells. Further, the motor-pump-set, controller and balance of system should also be manufactured indigenously. The vendor has to declare the list of imported components used in the solar water pumping system.

8.0 Enclosure Standard (IP) :

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IP54 Metallic Enclosure with test certificate from CPRI/ERDA/ MNRE accredited test house (issued not more than 10(ten) years from the date of this NIT) to be installed at a suitable position on civil structure / Solar module structure.

- IP54 cable glands and louver filters with cover must be used
- Canopy arrangement provided for protection from rain water

If Stainless Steel enclosure then it must be minimum SS 304 grade.

If Power coated, enclosure must have following Paint Process:

Triple surface treatment painting on enclosure surface – pass salt spray test upto 760Hrs.

1st Phase: Nano ceramic coating: A pre-treatment procedure for spray coat-priming-the nano ceramic coating.

2nd phase Electrophoretic dip coat-priming: thickness approx. 20 μm

3rd phase - Textured powder-coating: thickness approx. 80 μm

9.1 Cabling

9.1.1 DC Cable

- a) Standard: UL-1581 (UV Rated).
- b) Working voltage: Up to 1100V.
- c) Temperature range: -15 Deg C to +70 Deg C.
- d) Outdoor Suitability: UV Resistant.

9.1.2 AC Cable : All cables shall be of the following specifications and shall be of sufficient length for inter-connection between the SPV array to SPV Controller and the SPV Controller to solar powered pump set:

a) PVC insulated (Heavy Duty) 1.5, 2.5 sq.mm. electric cable duly ISI marked as per IS- 694/1990 with latest amendments.

b) Electrical wire: 1.1 KV single core stranded FR PVC insulated & unsheathed single core stranded copper wire as per IS: 2551-1963 & IS: 9823-1978 / IS 694 / 1990; BS 2004 (1861)

9.1.3 Electronic Signal Cable: Cat 6 or better and should be protected from mutual interference.

9.2 Cable Conduit

- All DC & AC cable must be laid underground through HDPE PLB cable conduit while goes from one stand to another stand
- This HDPE pipe must be PE63 grade
- Cable sealing plug must be used for cable entry and exit into the conduit
- In case of pipe joint, **pipe coupler** must be used
- Underground cable must be laid inside the ground at a trench depth of minimum 600mm

10.1 Surge Arrester :

- IEC 61643-1 Class-1 test and IEC 61643-11
- Recommended discharge current 40KA

11.1 Solar Lighting

- The system shall have dusk to dawn lighting arrangement in lighting pole with 12 V, 15Ah 2-in-1 Lithium ion/ Ferro- Phosphate battery with in-built 7-11 watt LED lamp , 50 Wp solar panel to cover the scheme area. The lighting system should be warranted for 5years from the date of installation.

12.1 Earthing: Installation of electrode and connection of grounding conductor:

Earthing of the motor shall be done as per IS 9283 in accordance with the relevant provisions of IS 3043. Separate earthing shall be provided for Controller, pump and SPV array. For safety purpose, it shall be ensured

A'

during installation that the earthing is capable of taking care of leakage current. In case of uPVC/HDPE pipes used as discharge pipe, a separate non-corrosive, low resistance conductor from motor earth terminal to control panel earth terminal shall be provided for earthing.

Earthing with 50 mm dia GI pipe 3.64 mm thick x 3.04 Mts. long and 1 x 4 SWG GI (Hot Dip) wire (4 Mts. long), 13 mm dia x 80 mm long GI bolts, double nuts, double washers incl. S & F 15 mm dia GI pipe protection (1 Mts. long) to be filled with bitumen partly under the ground level and partly above ground level driven to an average depth of 3.65 Mts. below the ground level as per attached drawing.

The electrode shall be buried in the ground vertically with its top not less than 200mm below the ground level. The pipe earth electrode shall be surrounded by, either salt & charcoal in alternate layers or a homogeneous mixture of the both, for a radius of about 150mm and up to a height of about 350mm below the top of the electrode. The balance portion of the excavated pit shall be filled with good quality soil and properly compacted.

The earthing lead connecting the earth electrode to the apparatus or installation directly shall be of the same material as earth electrode. The earthing leads shall be either wires or strips of adequate size as specified and of either G.I. or tinned copper. The G.I. leads shall be connected to the electrode by means of 16mm dia G.I. nut bolts with flat & spring washer.

The earthing lead from electrode onwards shall be suitably protected from mechanical injury by means of 15mm dia G.I. pipe for G.I. wires. The portion of this protection pipe within ground shall be buried at least 350 mm deep from ground level.

An earthing electrode shall not be situated within a distance of 2 meter from the building whose installation system is being earthed. The cross sectional area of earth continuity conductor in electrical installation shall be of 8swg GI wire. The earth resistance for various installations shall be within 5(five) ohm for installation capacity up to 5 KW and 1(one) ohm for installation of higher capacity.

All three-phase medium voltage equipment's shall be earthed by two separate and distinct connections with earth through earth electrodes. Single phase equipment's shall be earthed at least at one point. Pipe electrode earthing should be provided for the system.

Earth bus bar:

Supplying and fixing earth bar of galvanized M.S. Flat 40 mm x 5 mm x 250mm on wall having clearance of 25 mm. from wall including providing 10mm drilled holes (on busbar) about 30 mm. apart complete with G.I. bolts, nuts, washers etc. as required for tapping.

Testing of electrical installation.

Before the completed installation is put into service, the following tests shall be carried out by the contractor in presence of the Engineer-in-Charge or his representative.

a) Polarity of switches

It must be ensured by test that all single pole switches have been fitted on the live side of the circuits they control.

b) Insulation Test :

i) By applying a 500 volt meter between earth and the whole system of conductors or any section thereof, with all fuses in place and all switches closed, all lamps in position or both poles of installation otherwise electrically connected together:- The result in mega ohm shall not be less than 50 divided by the number of points on the circuit, and should not be less than 1 mega ohm.

ii) Between all conductors connected to one phase and all such conductors connected to the neutral or to the other phase conductors of the supply after removing all metallic connections between the two poles of the installation and switching on all switches. The insulation resistance shall be as in (i) above.

c) Earth continuity Test

The earth continuity conductor including metal conduits, and metal sheaths of cables in all cases shall be tested for electrical continuity. Electrical resistance of the above along with the earthing lead, measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed 1 (one) ohm.

d) Earth Resistance Test

To ensure effectiveness of installation earth, the value of earth resistance shall be within 5(five) ohm for installation capacity up to 5 KW and 1(one) ohm for installation of higher capacity.

The completed work will be taken over only if the results obtained in above tests are within the limits mentioned above, and in accordance with I.E. Rules.

13.1 Lightning Protection(pole mounted): The Bidder has to setup lightning protection system including lightning rod, ground rod and conductors to protect the entire system. A lightning arrestor shall be provided with every SPV Water Pumping System.

Lightning protection with 3" X 1.5" G.I pipe with base flange in proper RCC foundation and S & F Lightning Conductor Air Terminal made of 20 mm dia 1000 mm long GI pipe (ISI Medium) having five discharge prongs of 4 SWG GI (Hot Dip) wire at top . Earthing with 65 mm dia GI pipe (Medium) 3.0 Mts. long and 1 x 19/10 stranded GI (Hot Dip) wire (4 Mts. long), 20 mm dia x 125 mm long galvanized bolt, double nuts, double washers including socketing at both ends of stranded GI (Hot Dip) wire by crimping sockets/ thimbles and S & F 65 mm dia GI pipe (ISI-Medium) protection (3 Mts. long) to be filled with bitumen partly under the ground level and partly above ground level to an average depth of 3.65 Mts.

14.1 License/Certification

In case the equipment needs any special licence or certification (e.g. license for radio transmission in certain frequency bands), it will be the Bidder's responsibility to comply with the requirement.

15.1. HDPE Pipes and fittings : All materials should be BIS marked as per guidelines of **Pradhan Mantri Krishi Sinchai Yojana** and as per detail noted in BOQ.

16.1 Temporary Flooding

All the subsystems and wiring will be installed at a minimum height from ground to avoid damage due to temporary flooding and also convenient for human operation.

17.1 Documentation

Full documentation for installation, operation and maintenance of the system in both in English and Bengali language, should be provided with each of the solar PV pumping system. The Manual should have information about solar energy, photovoltaic, modules, motor pump set, tracking system, mounting structures, electronics and switches. It should also have clear instructions about mounting of PV module, DO's and DONT's and on regular maintenance and Trouble Shooting of the pumping system. Two hardcopies (in printed form) and two softcopies in separate media in CDROM/DVD of each manual will be a part of deliverables.

Manuals shall be for the system and each subsystem as detailed in the following sections. Documentation shall include System Block Diagrams, Layout Diagrams, and Line Diagrams and Wiring Diagrams for external connections, Interface Specifications, Protocols supported and configuration procedures, as applicable. Diagnostic Programs and Tools - Diagnostic Hardware and Software (including all necessary tools and tackles) required for maintenance shall have to be explained in detail in the documentation.

Installation manual of system and each subsystem supplied by the respective manufacturers (solar panel, pump, motor, data logger etc.) shall be a part of documentation. Installation procedure/guidelines recommended shall have to be followed during the installation process. **Name and address of the person or Centre to be contacted** in case of failure or complaint, should also be provided. A warranty card for the modules and controlling unit should also be provided to the beneficiary.

18.1 Training

Scope of work includes training the users on operation and maintenance of the system. Apart from departmental staff, the training should include the local WUA, who should be able to take care of minor day-to-day problems. They should also be able to report the problem properly to the appropriate authorities in proper format. Training plan indicating course outline, brief contents and schedules shall have to be submitted at time of execution of agreement.

Training will be repeated each year during the Warranty and CMC periods for refreshing the trained staff and training additional staff.

19.1 Warranty and Comprehensive Maintenance

All goods supplied for installation and commissioning of the project should be new, unused, and most recent or



current models and incorporate all recent improvement in drawing and technical specification unless provided otherwise in the contract. The entire system will be covered under a warranty against all design and manufacturing defects for a period of 5 years.. The PV Modules must be warranted for 25 year for its output wattage. The bidder shall provide **warranty for 01 year** and **comprehensive maintenance** for four (4) years thereafter. However, the PV modules must be warranted for output wattage, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years

The PCU should have free replacement warranty of 5(five) years. The warranty shall cover the following:

- a) Complaints about fault (s) received by courier , telephone, fax, email or SMS or whatever communication method shall be attended by the supplier within three (3) working days by site visit etc.
- b) Adequate stock of spare parts should be maintained so that unit becomes operational within maximum 3(three) days of complaint.
- c) Technical backup to the beneficiaries: They shall have to provide training to the beneficiaries regarding capacity building in all the aspects of the system like use and maintenance of PV modules and associated electrical controlling units for optimum output etc.
- d) Monthly checking up of the system as per requirement, for proper operation of the system.
- e) The scope of work includes repairing /replacement to make the system functional within comprehensive warranty period whenever a complaint is lodged by the user. The contractor shall attend the same within a reasonable period of time and in any case a breakdown shall be rectified within a period not exceeding 3(three)days.

Day-to-day operation will be done by the beneficiaries.

20.1 Insurance : Insurance coverage shall have to be provided to cover theft and natural calamity, and acceptance for replacement or repair of any part of the system due to damage or loss for a period of 5 years including warranty period of 1(one) year. The insurance is to be executed in the name of the bidder.

21.1. Performance Criteria

The following performance parameters must be strictly maintained.

- i) Average uptime – 99% computed over one year
 - ii) MTBF (Mean Time Between Failures) - 6 months
 - iii) MTTR (Maximum Time To Repair): 72 hours
- Down time will be computed on 24x7 basis from the time Authority communicates the problem to the bidder over telephone, SMS, email, courier, written report or any other mode of communication.

Civil Construction and materials:

CEMENT CONCRETE WORKS (PLAIN OR REINFORCED)

- i) **Shuttering and staging** :Wherever necessary, shuttering and staging must be provided. Unless otherwise stated, no payment will be made for such shuttering or staging and the cost thereof will be deemed to have been covered by the rate for relevant finished item of work. Where payment for shuttering has been specified, the rate shall be deemed to cover the cost of the necessary staging as well. Payment, if any, for shuttering will be on the basis of surface area of shuttering in actual contact with concrete.
- ii) Shuttering may be of approved dressed timber true to line not less than 2.5 cm. thick., Surface to be in contact with concrete are to be planed smooth except where otherwise stated. As an alternative, sufficiently rigid steel shuttering may be used for which same rate of timber shuttering shall be allowed. In every case, joints of the shuttering are to be such as to prevent the loss of liquid from the concrete. In timber shuttering the joints shall therefore be either tongued and grooved or the joints must be perfectly closed and lined with craft paper or other types of approved materials. In case of steel shuttering also, the joints are to be similarly lined. All shuttering and framing must adequately be stayed and braced to the



satisfaction of the Engineer for properly supporting the concrete during the period of hardening. It shall be so constructed that it may be removed without shock or vibration to the concrete.

iii) Before the concrete is placed, the shuttering shall, if considered necessary, be coated with an approved preparation for preventing the adhesion of the concrete of the finished concrete is not stained. Care shall also be taken that such approved preparation shall be kept out of contact with reinforcement.

In no circumstances, shall forms be struck until the concrete reaches strength of at least twice the stress of which the concrete may be subjected at the time of striking. Interior of all mould and boxes must be thoroughly washed out with a hose pipe or otherwise so as to be perfectly cleaned and free from all extraneous matter previous to the deposition of concrete. All form-work shall be removed without shock or vibration. Before the form work is stripped, the concrete surface shall be exposed where necessary in order to ascertain that the concrete has hardened sufficiently. In normal weather and with ordinary cement vertical or side shuttering may be removed after three days and the bottom shuttering of horizontal members after fourteen days in case of slabs and twenty-one days in case of beam and cantilevers etc. from the date of placing the last portion of the concrete in the structure. The above period are the minimum and may be extended if found necessary. Before stripping the shuttering of structural members, the contractor shall take previous permission of the Engineer or his representative.

iv) Protection and curing :

The contractor shall adequately protect freshly laid concrete, about 1 to 2 hours after its laying, from too rapid drying due to sunshine, drying winds etc. and also from running of surface water and shocks. After 24 hours of laying of concrete, the surface shall be cured by flooding with water of minimum 25 mm depth or by covering with wet absorbent materials. The curing shall be done for a minimum period of 10 days. Over

Foundation concrete masonry work may be started after 48 hours, but curing shall be continued for 10 days.

BRICK

All bricks shall be of approved quality of standard specifications, made of good brick earth, uniform deep red, cherry or copper colour, thoroughly burnt in kiln (machine made) without being vitrified, regular in shape and size, sound, hard, homogeneous in texture, true to shape and of standard dimension and shall be free from cracks, chips flaws, stones or humps of any kind and shall not show appreciable signs of efflorescence either dry or subsequent to soaking in water. The size of bricks shall be $9\frac{3}{4}$ " \times $4\frac{3}{4}$ " \times $2\frac{3}{4}$ " (conventional), 190 \times 90 \times 90 mm (modular). The Bricks shall emit a clear ringing sound on being struck and have minimum crushing strength of 105 kg./sq.cm. All the bricks which absorb water more than 20% of their own dry weight after 24 hours immersion in cold water shall be rejected.

COARSE AGGREGATE

Stone chips of stone ballast for cement concrete work (plain or reinforced shall be hard, of uniform and fine texture, free from faults or plane of weakness and free from weathered faces. The ballast or chip must be free from, loamy clay or any surface coating free from organic matter or other impurities and screened free of dust. Stone of black and hard variety as is generally available from quarries in Pakur areas will be normally used. Stone aggregates from other sources may also be used provided the same is found suitable in the opinion of the Engineer. The ballasts or chips shall be obtained by breaking from large blocks and must be more or less cubical in shape. Stone chips and Ballast should be graded in a way to give maximum density (i.e. minimum void.). All coarse aggregate for concrete work must be well graded. These shall be screened for removal of dust and if so necessary in the opinion of the Engineer shall be washed at the cost and expense of the contractor.

Sand

All sand shall be clean, sharp and free from clay loam organic or any other foreign matter and shall be obtained from approved sources. The contractor shall get the samples of sand to be used in different kinds of work approved by the Engineer before using the same in work. Sand which in the opinion of the Engineer or his representative, is dirty, must be washed to his satisfaction at the cost and expense of the Contractor.

(i) Sand for all cement concrete works should be coarse (heavier). The sand shall pass through a mess of 5 mm. Square measured clear. Sand shall not be used for concrete work if it contains more than 10 per cent of fine grains passing a 76 mesh sieve as used for cement test nor should the fineness modulus be less than 2:00 unless specific permission is obtained from Engineer.

(ii) Medium coarse sand should be used for cement mortar for masonry, plaster etc.

(iii) Fine sand should be used for building plinth-filling and the like. In Malda District only BANSLOI sand should be used in all types of cement works. In Nadia and Murshidabad Districts, coarse sand from SAINTHIA only should be used in structural concrete works.

Cement

All cement used at site should conform to ISS 455 latest version. Cement bags must be stored in a water tight shed as approved by the Engineer. Any cement damaged by water or otherwise detected must be removed from site immediately.

Steel

All steel shall be free from oil and loose rust. Any scale or loose rust shall be removed. ISI marked Tor Steel Rods of various diameters and categories for reinforced concrete works etc. should be used. The contractor must accept the actual weight as calculated on tolerance allowed for rolling or on theoretical weight on running metre basis allowed for a particular section of the bar as the case may be.

Acceptance of Materials : Materials shall be accepted at site on the basis of quality assurance certificates and physical verification at site by Departmental Officers.

Excavation of Foundation and Filling up Trenches :

i) Foundation when excavated to the level shown in the drawing will be shown to the Engineer and if on account of bad ground or for any reason whatsoever he decides to go deeper with the foundation, the contractor shall excavate further to the depths required by the Engineer. In no case shall the foundation soling or concrete be laid prior to receiving orders to that effect from the Engineer or his authorized representative.

ii) Excavation shall include throwing the excavated earth at least one meter or half the depth of excavation, whichever is more, clear of the edge.

i) The excavated areas around the foundation of structures are to be filled up properly to the required levels with earth obtained from excavation or other materials as directed, well rammed with water and consolidated in layers not exceeding 150 mm. at a time. The quantity for this item of work will be measured on the basis of quantity of excavation paid for less the volume occupied by the structure in foundation.

Installation of Buried Pipe Net Work : Earth Cutting for pipe trenches:

(a) The position of spout outlets have to be fixed before starting of earth cutting.

(b) Large stones or rubble should be separated and removed from the excavated soil to prevent any damage to the completed pipeline.

(c) The bottom of trench should have uniform gradient throughout its length and it should be free from humps before pipe is laid. Fine earth or sand can be used to maintain required grade. Stones or other hard substances should be removed before pipe laying.

(d) Check the trench depth and gradient before pipe laying.

(e) Excavated materials should be deposited at a sufficient distance away from the trench to prevent damage to pipeline through falling stones and debris.

