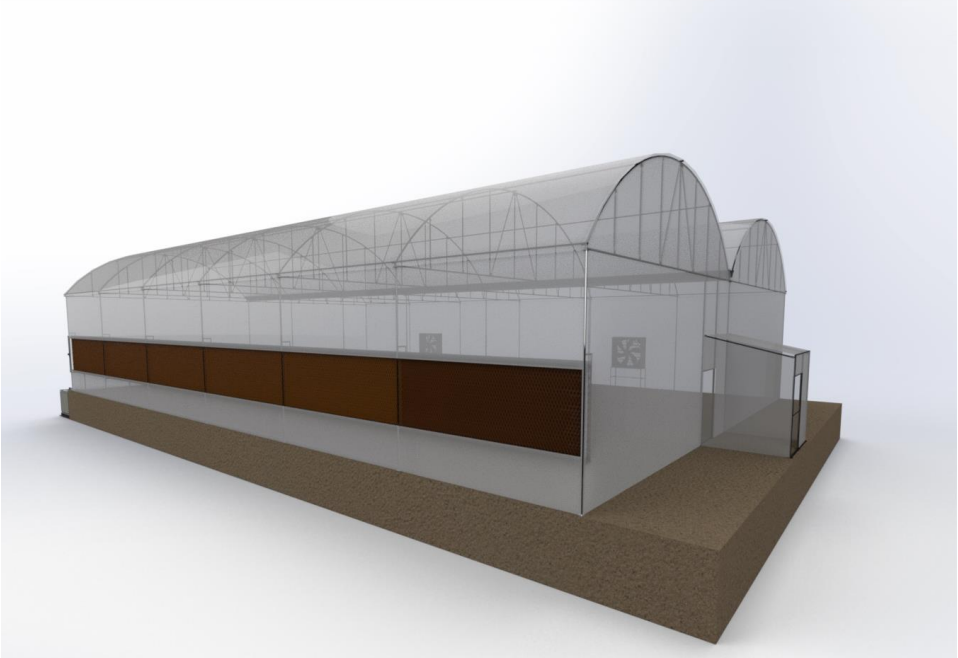
VIGYAN ASHRAM

Do-It-Yourself Manual

POLYHOUSE FAN-PAD SYSTEM



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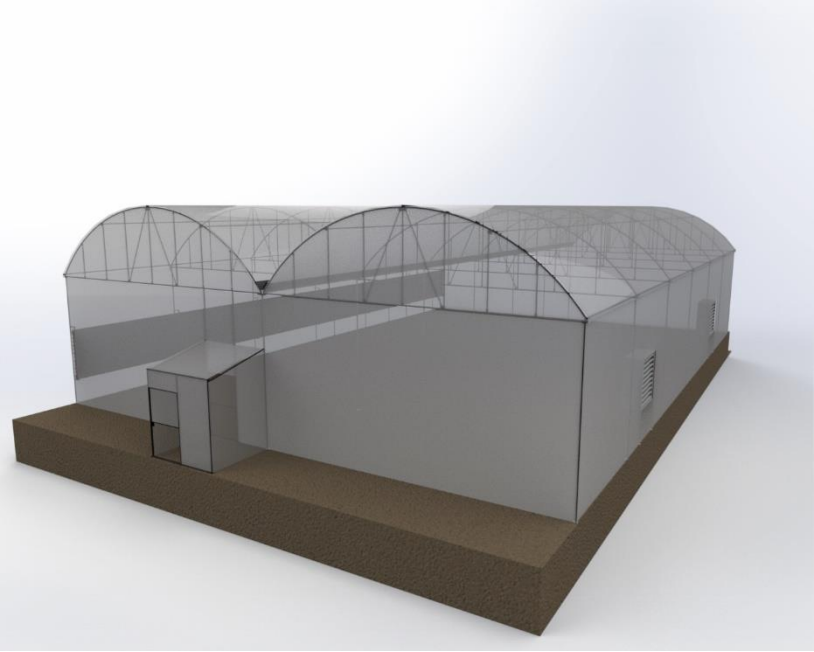
Vigyan Ashram has designed & developed a fan-pad based climate-control polyhouse structure for Precision Agriculture practices as well as for farmers. Users of the manual will be able to build their own climate-control polyhouse structure using this manual. All the Bills of Materials (BOM) and dimensions of the systems are given in the design. We have provided designs files drawn using Solidworks along with this manual. Users are suggested to read the manual carefully along with the site conditions before the fabrication of the unit.

