1. Tilted Structure – Metal Roof
2. Flush Mounted Structure – Metal Roof
3. Tilted Structure – RCC Roof

Work Methodology for Roof top Projects - Metal Roof	
Step	**Activity**
A	**Site Safety Work**
1	**Proper Roof access**- Check that Monkey ladder/Staircase is available for roof access. Both side railing for Staircase & Vertical lifeline with Fall arrestor for monkey ladder must be installed to ensure safe access to Roof. Landing platform with both side railing is also required on roof.
2	**Temporary Safety Lifeline with Fall Arrestor-** Fix safety line with fall arrestor for safe manpower movement on roof where there is no permanent safety line or till permanent safety lifeline is not installed in that area.
3	**Safety Net-** Cover all skylights on roof with Proper size of Safety net to secure the skylights.
B	**Initial site work**
1	**On site Drawing Review-** Check Equipment Location, Cable routing, Earth Pit area etc is as mentioned in provided drawings. Please inform in case of any deviation to get the necessary approvals or make the necessary changes in drawings to avoid delay at the time of execution.
2	**Interconnection Point Verification**-Check the final interconnection point and ensure the feasibility to terminate the cable or install MCCB in given cubicle space in Client's panel as mentioned in drawing. In case the MCCB/ACB is already installed in Client Panel, please ensure that it is in working condition and Busbar space is sufficient to connect Solar Output Cable.
2	**Roof checking** for any damages and leakages
2.1	**Visual Inspection**- Visually check and mark on roof with paint and in drawing also for any damage found on site in presence of Cleint's representative.
2.2	**Water Leakage Test**- Pour water on roof & check for any water leakages from below the roof in presence of client's representative and mark the same on roof and in drawing.
2.3	**Prepare roof leakage test report**- Mention all leakage points and attach necessary photos in Leakage Test report. Get it signed from the client representative who was present at the time of test and send the signed report to Construction Manager for further necessary action.

6	Verification of Contractor tools physically with Tool list documents (Doc No.:)
7	In-between Site In charge will get Flash Test report in his mail ID to take confirmation weather the modules delivered at site is according to list or not
8	After confirmation, CM will submit the Module sorting list within 2 days.
9	Arrangement and Fixing of 3-4 Power Distribution Boxes for construction work - **By Vendor**
B	**Material receiving**
1	Check the documents received with truck-Weigh Slip/Packing List/Invoices/PO (If document not received please do not unload the material and immediately inform to CM)
2	Take photo of Truck before unloading the material
3	Identify the material as per packing list/Invoice
4	Take photo of every material during unloading and Check the material for any damages/fatigue/loose condition, if any Damage material found, then prepare a Damage Report and mention the damage details in LR Copy
5	Prepare damage Report and attach damaged material pictures in it. Send the Damage report to Warehouse team keeping CM in CC.
6	Counting of every material and after counting preparation of Goods Receipt Note (GRN)
7	Preparation of GRN in ERP
D	**Demo Structure Preparation**
1	Preparation of Walkway and structure Demo on ground with placement and connection of all related accessories to understand the fixing arrangement. Submit the photos to Structure Design Department for Necessary Approval.
E	**Project Execution**
1	**Visual Edge Barricading Work**- Barricade the roof with Barricading post, Rope & Caution tape to mark the area in which work will be done. No Manpower movement allowed outside the barricaded area on roof. Barricade the area around turbo vents also to restrict the manpower movement near turbo vents.