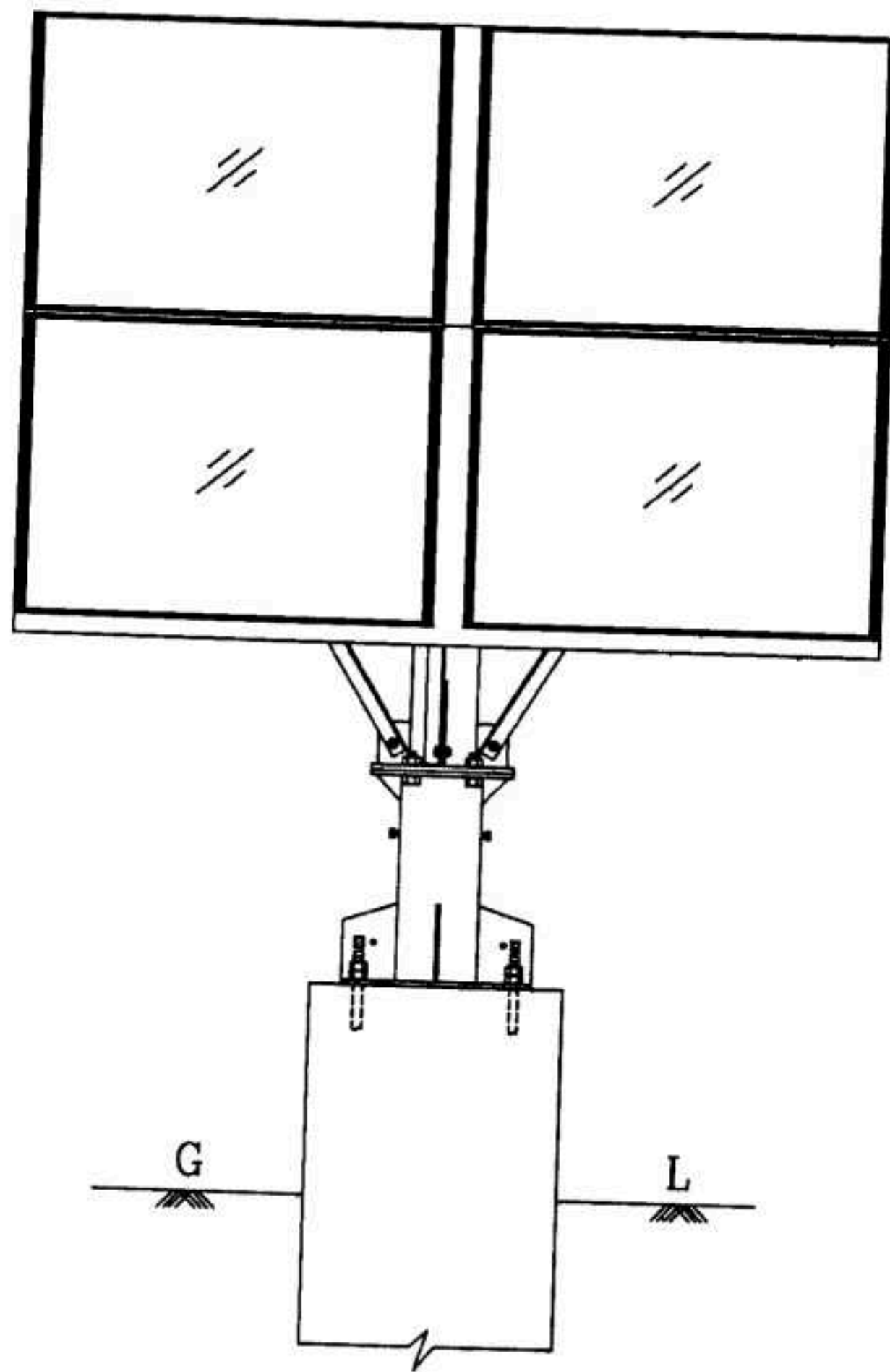
Stacking of HDPE Pipes:

Pipes should be stacked on a surface flat and free from sharp objects, stones and projections in order to avoid deformation or damage. Ends of pipes should be protected from abrasion and chipping. The pipes should be supported evenly over their whole length. The bottom layer of the stack should be supported on wooden battens of uniform size, at least 50mm wide and placed not more than 2 m apart.

 4/8/21

Chief Engineer - II
Water Resources Development Directorate
Govt. of West Bengal

FRONT VIEW OF SOLAR MODULES - 4 MMS



FRONT VIEW OF SOLAR MODULES
- 4 MMS

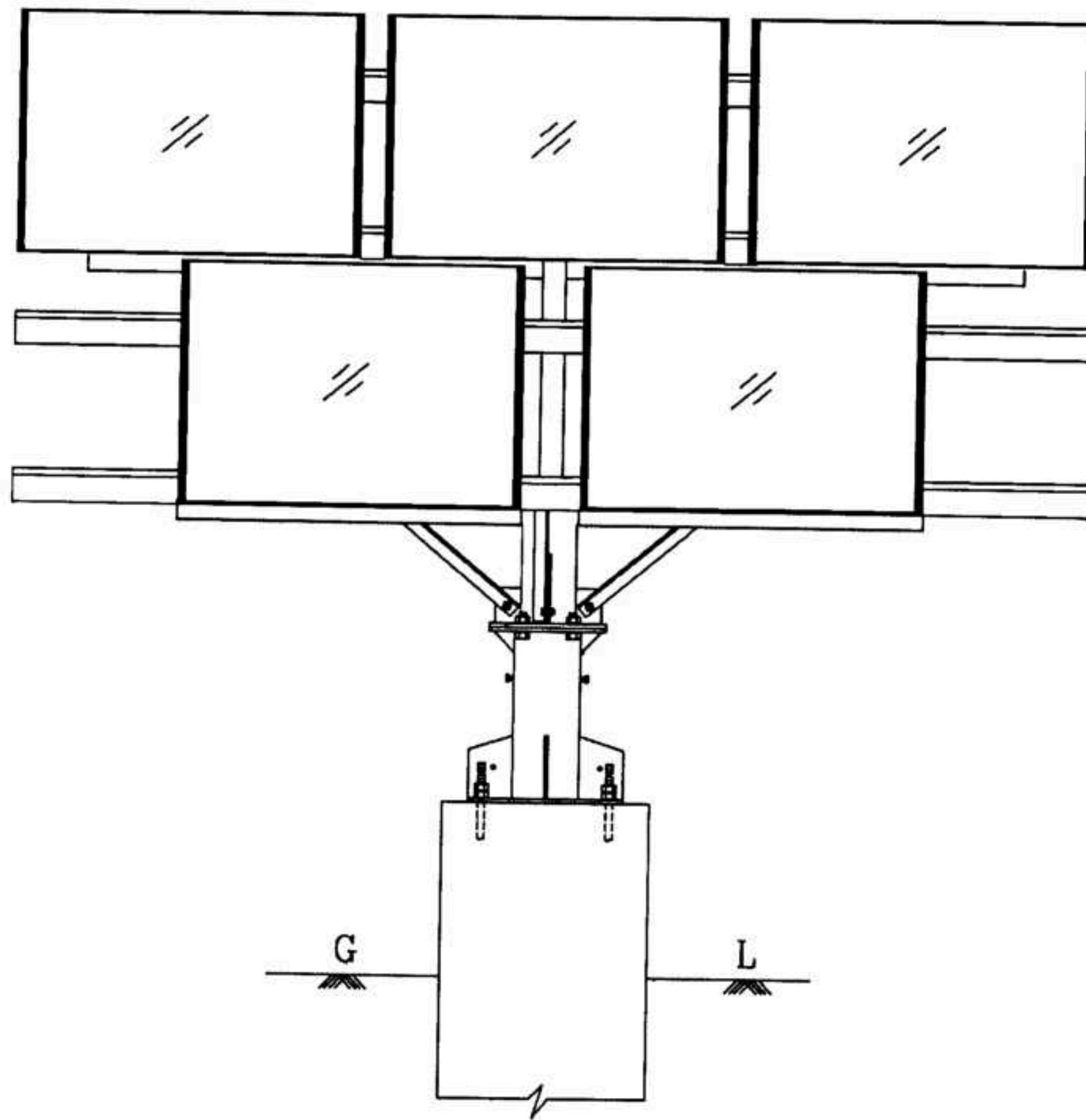
TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR
WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

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FRONT VIEW OF SOLAR MODULES - 5 MMS



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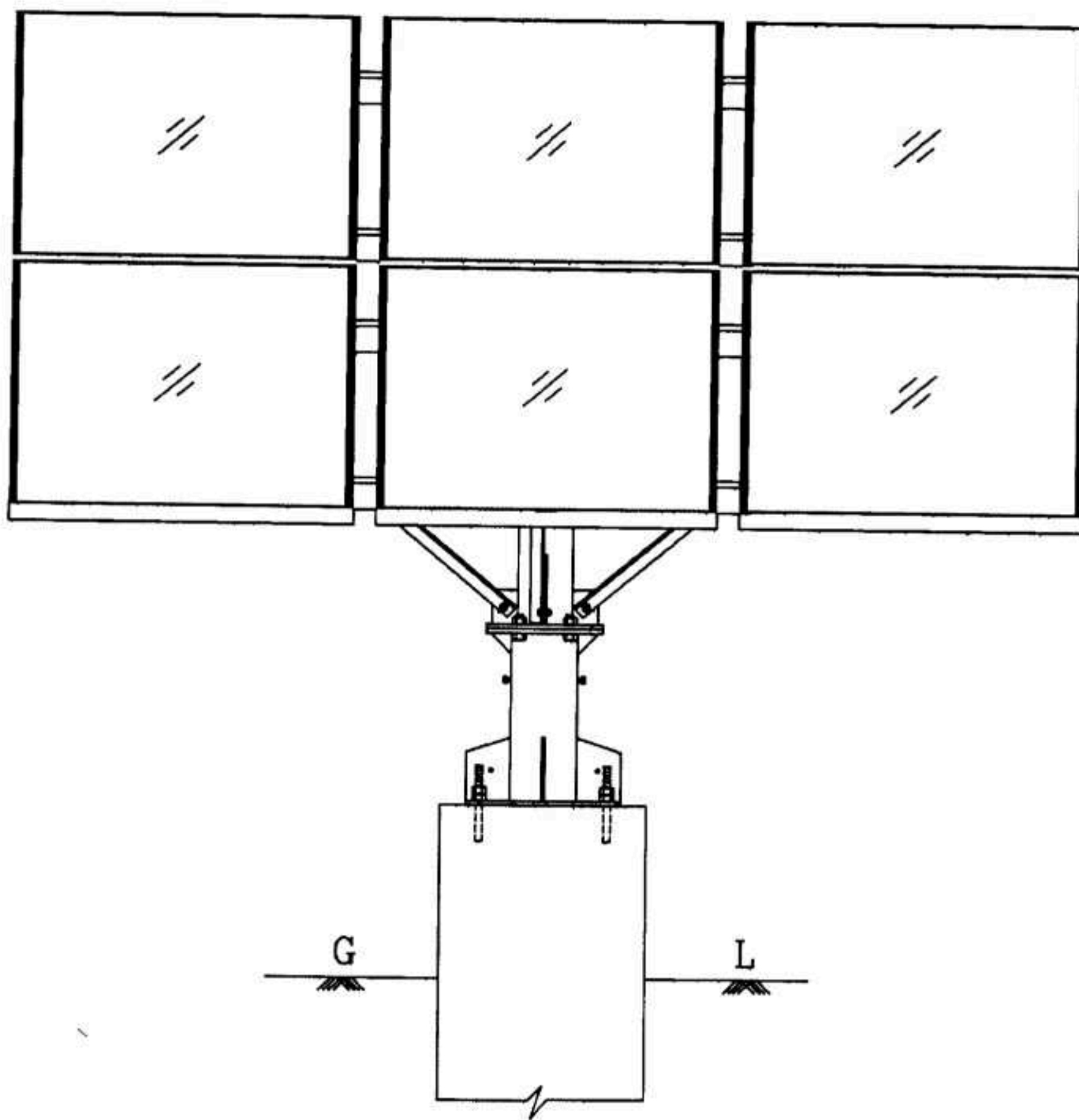
FRONT VIEW OF SOLAR MODULES
- 5 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR
WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

FRONT VIEW OF SOLAR MODULES - 6 MMS



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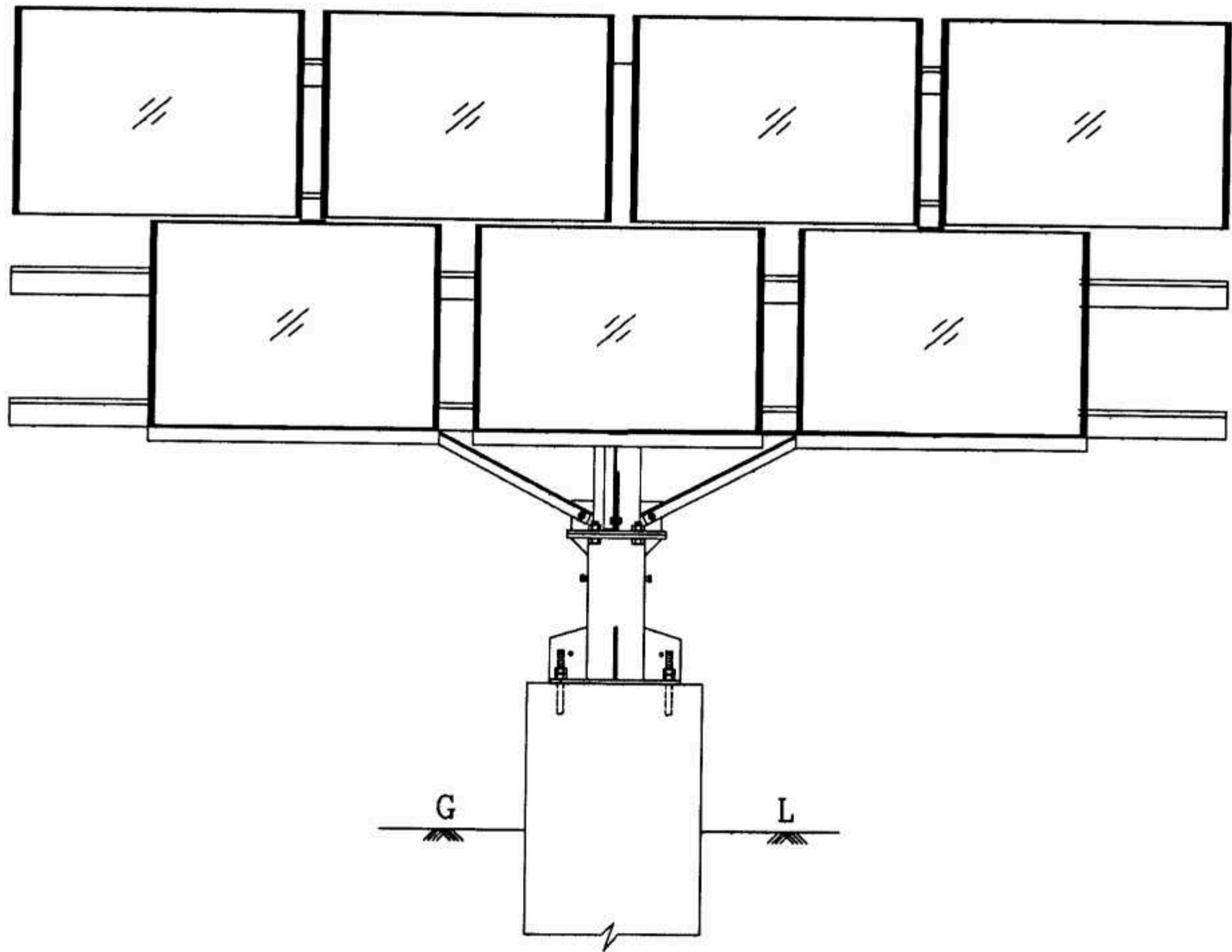
FRONT VIEW OF SOLAR MODULES
- 6 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR
WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

FRONT VIEW OF SOLAR MODULES - 7 MMS



(Handwritten signature)

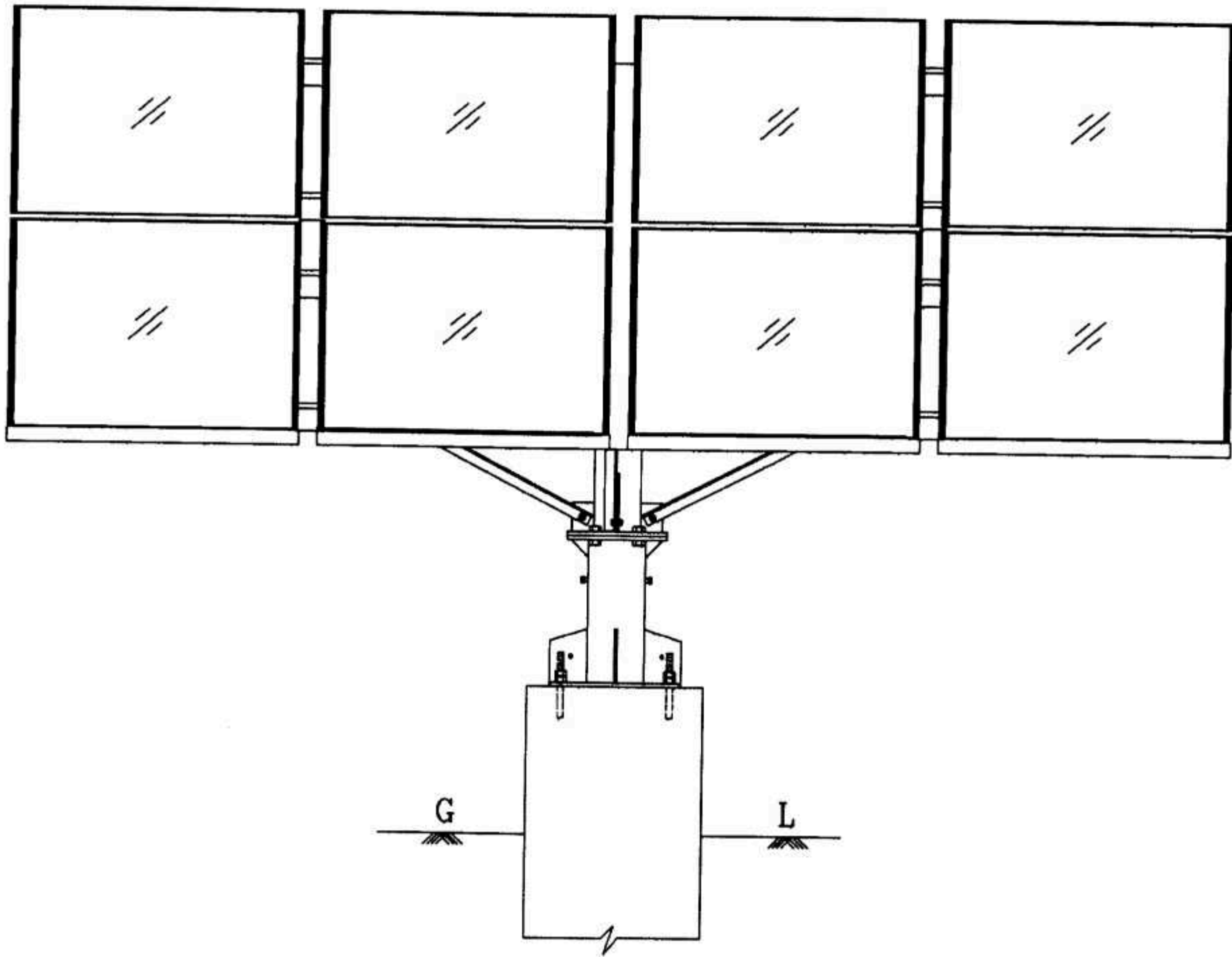
FRONT VIEW OF SOLAR MODULES
- 7 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR
WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

FRONT VIEW OF SOLAR MODULES - 8 MMS



Handwritten signature or initials.

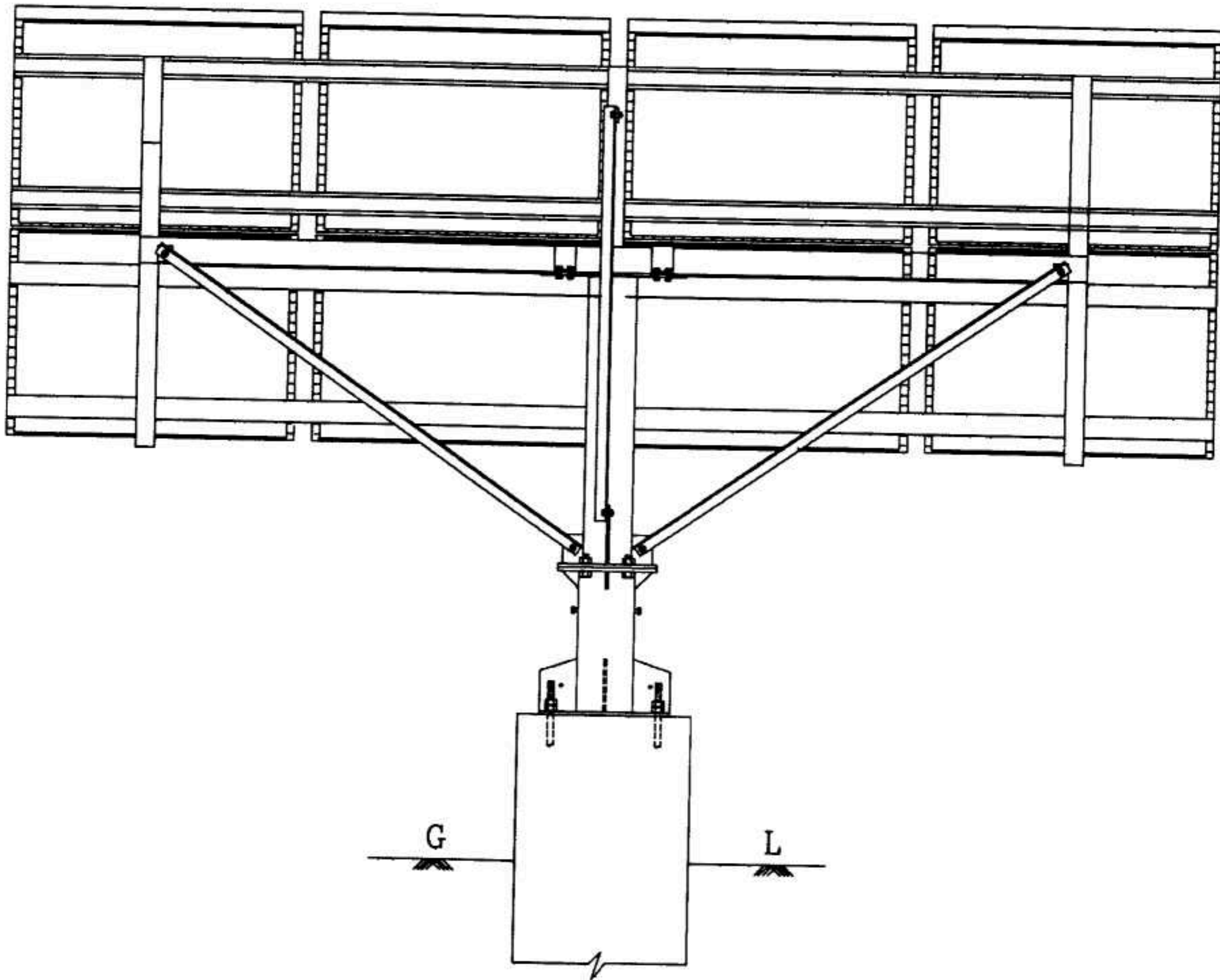
FRONT VIEW OF SOLAR MODULES
- 8 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR
WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

REAR VIEW FOR SOLAR MODULES - 8 MMS

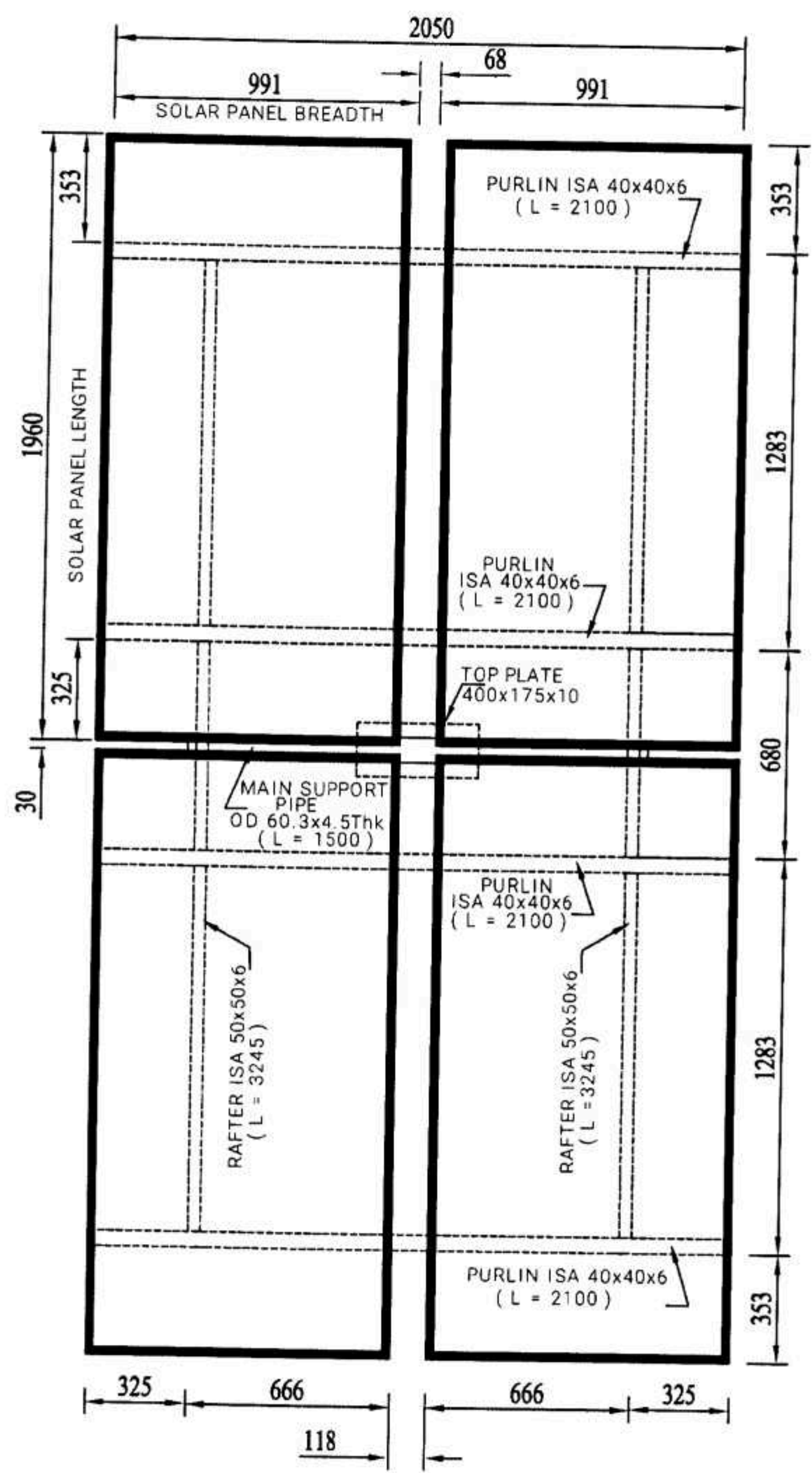


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REAR VIEW OF SOLAR MODULES
- 8 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR
WATER PUMPING SYSTEM
ALL DIMENSIONS ARE IN MM U. O. STATED SCALE - 1 : 25

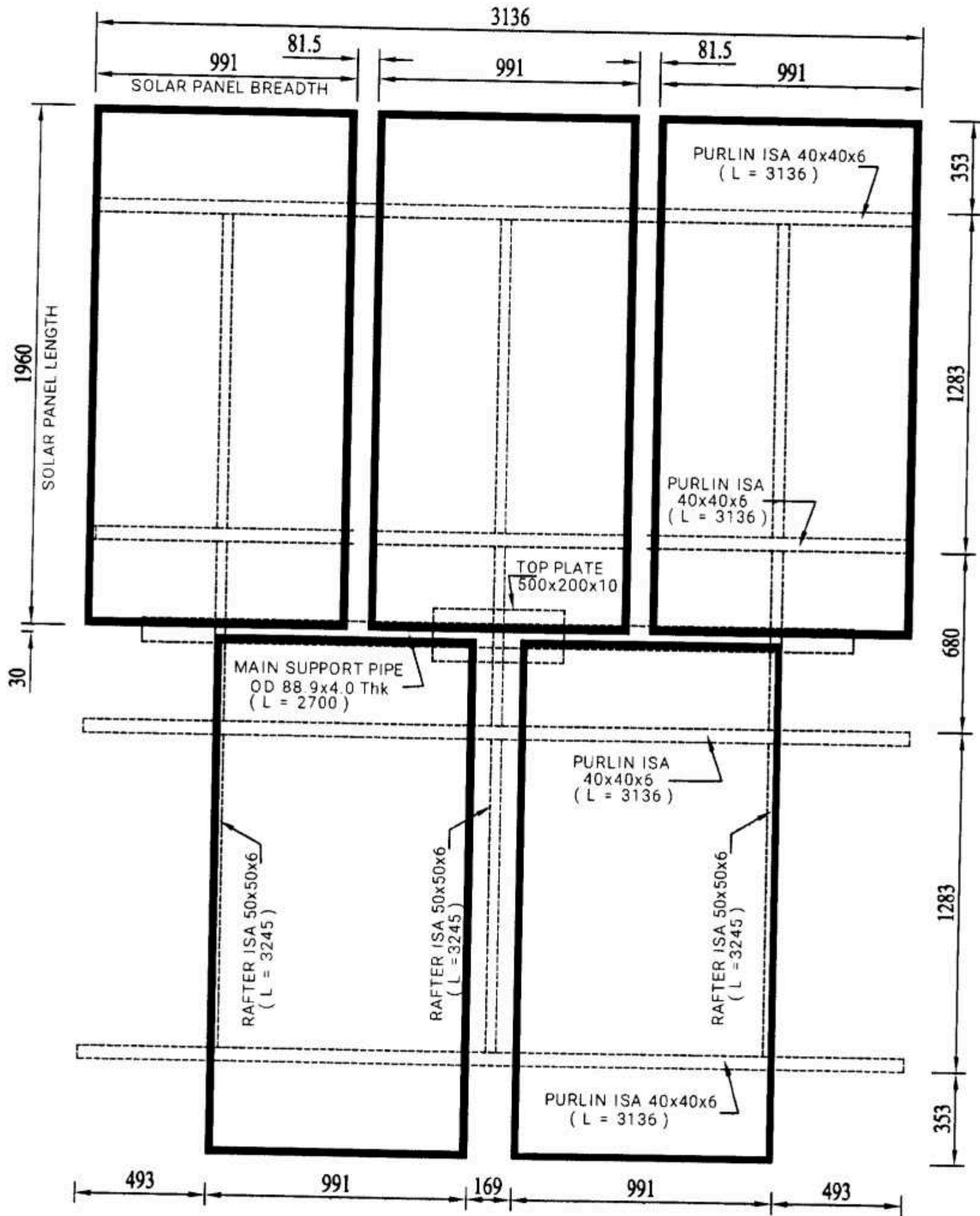
PLAN FOR GENERAL LAYOUT OF PANELS, RAFTERS, PURLIN ETC.-4 MMS



N.B.- DIMENSION OF SOLAR MODULE MAY VARY SLIGHTLY FROM MANUFACTURER TO MAMANUFACTURER. THE POSITION OF SIDE TUBES AND PURLINS WILL VARY ACCORDINGLY WHICH IS TO BE TAKEN CARE AT THE TIME OF FABRICATION AND INSTALLATION .

PLAN OF SOLAR PANELS - 4 MMS	TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM	
	ALL DIMENSIONS ARE IN MM U. O. STATED	SCALE - 1 : 25

PLAN FOR GENERAL LAYOUT OF PANELS, RAFTERS, PURLIN ETC. - 5 MMS



N.B.- DIMENSION OF SOLAR MODULE MAY VARY SLIGHTLY FROM MANUFACTURER TO MANUFACTURER. THE POSITION OF SIDE TUBES AND PURLINS WILL VARY ACCORDINGLY WHICH IS TO BE TAKEN CARE AT THE TIME OF FABRICATION AND INSTALLATION.

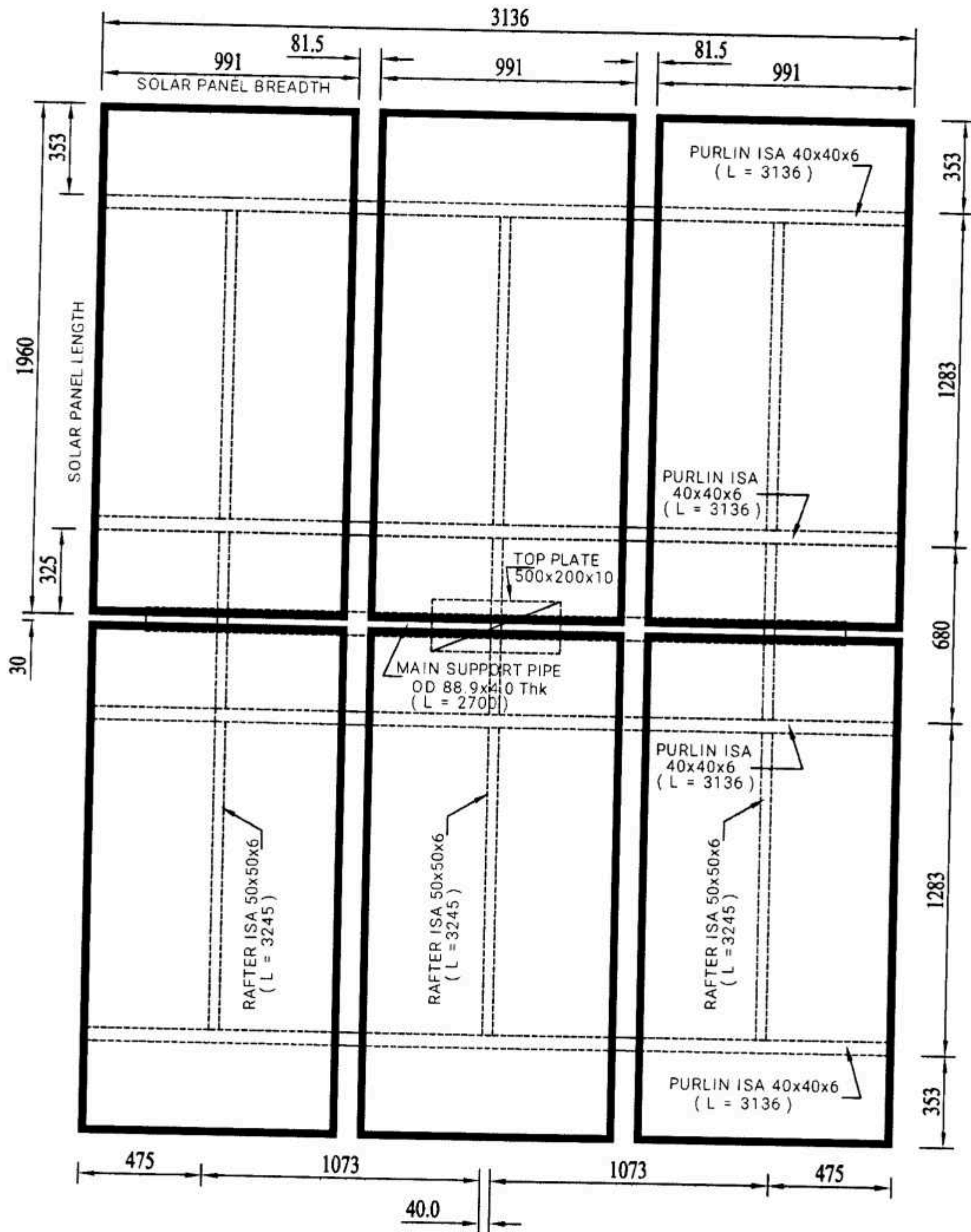
PLAN OF SOLAR PANELS - 5 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

PLAN FOR GENERAL LAYOUT OF PANELS, TUBES , PURLIN ETC.-6 MMS



N.B.- DIMENSION OF SOLAR MODULE MAY VARY SLIGHTLY FROM MANUFACTURER TO MANUFACTURER. THE POSITION OF SIDE TUBES AND PURLINS WILL VARY ACCORDINGLY WHICH IS TO BE TAKEN CARE AT THE TIME OF FABRICATION AND INSTALLATION .

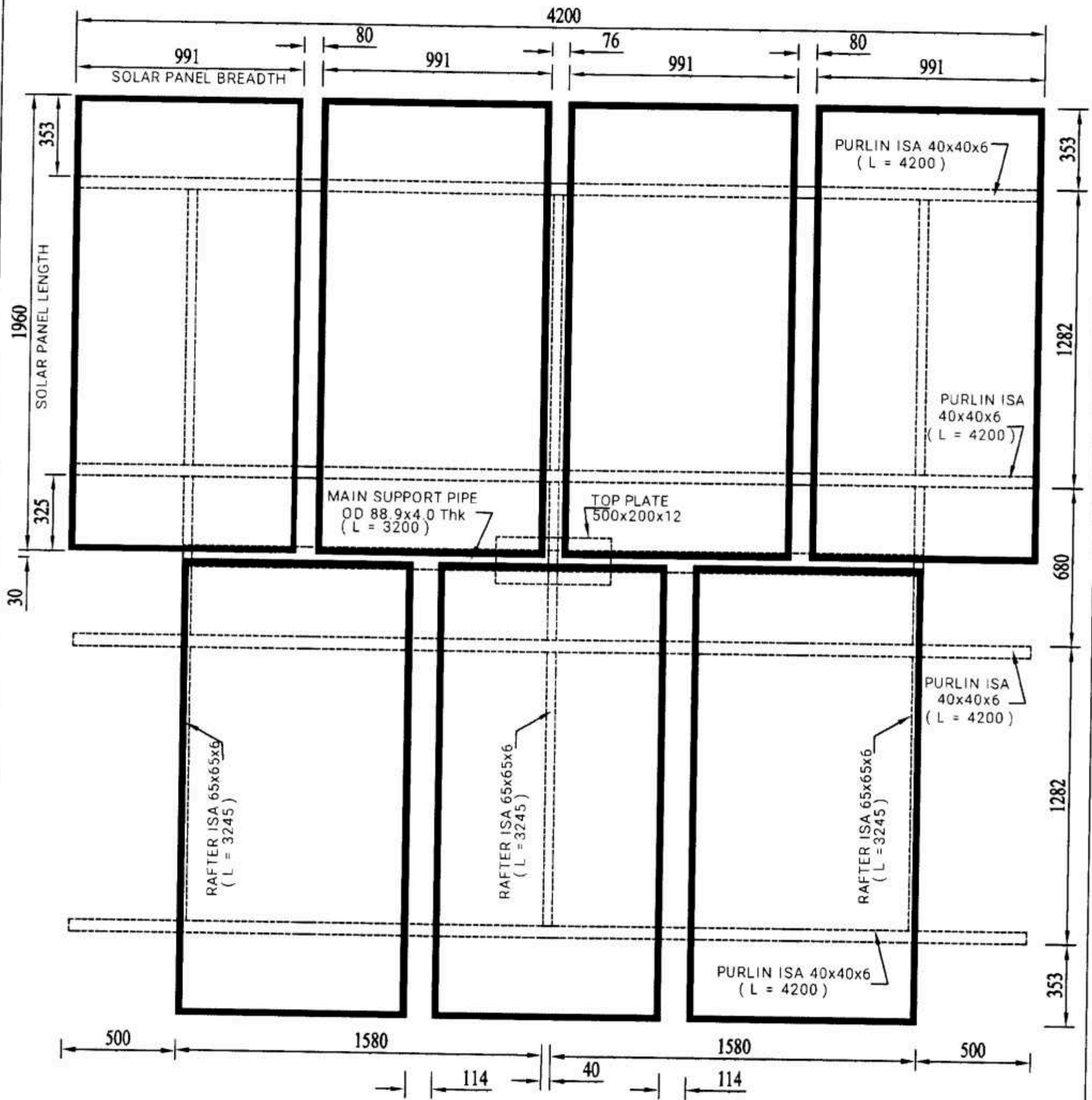
PLAN OF SOLAR PANELS - 6 MMS

DRAWING NO. DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

PLAN FOR GENERAL LAYOUT OF PANELS, TUBES , PURLIN ETC.-7 MMS



N.B.- DIMENSION OF SOLAR MODULE MAY VARY SLIGHTLY FROM MANUFACTURER TO MAMANUFACTURER. THE POSITION OF SIDE TUBES AND PURLINS WILL VARY ACCORDINGLY WHICH IS TO BE TAKEN CARE AT THE TIME OF FABRICATION AND INSTALLATION .