2	**Safety Net**- Cover all skylights on roof with Proper size of Safety net to secure the skylights.
3	**Start Marking work** - Please ensure marking work done as per drawing with proper measurements
4	Shift Only small quantities of material on Roof to avoid damage to roof sheet due to excess load.
6	Stack all required material in boxes to avoid material loss and cleaning
5	First Walkway & Safety lifeline work should start with suitable no. of Manpower to avoid access loading on metal roof
6	After getting final approval, fix one proto-type structure in metal roof
7	Take Photo of Fixed Proto-type structure and its connection from different angles and submit the photos for Approval, after getting approval please start structure erection.
	Please Note: Engineer must ensure water pipeline work should complete just after completion of walkway work.
8	After getting the approval, please install all the structure accordingly
9	In parallel start marking of SMCB, Inverter, ACDB, IPLON location, earth pit location, Earthing Strip Path (From Metal Roof to earth pit location) as per drawing (For any confusion, deviation please take approval)
10	After above equipment installation, Start Cable Tray work for Inverter's, TVM, Isolator Panel, ACDB, IPLON, etc. as per drawing
11	After getting approval start above equipment mounting, earth strip laying and earth pit work in parallel
12	After installation of SMCB, Inverter, TVM, Isolator Panel, ACDB, IPLON, earth pit and earth strip laying work take photos of every section and send the same for information - Do not terminate the earth strip at earth pit and equipment side.
13	According to module sorting list please make modules group according to the list and distribute the group modules according to group sorting list
	Fill checklist before module installation and send to EHS Head, Zonal EHS lead & CM for approval along with Roof photos.
14	After getting approval for module installation start installing Modules according to the Module Layout.(Ensure Module shifting on roof is being done in proper cages to avoid damage of modules as well as roof sheet, please ensure that module cage is suspended on roof and the cage is not resting on roof sheet to avoid damages due to combined heavy weight of cage and modules)

15	**Start DC Wiring/String work (From modules to SMCB and SMCB to Inverter) -** Do not terminate the cable
	In parallel start AC cabling work (from inverter to ACDB to TVM to Isolator Panel to Client Panel) - Do not terminate the cable
	Please conduct meggar test for DC cable and AC Cables before cutting the cable and prepare the report. Also Prepare cable drum schedule for
	a. All major cables
	b. Prepares cable register (DC Cable and AC cable actual laying length for making as built cable schedule)
	Please Note-
	a. ferruling is must require before any termination of the cable in case of DC Cable
	b. Aluminium Tags must require for cable identification (From and To) in case of AC Cable
16	Earthing wire should come inside the cable tray as per drawing (for equipment's)
17	Conduct earthing resistance test of each and every earth pits and prepare a report for documentation
18	After taking earth resistance of earth pits, terminate the earth strips in both sides (Equipment & Earth Pit)
19	Communication work can be done in parallel with DC cabling work including DG Sync cabling
21	Identify the location of sensor according to drawing before installation, After that Install all the sensors.
22	Start communication cabling work
23	Please Note - Communication cable will always be laid inside conduits. Please check continuity after cable laying.
24	Before termination of cables, conduct visual check of all the cables - Please take photos of all the dressing work and send to CM for approval
25	Install meter on customer DG Panel.

26	Terminate all the communication cables in IPLON/Gauranga including DG Sync cable.
27	Terminate all the cables in TVM, Isolator Panel, ACDB, Inverter, SMCB (Please ensure sufficeint torque as required is applied after termination)
28	Also conduct testing of DC System (+ve to GND and -ve to GND, +ve to -ve, Current and Voltage) and make a report for documentation - Time in-between 10:00 AM to 3:00 PM
	After all work is finished at site for Test charging, please drop a mail confirming the date of Test charge.
	Cms will confirm the date of test charge to O&M team to witness the test charge, and also to regulatory team to confirm the site readiness for CEIG visit.
	CMs will ensure that they reaches site 1 day before the test charging date to check all connections, quality of work and plant readiness for test charging.
	After ensuring that everythig is in order and site is ready for test-charging, CMs will fill the Test-charging Checklist and will mail it to Project Head & EHS head to takee permission for test charging.(Please attach photos of Cable laying in Cable tray, Cable terminations, Equipment earthing, Dressing etc along with checklist.)
	After getting the required approval from Project Head, CM will test charge the plant in the presence of O&M team.
29	In case of doubt/query in commissioning of Inverters, please refer Inverter Manual supplied with the inverter or contact reporting Manager for better understanding.
30	Please Note:
	1. If string voltage is not proper, then check string for any damage or loose connection, also check if the numbers of modules connected in that particular string is same as mentioned in drawing.
	2. Also check torqueing of connection as per manual
	Immediate after inverter charging, ask client to provide permission for DG Synchronising (the same should be on written basis)
	If customer agrees for the same, immediately plan the date for the same and inform the same to Iplon/Gauranga team and complete the DG Synchronisation
	If customer does not agree for the same, immediately mail the same to CM, CM will mail or discuss with the client to provide the approval and date for the same.
	After getting the date please plan for DG sync.