CA

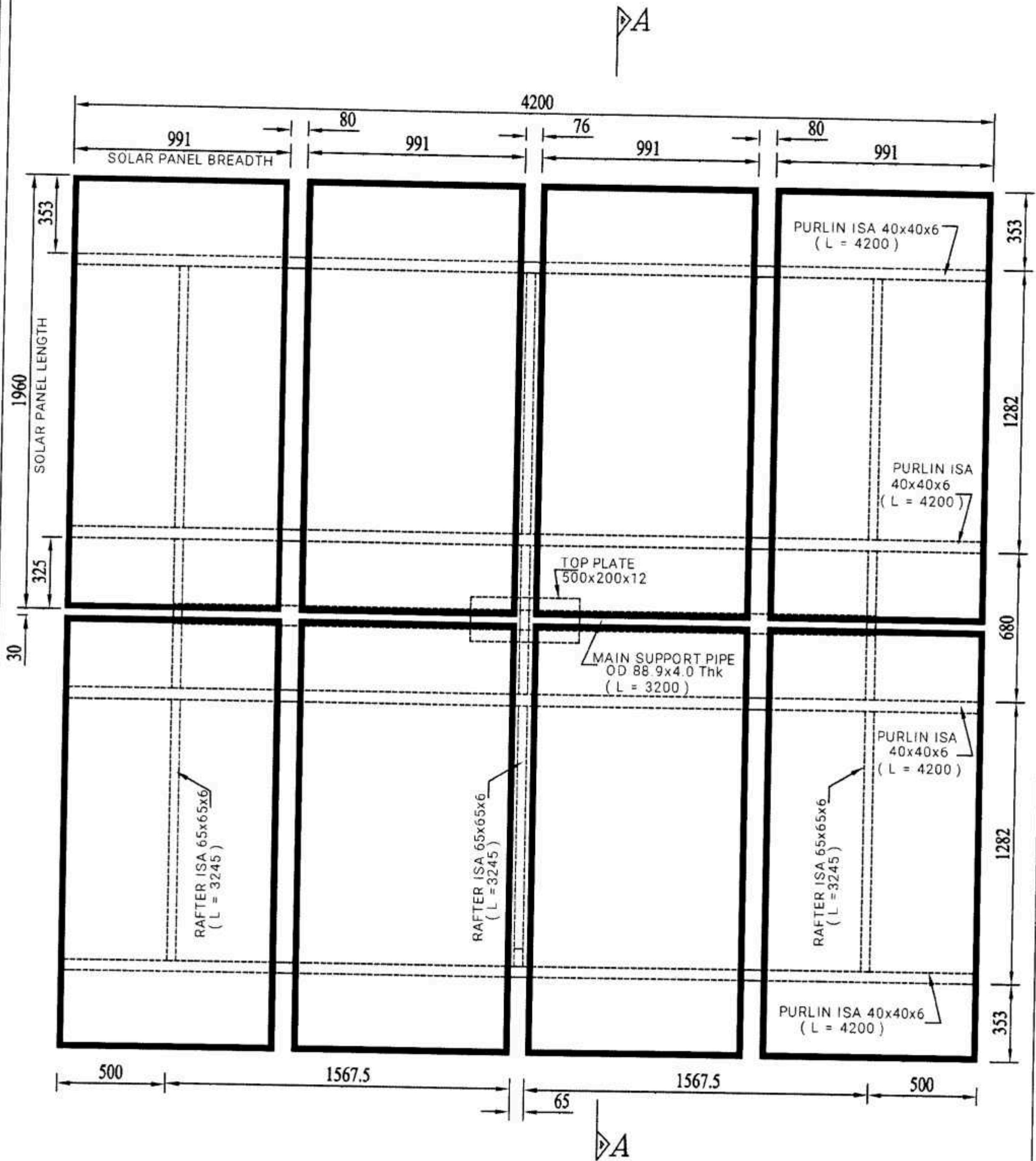
PLAN OF SOLAR PANELS - 7 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

PLAN FOR GENERAL LAYOUT OF PANELS, TUBES , PURLIN ETC.-8 MMS



N.B.- DIMENSION OF SOLAR MODULE MAY VARY SLIGHTLY FROM MANUFACTURER TO MANUFACTURER. THE POSITION OF SIDE TUBES AND PURLINS WILL VARY ACCORDINGLY WHICH IS TO BE TAKEN CARE AT THE TIME OF FABRICATION AND INSTALLATION .

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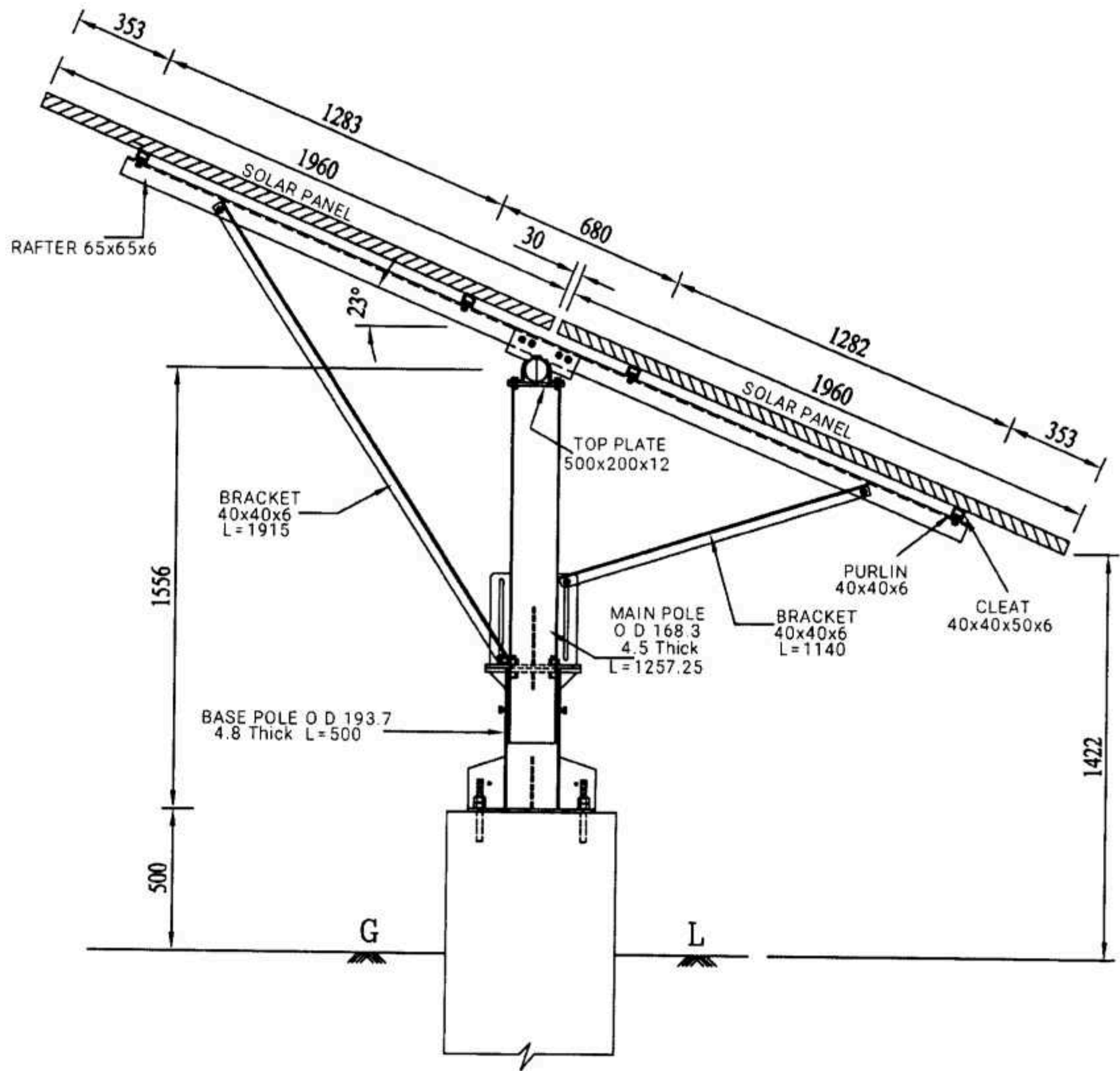
PLAN OF SOLAR PANELS - 8 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

SECTION ON A-A FOR SOLAR STRUCTURE - 8 MMS (23°)



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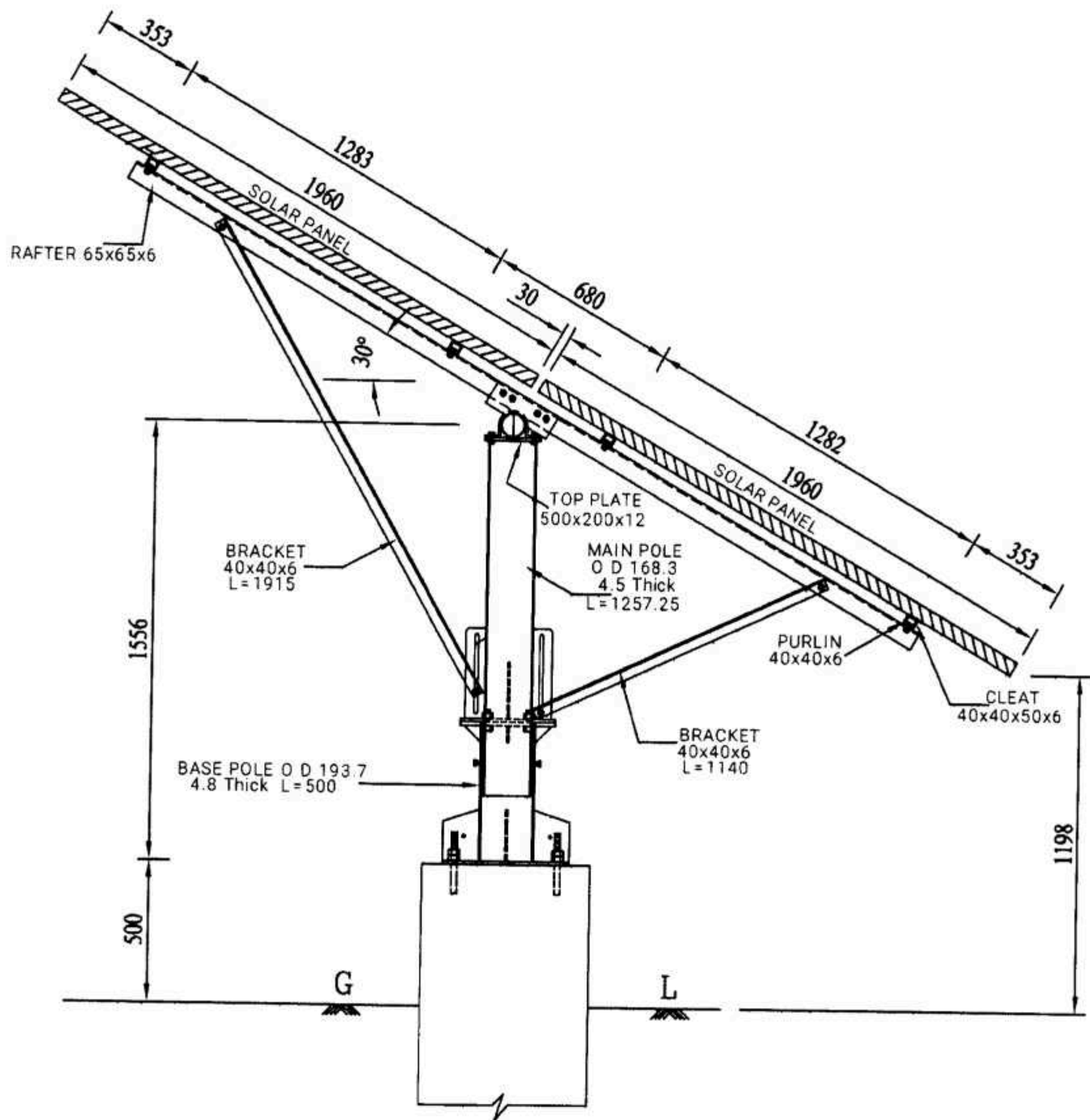
DETAILS OF SECTION ON A-A FOR 8 MMS (23°)

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

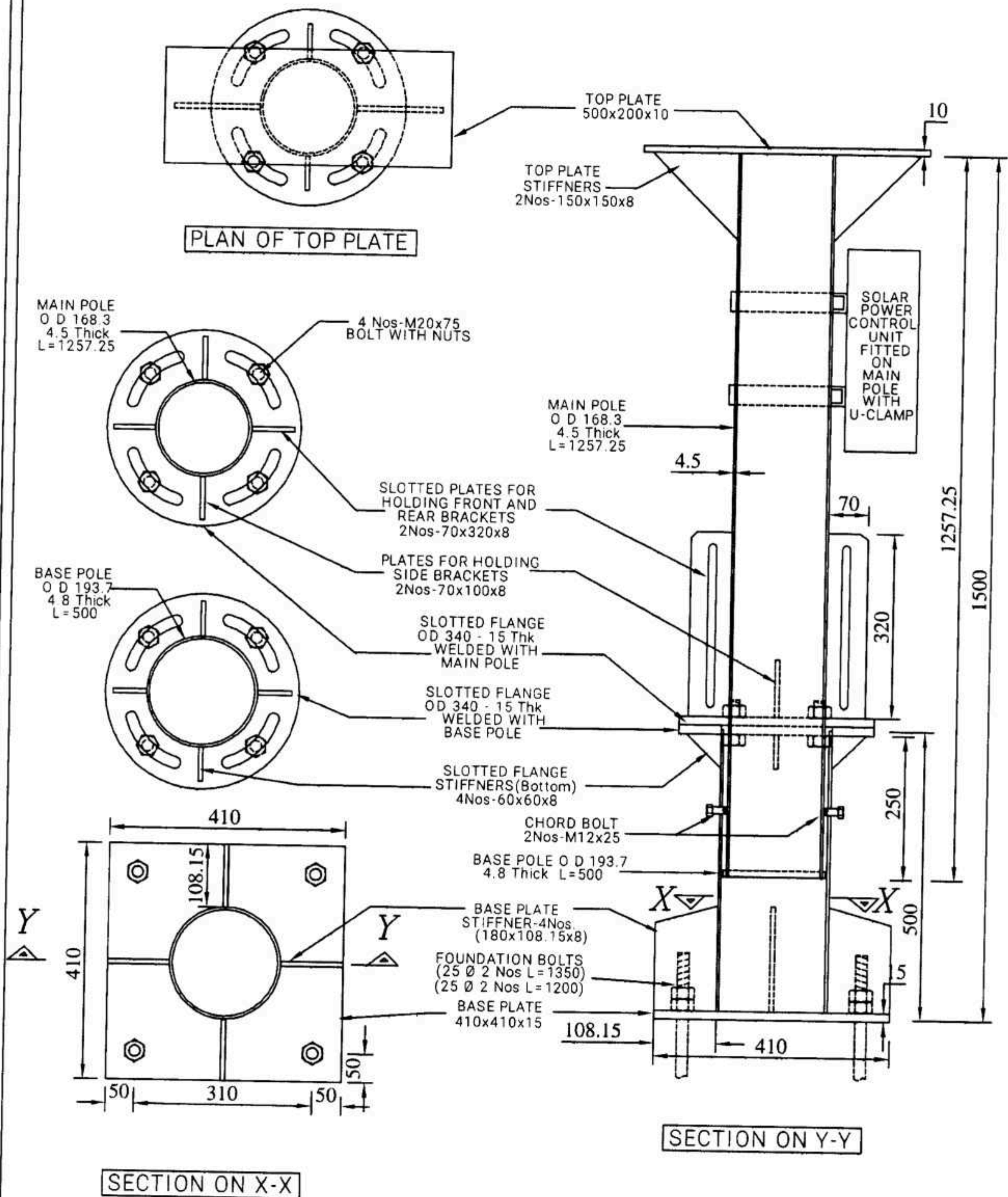
SECTION ON A-A FOR SOLAR STRUCTURE - 8 MMS (30°)



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DETAILS OF SECTION ON A-A FOR 8 MMS (30°)	TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM
	ALL DIMENSIONS ARE IN MM U. O. STATED SCALE - 1 : 25

DETAILS OF MAIN POLE FOR 6 MMS



N.B. - 1) WELDING SHOULD BE DONE AS PER I.S. - 822 & GRADE OF WELDING WIRE SHOULD BE ER70S-6 .
2) POSITION OF SOLAR POWER CONTROL UNIT IS TO BE DECIDED AS PER SITE CONDITION.

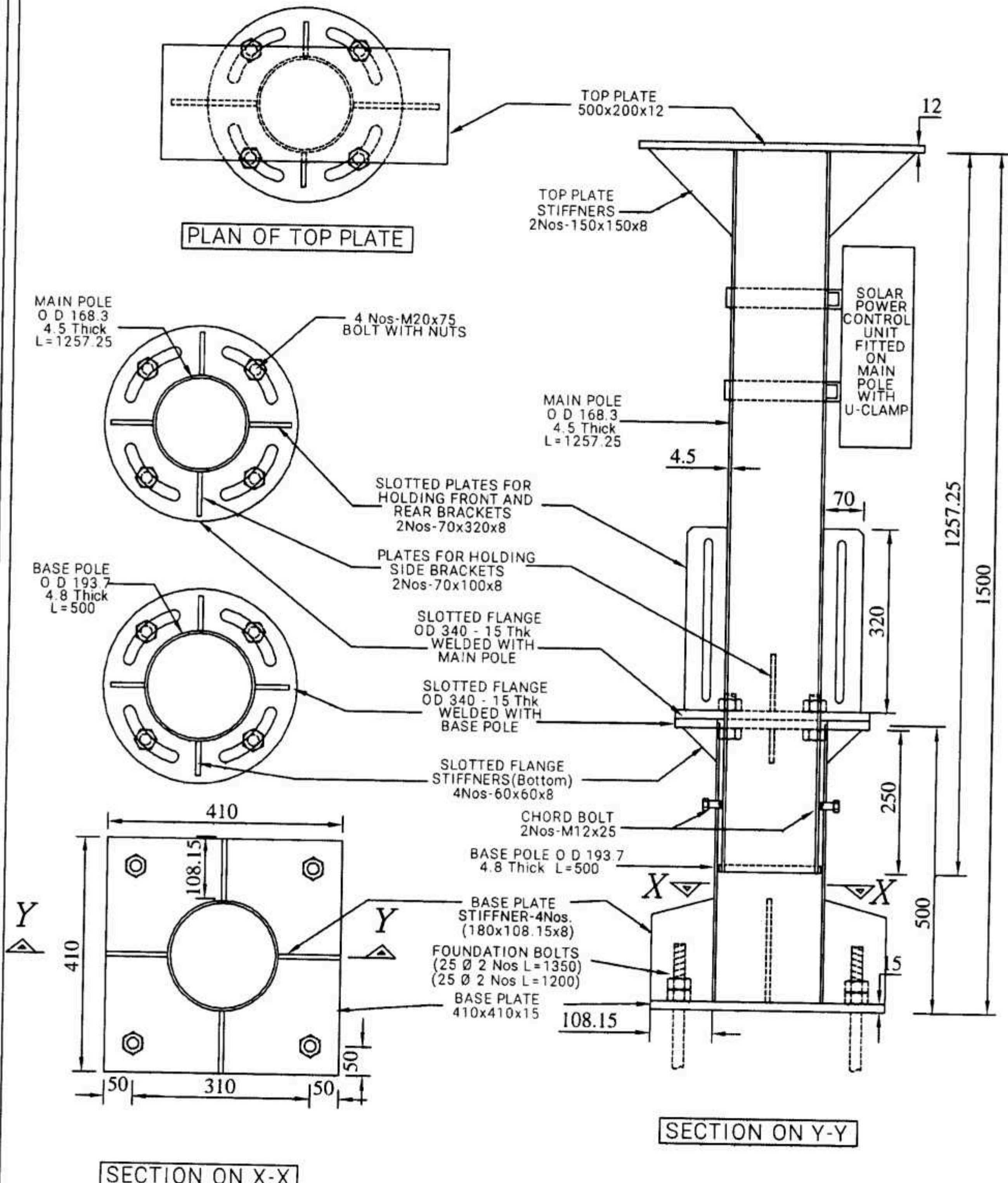
A

DETAILS OF MAIN POLE FOR 6 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED SCALE - 1 : 10

DETAILS OF MAIN POLE FOR 8 MMS

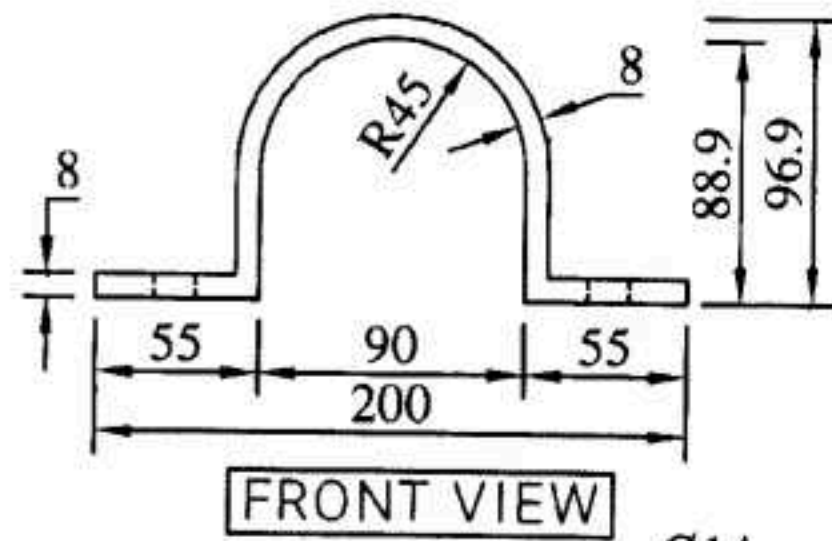


N.B. - 1) WELDING SHOULD BE DONE AS PER I.S. - 822 & GRADE OF WELDING WIRE SHOULD BE ER70S-6 .
 2) POSITION OF SOLAR POWER CONTROL UNIT IS TO BE DECIDED AS PER SITE CONDITION.

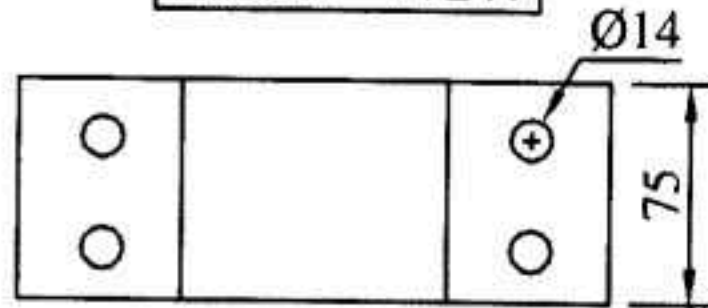
[Handwritten Signature]

DETAILS OF MAIN POLE FOR 8 MMS	TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM	
	ALL DIMENSIONS ARE IN MM U. O. STATED	SCALE - 1 : 10

DETAILS OF CLAMP, SLOTTED PLATE & BLADE

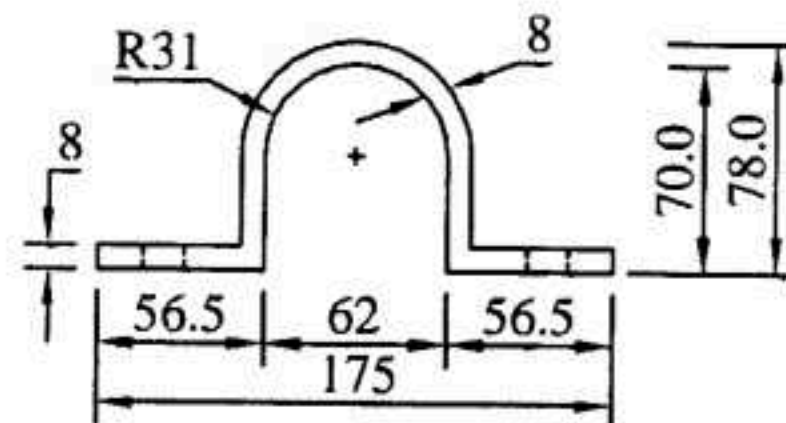


FRONT VIEW

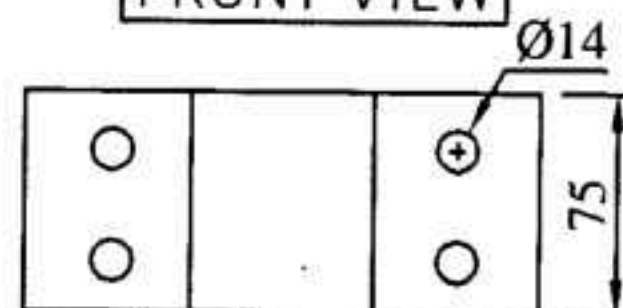


PLAN

FOR 8/6 MODULE



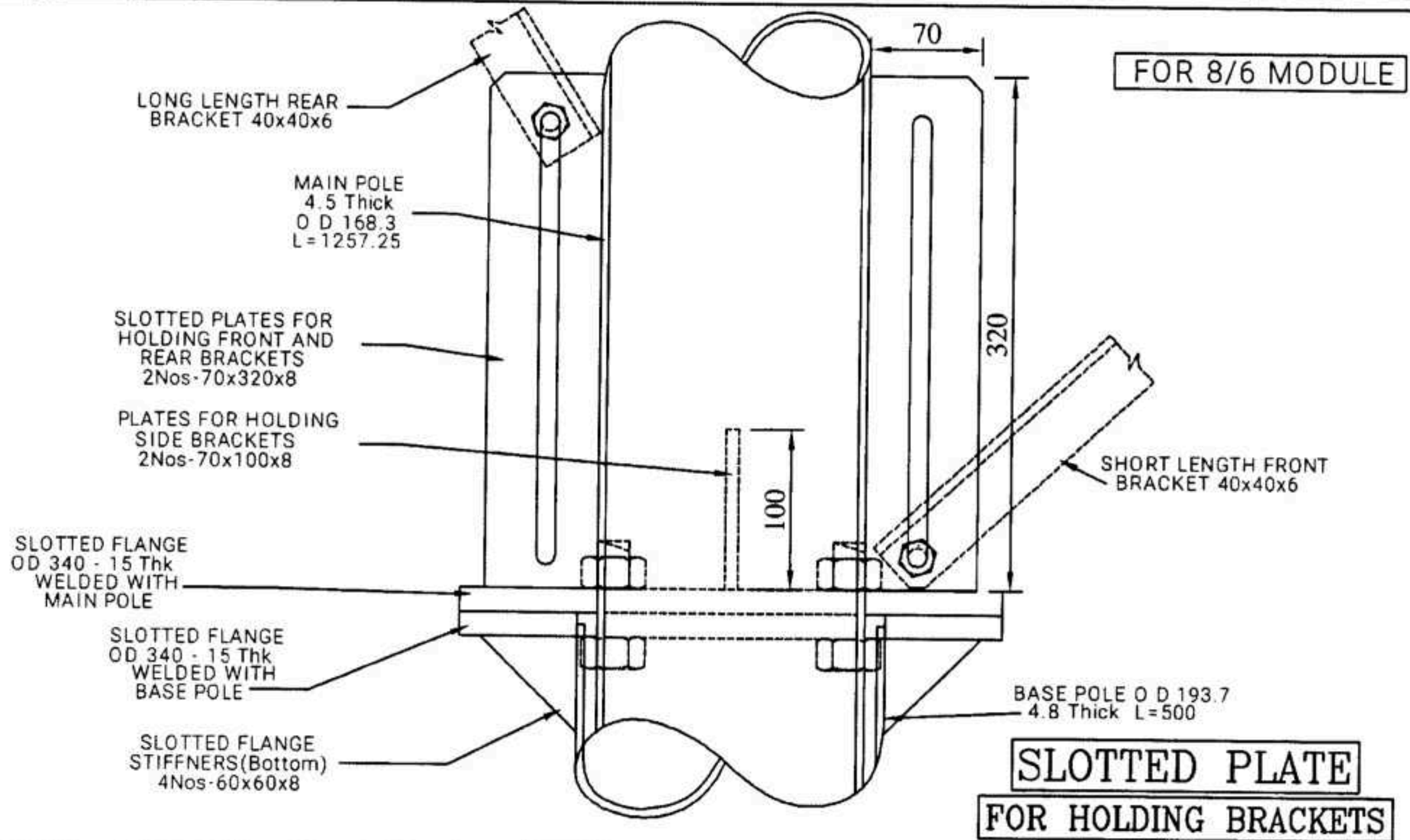
FRONT VIEW



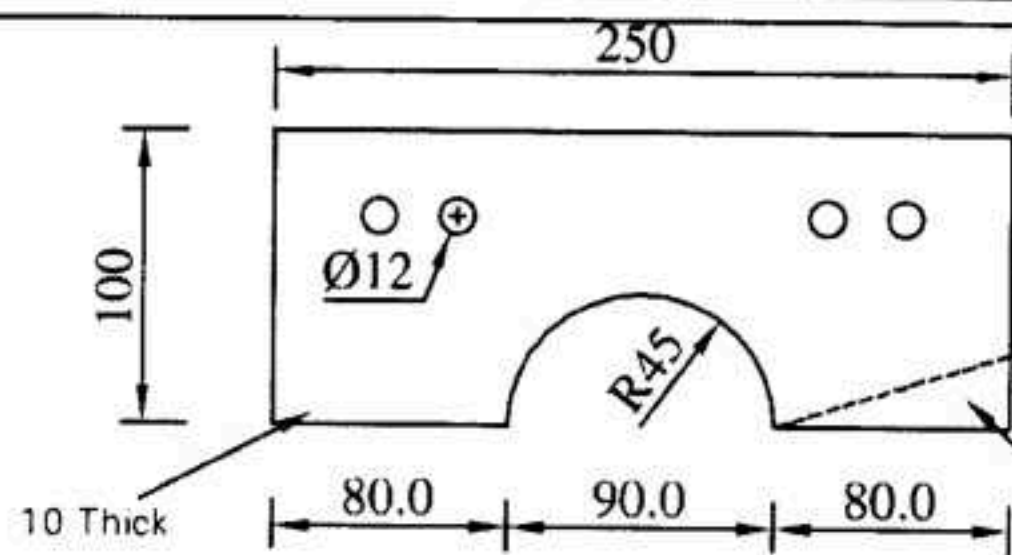
PLAN

FOR 4 MODULE

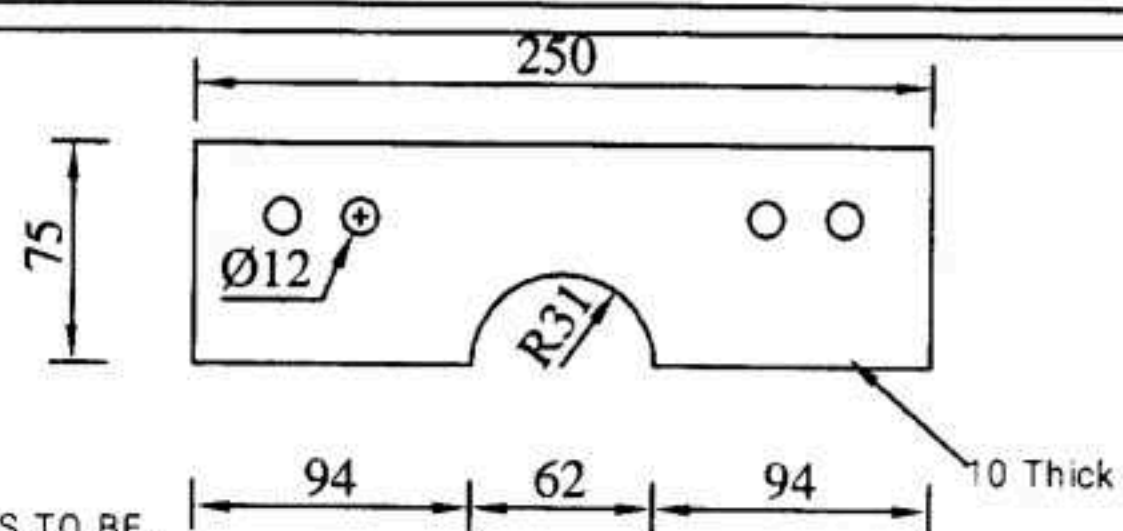
CLAMP FOR HOLDING MAIN HORIZONTAL PIPE SUPPORT



SLOTTED PLATE
FOR HOLDING BRACKETS



FRONT VIEW
FOR 8/6 MODULE



FRONT VIEW
FOR 4 MODULE

THIS PORTION IS TO BE TRIMMED ACCORDING TO SITE CONDITION TO MAINTAIN 22.5° TO 30°
(APPLICABLE FOR 4 MODULE ALSO)

BLADE FOR FIXING RAFTOR WITH MAIN PIPE SUPPORT

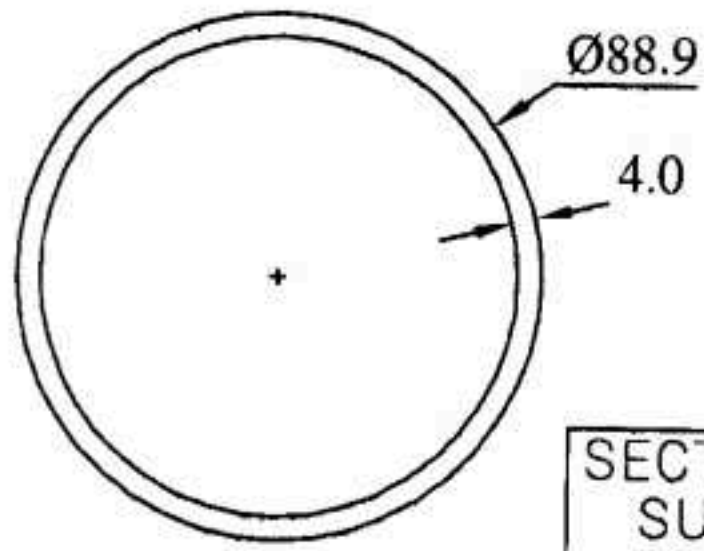
DETAILS OF CLAMP, SLOTTED PLATE & BLADE

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM

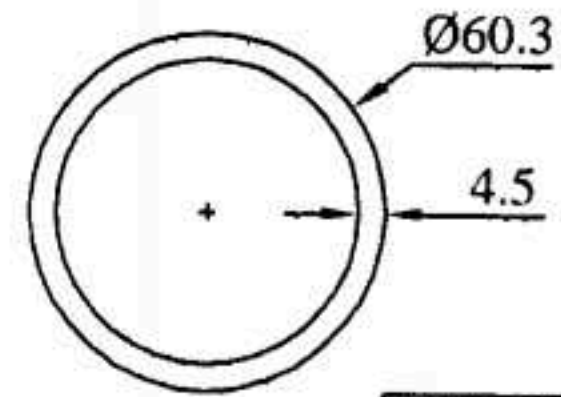
ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 5

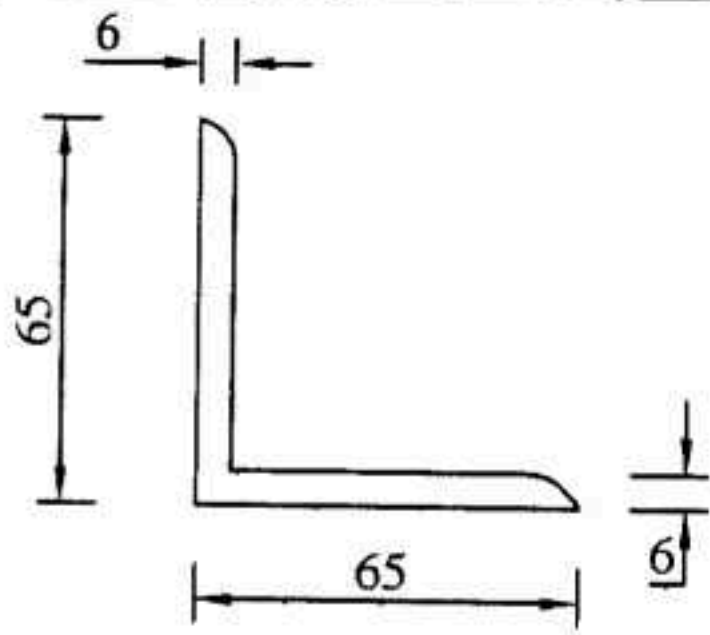
DETAILS OF MAIN SUPPORT PIPES, RAFTOR, PURLIN & CLEAT



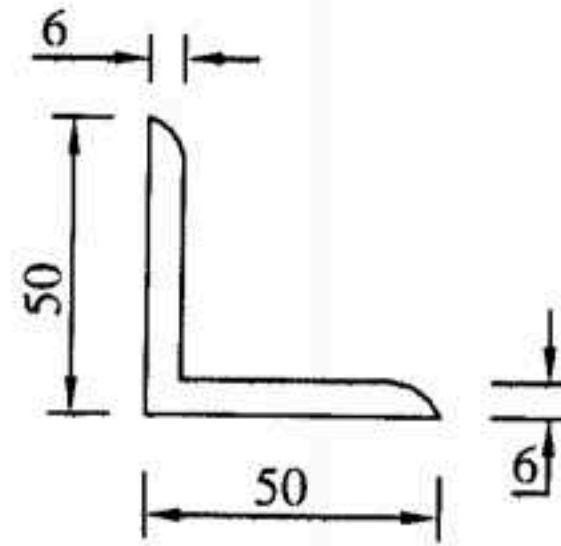
SECTION OF MAIN SUPPORT PIPE FOR 8 / 6 MMS