Please Note: If the same is getting late (SLA is 10 Days after Charging of the plant) immidiatly raise the issue to higher concerns, and discuss the same with Sr. Construction Manager for further plan or action.
After Inverter commissioning conduct PR test on each string individually (Please note PR should come more than 75%)
Note: Please refer PR test method given below
After preparation of string connect one string to inverter
Then start the inverter
Calculate the string power (Standard)
Example: String of 20 modules of 300 Wp having standard power is
P = 20X300 Wp
P = 6000 Wp
Note the instantaneous power (In inverter screen)
Note the instantaneous irradiation (from web portal)
Calculate the PR of string using formula:
PR = ((Instantaneous Power X 1000)/ (Standard Power X Instantaneous Irradiation)) X100
If PR of string is coming less than 75% then please check the string connection, cable laying, MC4 connection termination etc.
Please send all the report to office for approval (Earthing, String PR, String voltage and current, meggar, cable schedule, AC side parameter)
After approval Please keep all switches in off condition
First Switch ON all the SMCB and Inverter Isolator then switch ON the CB of Client Panel Then Switch ON all inverter MCB's in ACDB at last switch ON ACDB main Incomer, please ensure at the same time isolator should be in ON condition.

36	After charging of the plant Engineer must give first level punch points to the contractor in which all the pending/bad work should include.
37	After completion of the pending and punch point given by Site Engineer, Site Engineer will provide the invitation mail for Quality and O&M audit to CM, CM will mail further to concern departments.
	Please Note: Before inviting both department Site Engineer must complete and submit following:
	1. Final FQP with all work closer
	2. Pre-Commissioning Report
	3. As Built Drawings (All Mechanical and Electrical)
	4. As Built Cable Schedule
	5.MMS, Walkway, Module & MC4 checklist
	6. As Built BOQ
38	During the visit of O&M and Quality, Site Engineer will again test the roof in front of them and will generate the final leakage report, if any leakage found at that time Site Engineer will rectify the same with the help of contractor/structure team/Sr. Construction Manager.
38	O&M and Quality Dept. will mail the report to Construction (Within 3 Days), after getting the report getting report site engineer will forward the report to contractor and will take the action plan for rectification work and complete all the punch points/pending points within 5-10 Days and will generate the compliance report along with photos (Old Vs rectified).
39	After completion of all the work Engineer will make report for balance material reconciliation after counting (Balance material entry will be in the Standard BOM for Electrical and Mechanical) and submit the same to CM.
40	CM will mail the balance material details to Procurement/Logistics for arrangement of the truck.
41	After arrangement of truck Procurement/Logistics will inform the site Engineer, after loading of the material from site, Engineer will demobilize from the site

Tilted Structure on RCC Roof

The methodology of Tilted structure on RCC Roof is same as Tilted Structure on metal roof except few points:

1. In RCC Roof there is no requirement of water leakage test.
2. No requirement of walkway in RCC Roof
3. Roof clamp/base rail/Z Flashing installation is replaced by RCC Chipping and drilling work for anchor fastening.
4. After structure erection, pedestal preparation (Small foundation covering column base plate.
5. Rest all the methodology is same.