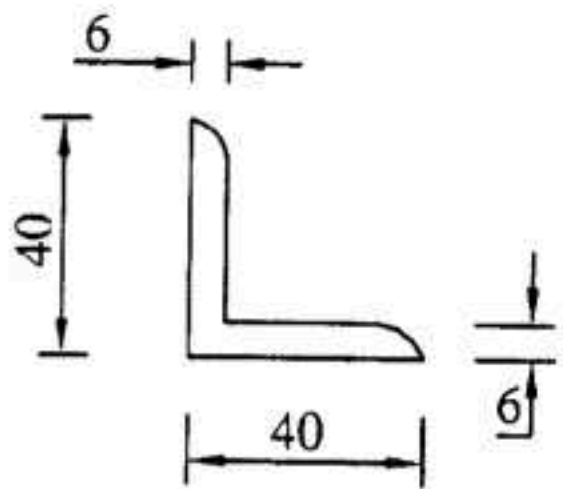
SECTION OF MAIN SUPPORT PIPE FOR 4 MMS



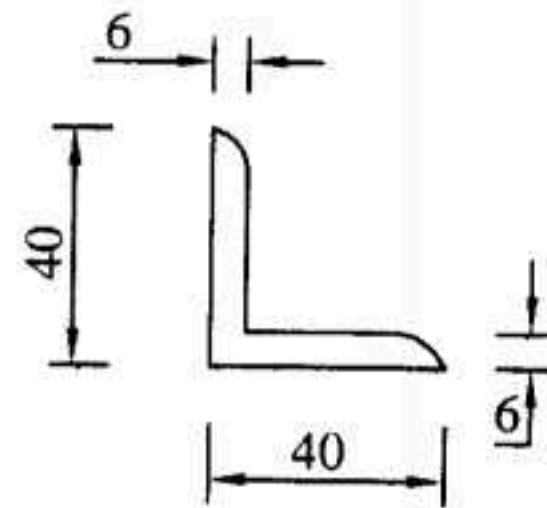
SECTION OF RAFTOR 65x65x6



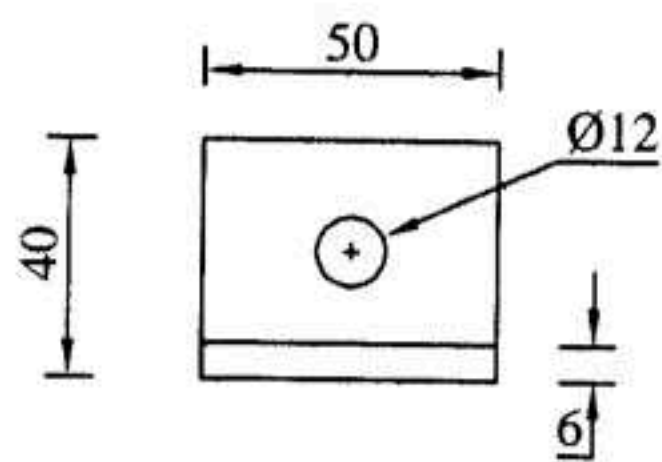
SECTION OF RAFTOR 50x50x6



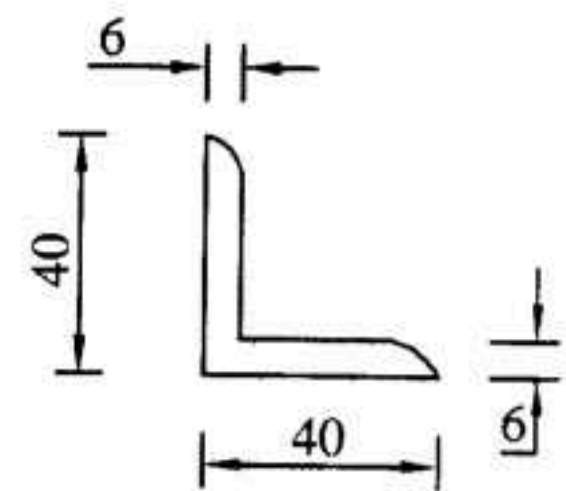
SECTION OF PURLIN 40x40x6



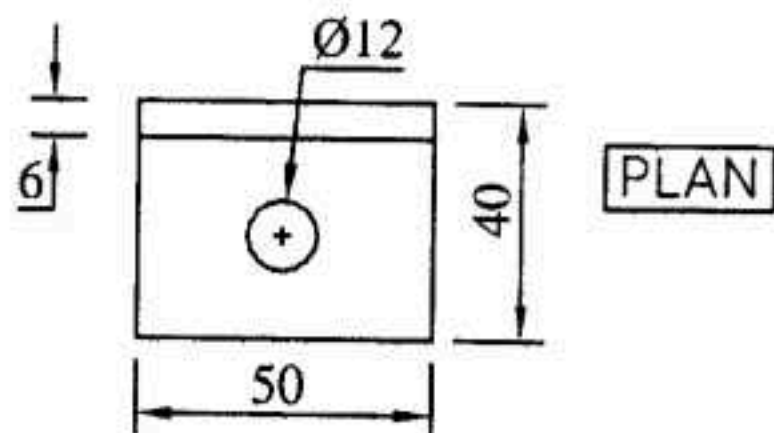
SECTION OF BRACKET 40x40x6



FRONT VIEW



SIDE VIEW



PLAN

CLEAT FOR FIXING PURLINS WITH RAFTOR

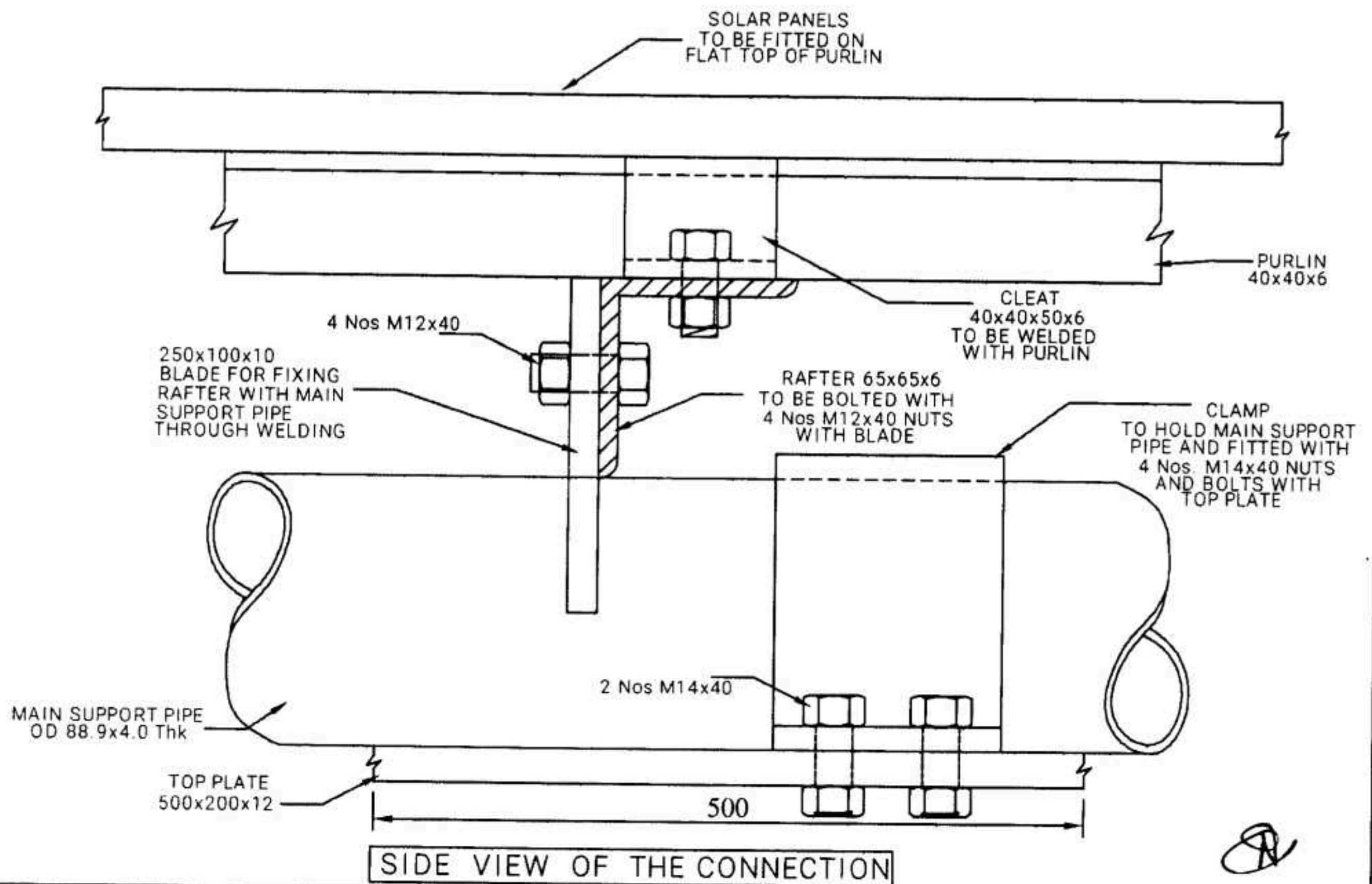
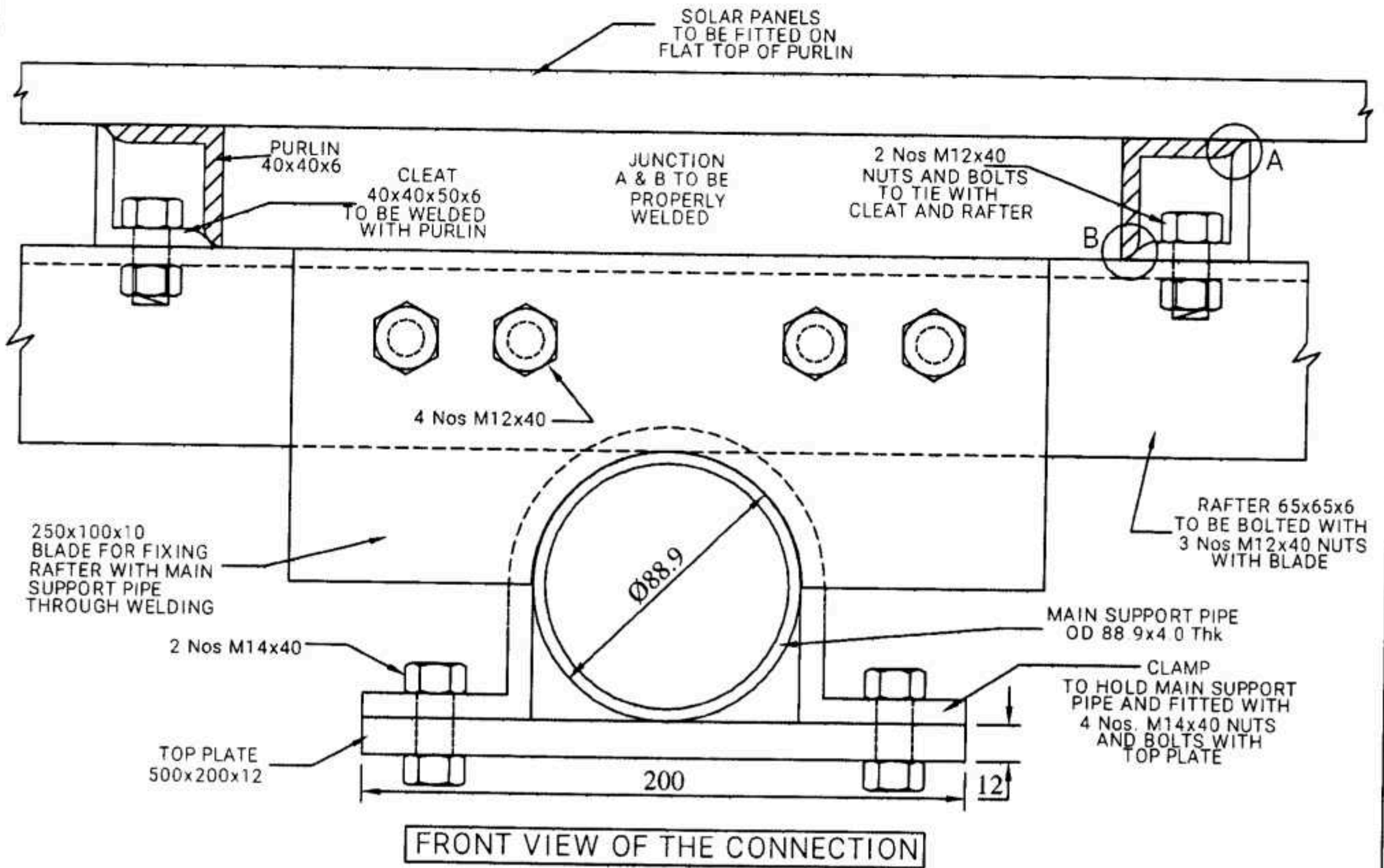
DETAILS OF MAIN SUPPORT, RAFTOR, PURLIN & CLEAT

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 2.5

DETAILS OF CONNECTION WITH RAFTER, PURLIN, CLEAT AND BLADE FOR 8 MMS



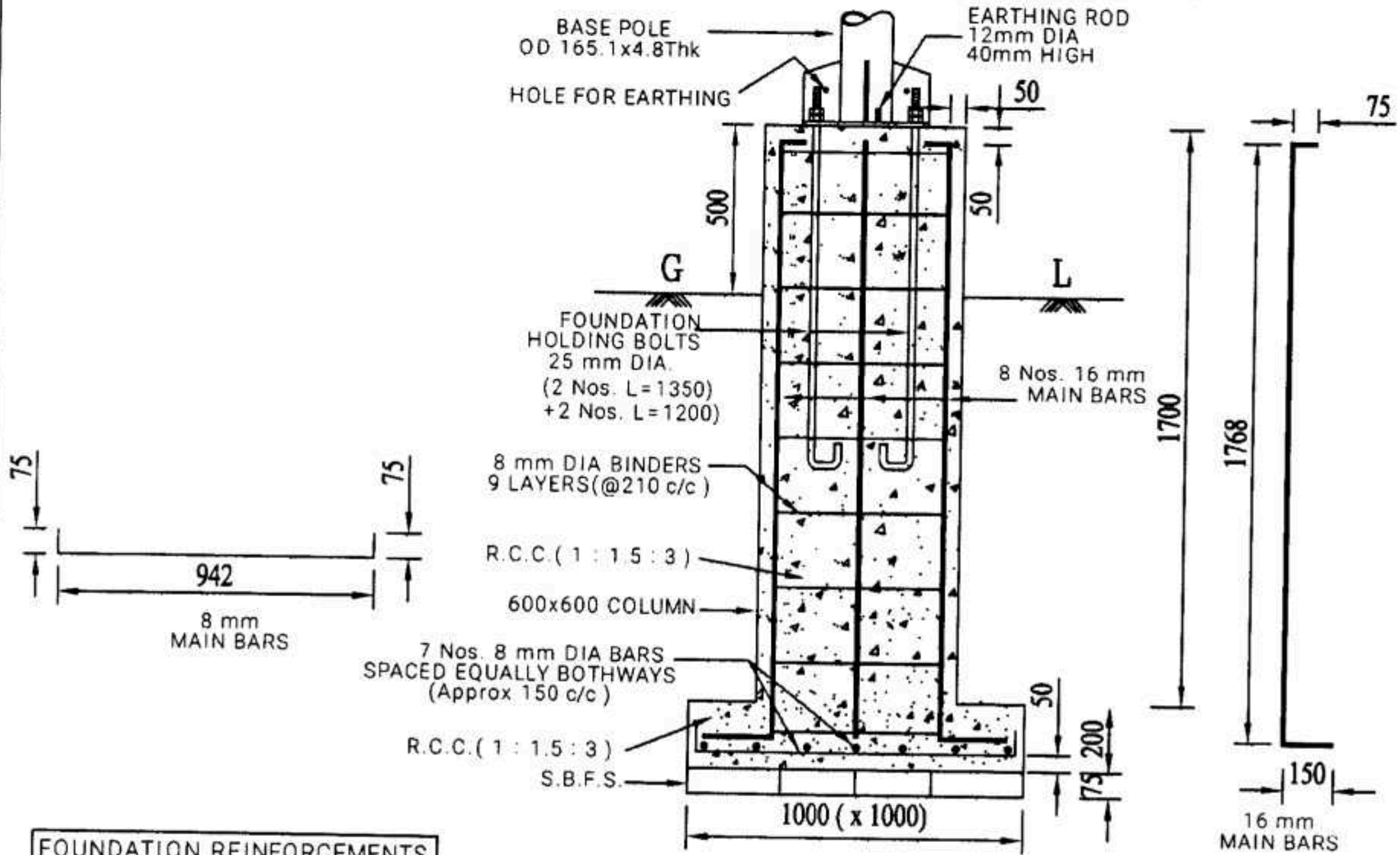
**DETAILS OF CONNECTION WITH RAFTER,
PURLIN, CLEAT AND BLADE FOR 8 MMS**

**TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR
WATER PUMPING SYSTEM**

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 2.5

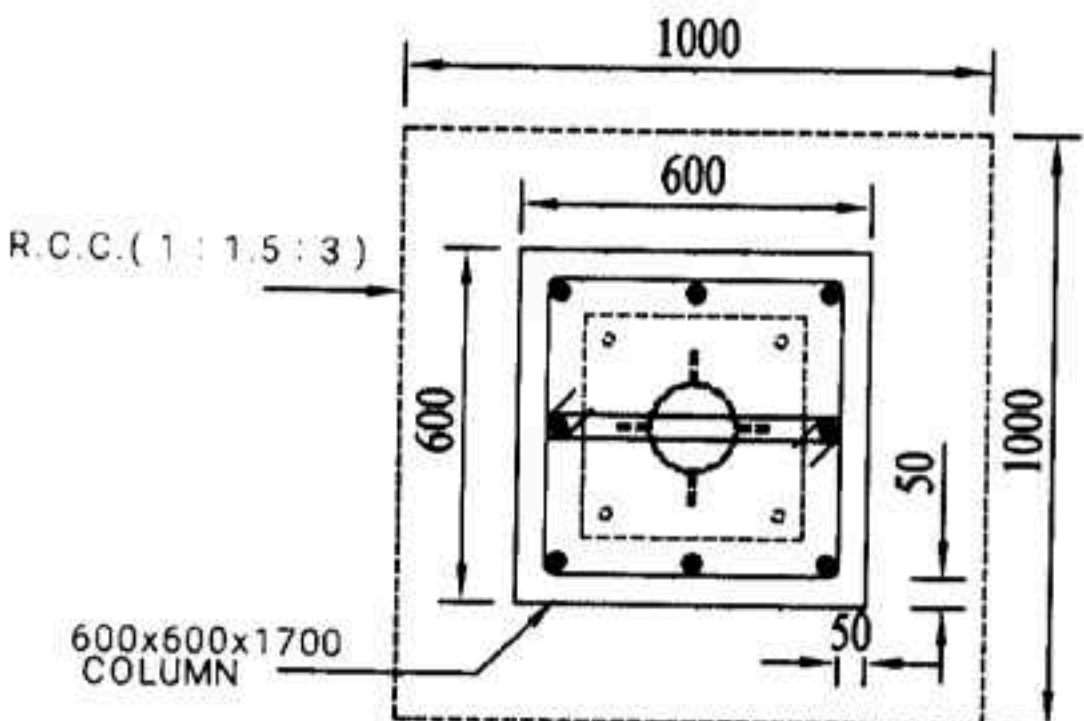
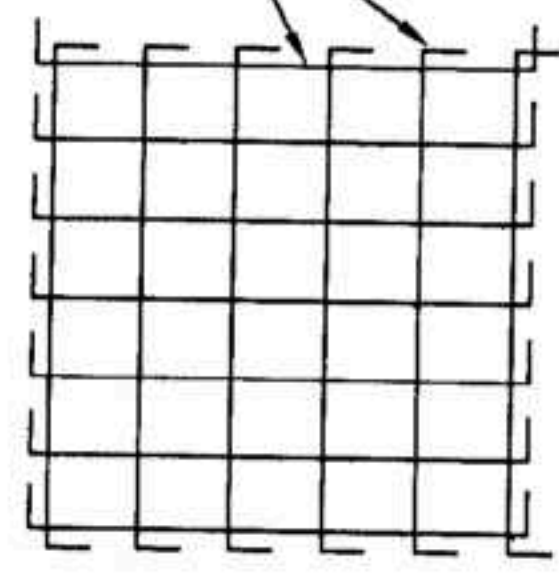
FOUNDATION DETAILS FOR 4 MMS



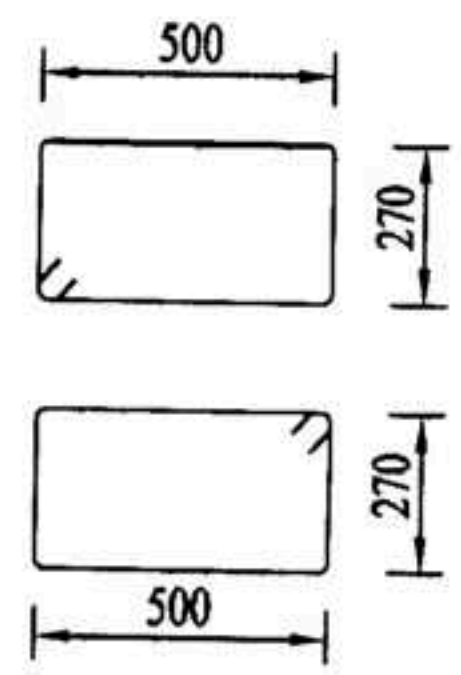
FOUNDATION REINFORCEMENTS

DETAILS OF FOUNDATION

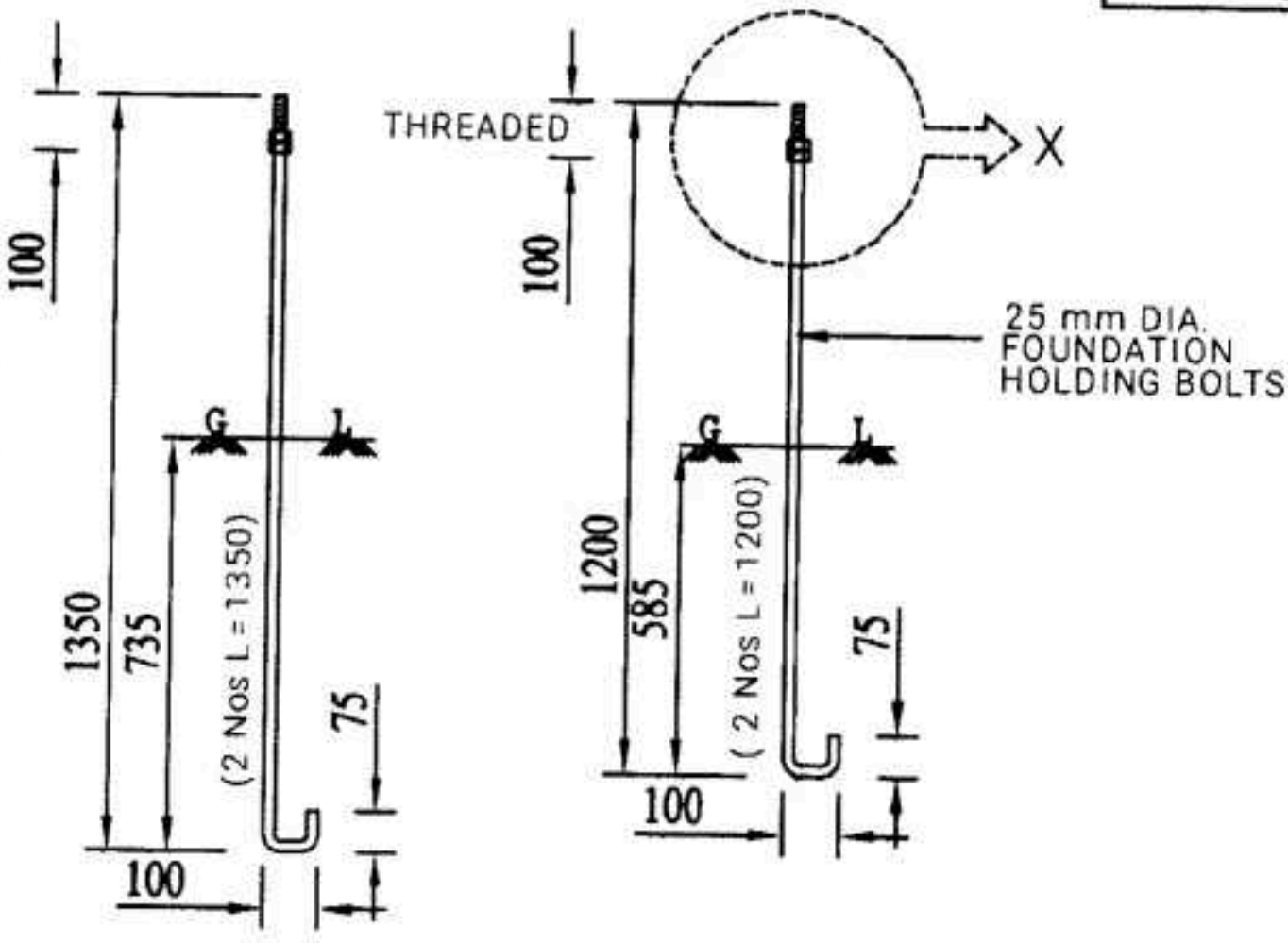
7 Nos. 8 mm DIA BARS
SPACED EQUALLY BOTHWAYS
(Approx 150 c/c)



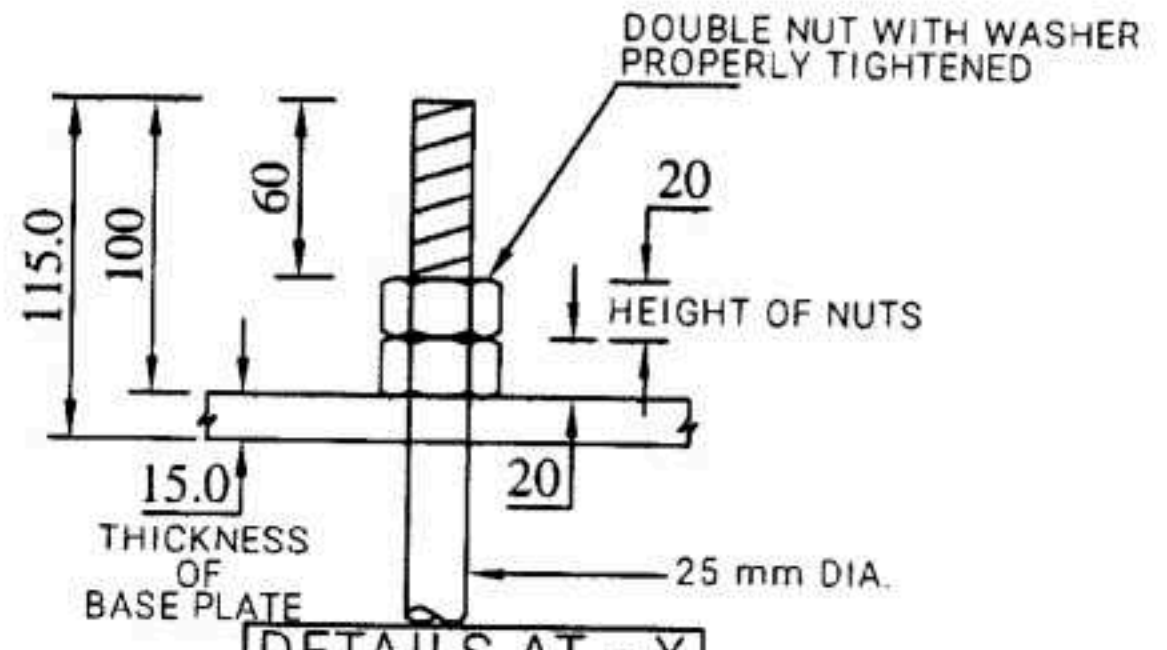
PLAN OF FOUNDATION



8 mm DIA BINDERS
2 Nos. AT EACH LAYER



DETAILS OF FOUNDATION HOLDING BOLTS

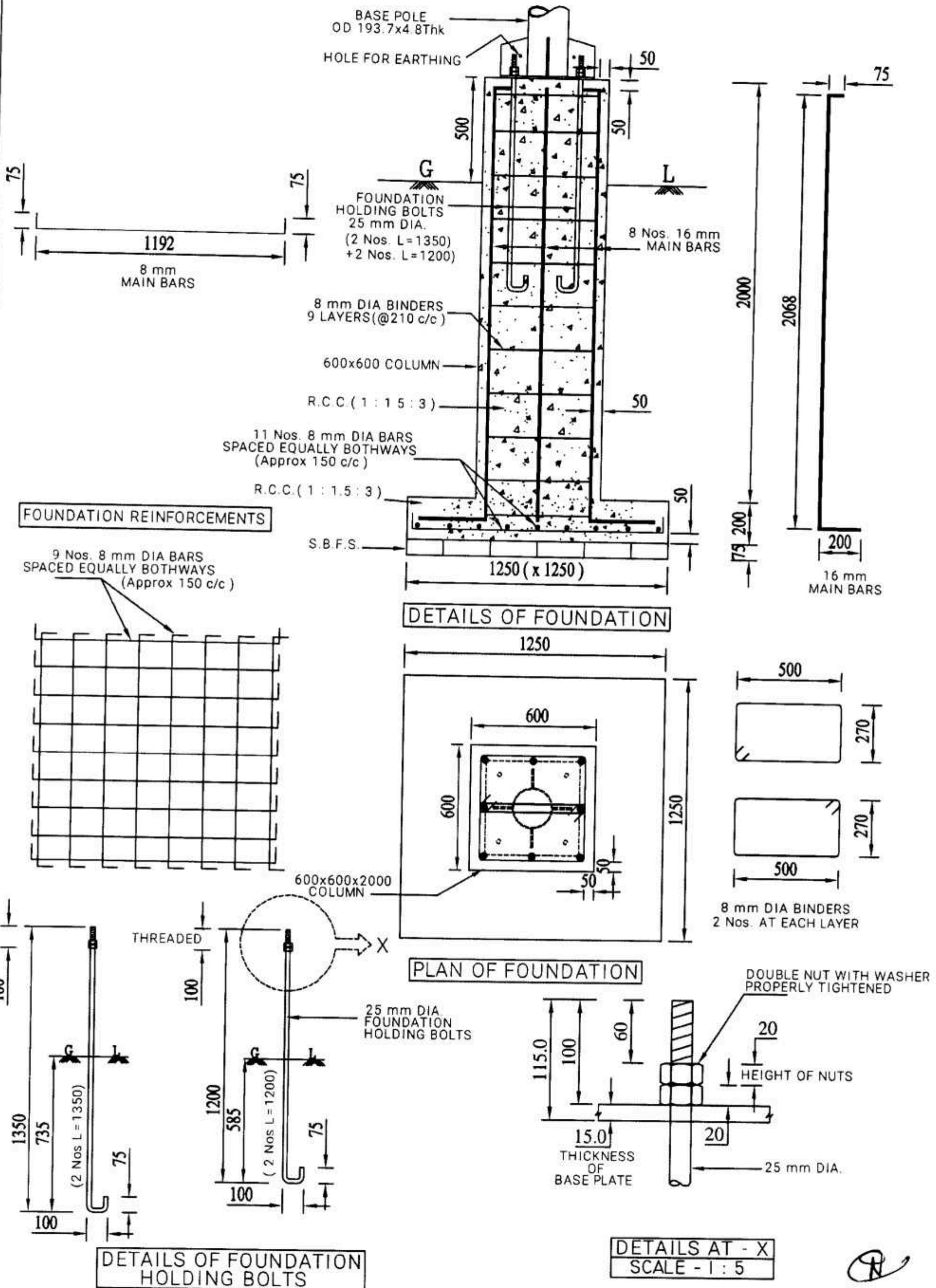


DETAILS AT - X
SCALE - 1 : 5

FOUNDATION DETAILS FOR 4 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM
ALL DIMENSIONS ARE IN MM U. O. STATED SCALE - 1 : 25

FOUNDATION DETAILS FOR 7/8 MMS



FOUNDATION DETAILS FOR 7/8 MMS

TITLE - DUAL AXIS MANUAL TRACKING TYPE MMS FOR SOLAR WATER PUMPING SYSTEM

ALL DIMENSIONS ARE IN MM U. O. STATED

SCALE - 1 : 25

BILL OF MATERIALS For structure holding 08, 06 and 04 nos SPV Modules

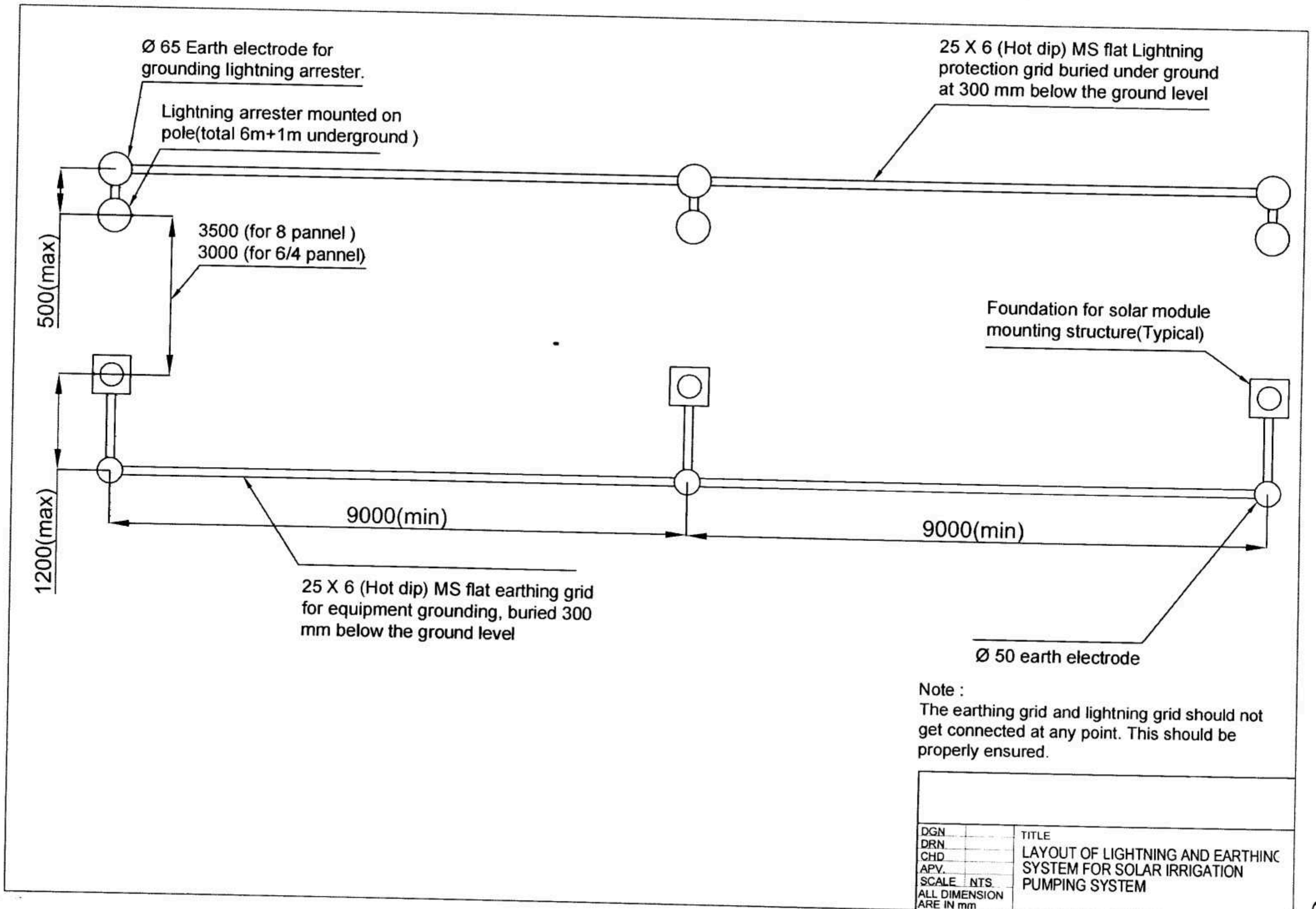
Sl. No.	Description of items	Qty	unit	length(m) /area(m ²)/ nos for 8 modules	length(m) /area(m ²)/ nos for 6 modules	length(m) /area(m ²)/ nos for 4 modules
1	Base pole (OD 193.7 X 4.8thk), IS 1161, 8 & 6 module	1	m	0.5	0.5	
2	Main Pole OD (168.3 X 4.5thk), IS 1161, 8 & 6 module	1	m	1.25	1.25	
3	Base pole (OD 165.1 X 4.8thk), IS 1161, 4 module	1	m			0.5
4	Main Pole OD (139.7 X 4.5thk), IS 1161, 4 module	1	m			1.25
5	Main Support OD(88.9 X 4.0 thk), IS 1161, 8 & 6 module	1	m	3.2	2.7	
6	Main Support OD(60.3 X 4.5 thk), IS 1161, 4 module	1	m			1.5
7	Rafter ISA 65 x 65 x 6, IS 808, 8 mod	3	m	3.245		
8	Purlin ISA 40 x 40 x 6, IS 808, 8 mod	4	m	4.2		
9	Rafter ISA 50 x 50 x 6, IS 808, 6 mod	3	m		3.245	
10	Purlin ISA 40 x 40 x 6, IS 808, 6 mod	4	m		3.136	
11	Rafter ISA 50 x 50 x 6, IS 808, 4 mod	2	m			3.245
12	Purlin ISA 40 x 40 x 6, IS 808, 4 mod	4	m			2.1
13	Cleat for fixing rafters with purlins (ISA 50 x 50 x 6 x 50 long) -8 module	12	m	0.05		
14	Cleats for fixing rafters with purlins (ISA 50 x 50 x 6 x 50 long) -6 module	12	m		0.05	
15	Cleats for fixing rafters with purlins (ISA 50 x 50 x 6 x 50 long) -4 module	8	m			0.05
16	Rafter-pole Tie ISA 40 x 40 x 6, IS 808	2	m	1.55	1.4	1.2
17	Rafter-pole Tie ISA 40 x 40 x 6, IS 808	1	m	1.92	1.92	1.92
18	Rafter-pole Tie ISA 40 x 40 x 6, IS 808	1	m	1.14	1.14	1.14
19	Base plate (0.41 x 0.41 x .015)	1	nos	1	1	
20	Base plate (0.350 x 0.350 x .012)	1	nos			1
21	Base Plate Stiffeners (0.180 x 0.100 x 0.008)(trapezoidal)	4	nos	4	4	4
22	Flange attached to OD 193.7 mm pipe (OD 340, ID 195 X 15thk)- 8 module	1	nos	1	1	
23	Flange attached to 168.3 mm pipe (OD 340, ID 170 X 15 thk)- 8 module	1	nos	1	1	
24	Flange attached to OD 152.4 mm pipe (OD 300, ID 154 X 10 thk)- 4 module	1	nos			1
25	Flange attached to 139.7 mm pipe (OD 300, ID 142 X 10 thk)- 4 module	1	nos			1
26	Slotted Flange stiffeners (0.06 x 0.06 x .008) - bottom	4	nos	4	4	4
27	Slotted Flange stiffeners and for fixing brackets (0.100 x 0.07 x .008)(trapezoidal) - top	2	nos	2	2	2
28	Slotted Flange stiffeners with curved slot for fixing brackets (0.320 x 0.070 x .008) - top	2	nos	2	2	2
29	Top plate (0.5 x 0.2 x .012thk), 8 module	1	nos	1		
30	Top plate (0.5 x 0.2 x .010thk), 6 module	1	nos		1	
31	Top plate (0.4 x 0.175 x .010thk), 4 module	1	nos			1
32	Top plate stiffeners (0.15 x 0.15 x 8thk)	2	nos	2	2	2
33	Ring/Metal strip ,15x3 mm	1	m	0.2	0.2	0.17
34	Clamp on main support for brackets (0.05 width x 0.4 long x 6thk)	2	nos	2	2	2

12

Sl. No.	Description of items	Qty	unit	length(m) /area(m ²) / nos for 8 modules	length(m) /area(m ²) / nos for 6 modules	length(m) /area(m ²) / nos for 4 modules
35	Plates on main pole for holding rafters, (0.100 x 0.25 x 10thk), 6 & 8 mod	3	nos	3	3	
36	Plates on main pole for holding rafters, (0.075 x 0.25 x 10thk), 4 mod	1	nos			2
37	Chord bolt, M12 x 50mm	2	nos	2	2	2
38	Bolt with nut, M20 x 70mm for slotted Flange		nos	8	8	8
39	Bolt with nut, M12/14 x 50mm for fixing the structure		nos	29	29	22
40	U clamp from 80 x 8mm M S flat, 400mm long with 4 nos 12Ø bolts for holding 80mm main support.	2	nos	2	2	
41	U clamp from 80 x 8mm M S flat, 280mm long with 4 nos 12Ø bolts for holding 80mm main support.	2	nos			2
42	Foundation holding bolts (25mm)1525mm, total length	2	m	1.525	1.525	1.525
43	Foundation holding bolts (25mm)1375mm, total length	2	m	1.375	1.375	1.375

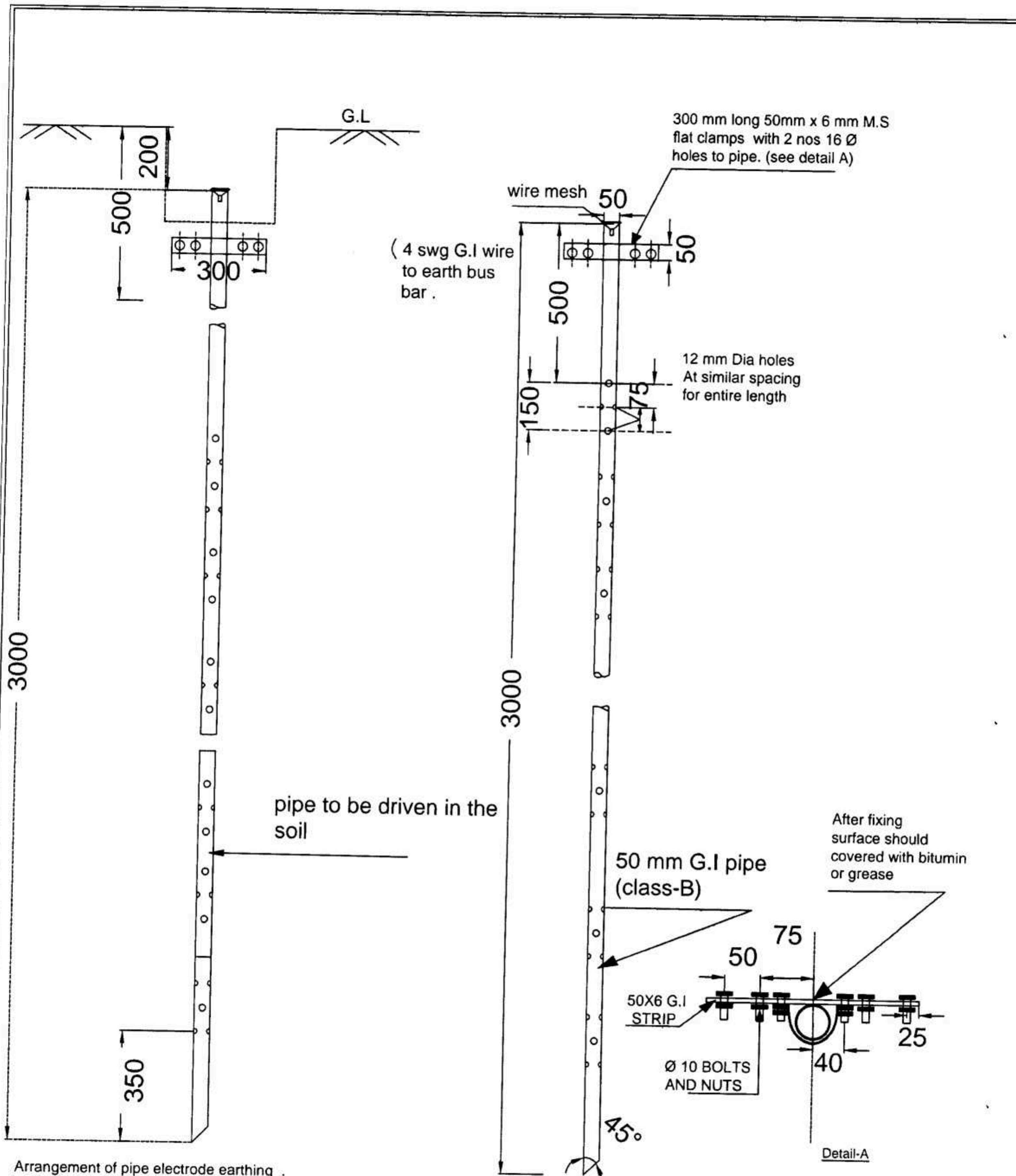
- Note: 1. All drilling and cutting edges if any after galvanisation should be protected from rusting.
2. The pipe material grade should be of Yst 240 as per IS 1161/1239 and E250 as per 1079/2062
3. Plate material grade should be Yst - 240 as per: - IS: 1161 / 1239 & E250 as per: - IS: 1079 / 2062
4. All structural steel should be Hot Dip Galvanized as per: - IS: 4759
5. Welding should be done as per IS: -822 & grade of welding wire should be (ER70S-6).
6. Tolerances applicable as per respective IS.

PR



Note :
 The earthing grid and lightning grid should not get connected at any point. This should be properly ensured.

DGN		TITLE
DRN		LAYOUT OF LIGHTNING AND EARTHING
CHD		SYSTEM FOR SOLAR IRRIGATION
APV.		PUMPING SYSTEM
SCALE	NTS	
ALL DIMENSION ARE IN mm		




Arrangement of pipe electrode earthing .

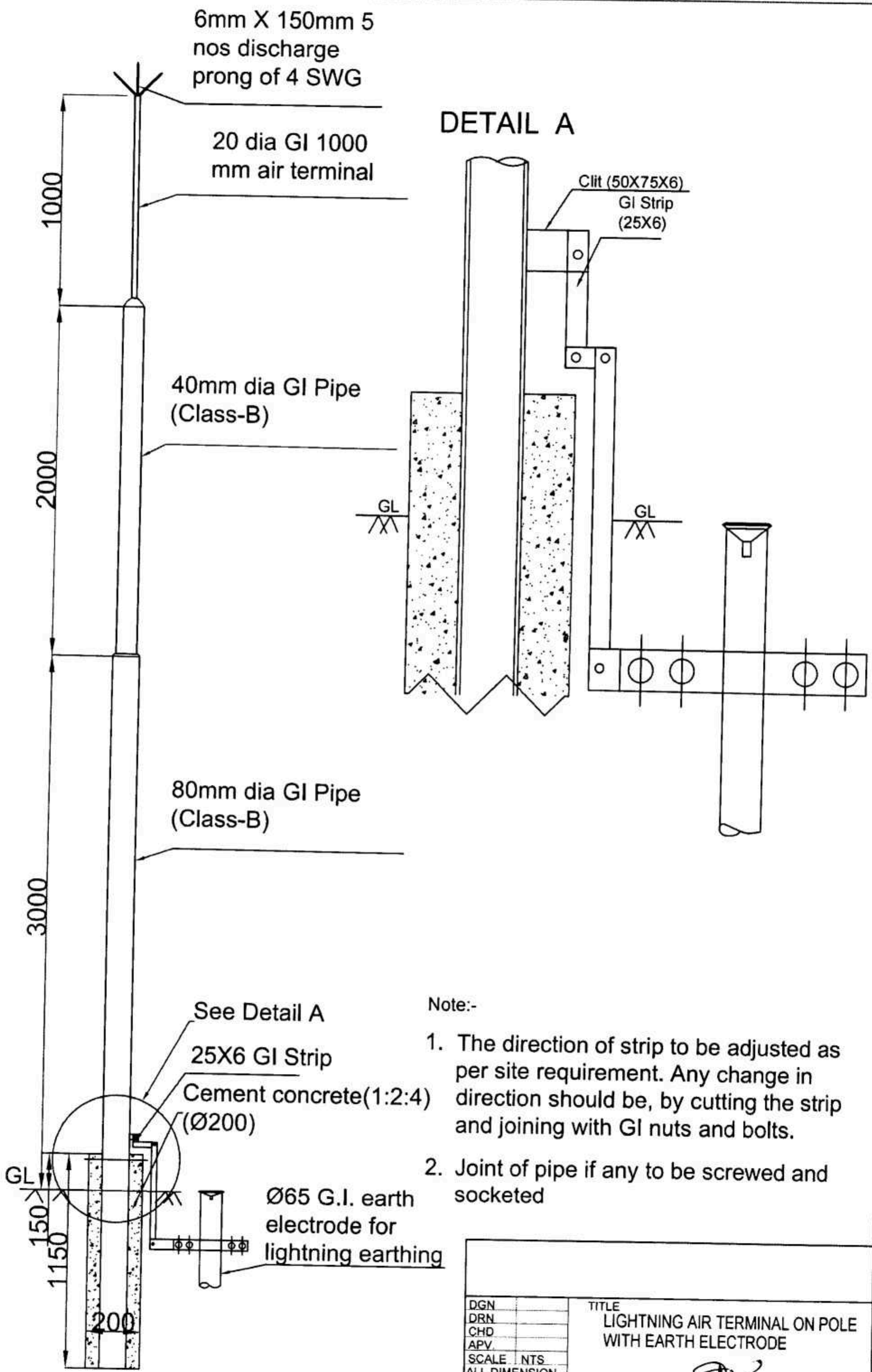
Detail of earth electrode.

Detail-A

TITLE: TYPICAL ARRANGEMENT OF AN
EARTH ELECTRODE FOR
EQUIPMENT EARTHING

All dimension are in mm

CONVENTION:  SCALE: 1:1



6mm X 150mm 5 nos discharge prong of 4 SWG

20 dia GI 1000 mm air terminal

40mm dia GI Pipe (Class-B)

80mm dia GI Pipe (Class-B)

DETAIL A

Clit (50X75X6)
GI Strip (25X6)

See Detail A

25X6 GI Strip

Cement concrete(1:2:4) (Ø200)

Ø65 G.I. earth electrode for lightning earthing

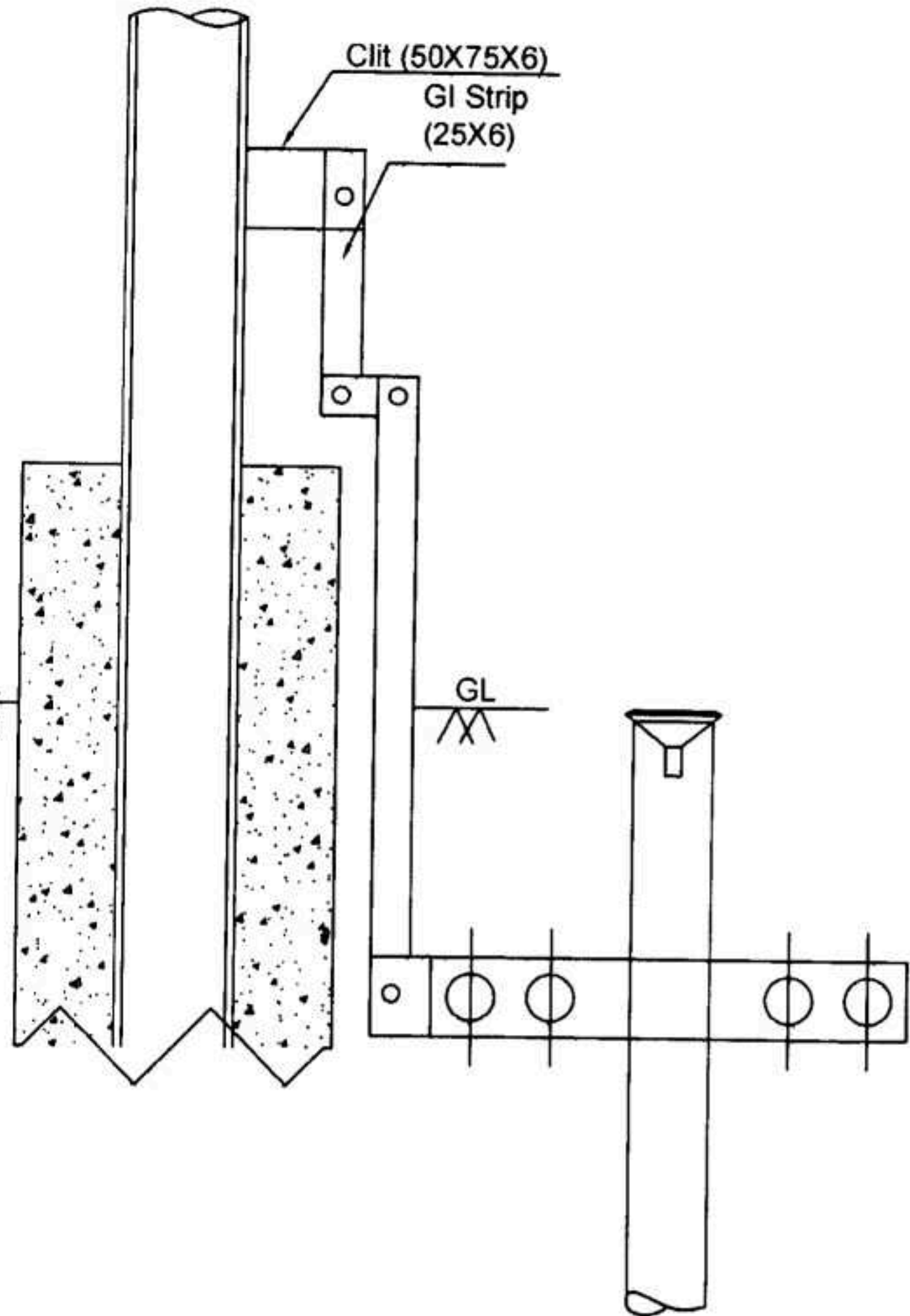
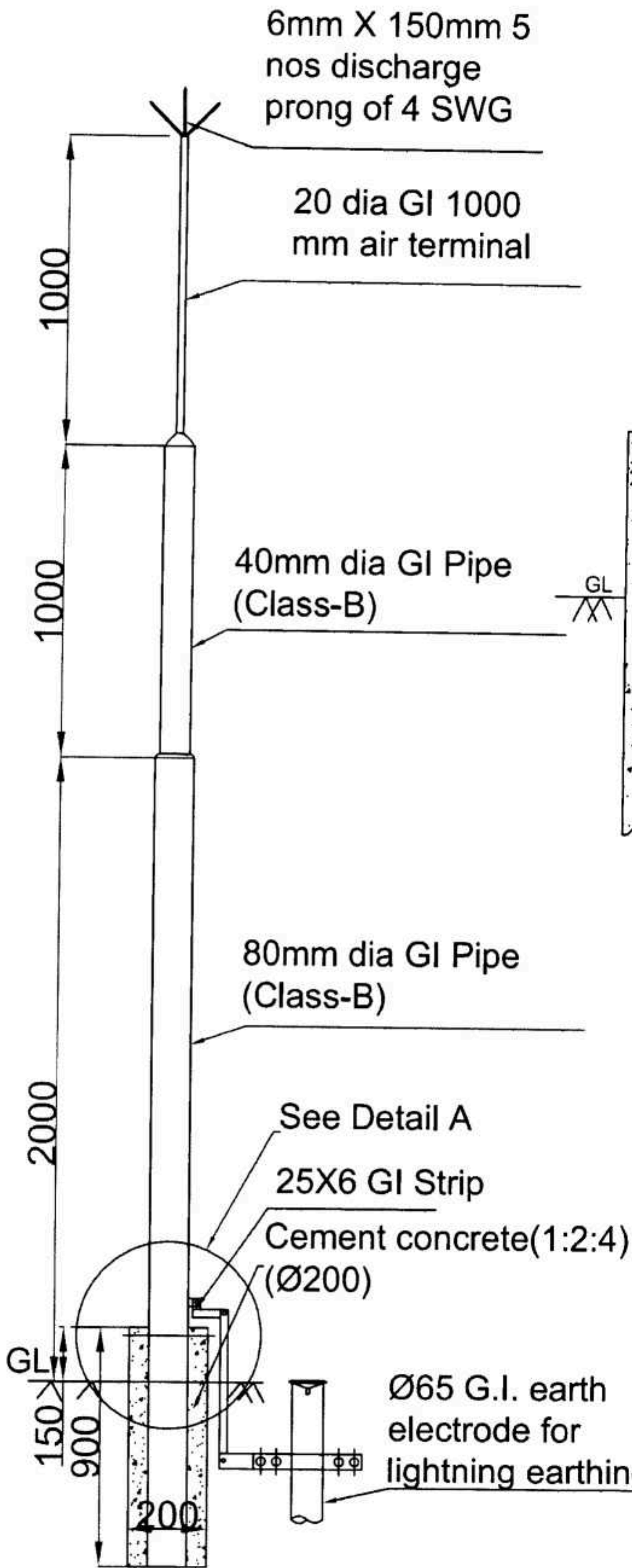
Note:-

1. The direction of strip to be adjusted as per site requirement. Any change in direction should be, by cutting the strip and joining with GI nuts and bolts.
2. Joint of pipe if any to be screwed and socketed

DGN	
DRN	
CHD	
APV	
SCALE	NTS
ALL DIMENSION	

TITLE
LIGHTNING AIR TERMINAL ON POLE WITH EARTH ELECTRODE

DETAIL A



Note:-

1. The direction of strip to be adjusted as per site requirement. Any change in direction should be, by cutting the strip and joining with GI nuts and bolts.
2. Joint of pipe if any to be screwed and socketed

DGN	
DRN	
CHD	
APV	
SCALE	NTS
ALL DIMENSION ARE IN mm	

TITLE
LIGHTNING AIR TERMINAL ON POLE
WITH EARTH ELECTRODE