Please watch following video carefully:

- https://www.youtube.com/watch?v=A-EQcbzReaY
- https://www.youtube.com/watch?v=7FMvg_0gyuE
- https://www.youtube.com/watch?v=j70iWCQO6Uw
- https://www.youtube.com/watch?v=J8ZZegIFk-I
- https://www.youtube.com/watch?v=ndURntKGT20
- https://www.youtube.com/watch?v=OKPIwFeCYZg

2. Purpose of Manual

- To share the standardized design of Polyhouse Fan Pad System suitable for Precision Agriculture practices as well as farmers.
- Design to be made available online for local fabricators to build Polyhouse Fan Pad System for their customers.



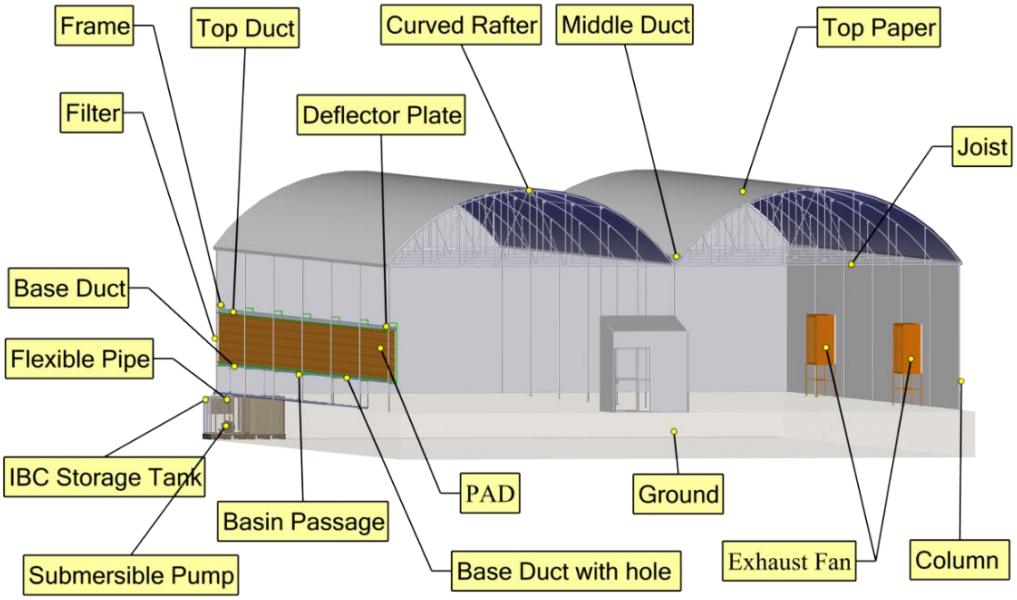
During fabrication of the system, we should use safety equipment such as hand gloves, shoes and glasses.

(And as appropriate)

4. Product Description

This is a Polyhouse Fan Pad System. This system can be deployed on plain ground. A Polyhouse is typically made from G.I. and covered in UV stabilized polyethene film. For structure, this system has the following main parts are G.I. Truss, truss supports & Columns. The system consists of 14 G.I. Truss & truss supports as well as 21 Columns. On one side of the structure has Cellulose Pads (Honeycomb Structure) and on the opposite side two Fan units of 1.1 KW AC motors. For cooling of pads, water is delivered through the distribution pipe.

The detail view and BOM are shown in below:



5. Features

- Total area required: (28 m*16.12 m) = 451.36 mtr^2 = 4858.40 sq. feet
- Method Used: Polyhouse Fan Pad System
- Requires less area to get maximum yield and benefits.
- Uniform and better quality
- Reduction in labor cost
- Less fertilizer requirement, thus reduction in fertilizer cost.
- Low water requirement thus saving in water.
- Fewer chances of disease attack, thus reduction in disease control cost.
- Higher Efficiency of Water & Fertilizer Use.
- Cultivation in problematic topography, soil conditions & climate conditions.
- Easy to operate, maintain & control.
- UV stabilized covering materials of Polyethylene film.
- Air circulation fans
- The heating system in a cold climate.

- The prefabricated structure makes it easy to assemble & disassemble.
- Operation of CO2 Generator, Climate Control, Temperature, Humidity, Heat Radiation, Control of EC, PH, PPM level in irrigation water etc. as required to the plant.

- Uses:
    - Production of vegetable crops, Flowers & Herbs.
    - Nursery.
    - Secondary hardening nursery of Tissue cultured plant.
    - Growth / Production of rare plants, orchids/herbs, medicinal plants.

NOTE: There is no conclusive evidence that produce grown in polyhouse are more nutritious or healthier than produce grown by any other method.

No.	Part Name	Dwg. Ref (pdf)	Qty.
1.	Column & tie plate	VA2021-P002-01-0001	14
		VA2021-P002-01-0001(a)	1
		VA2021-P002-01-0001(b)	2
		VA2021-P002-01-0001(c)	6
2.	Curved Rafter 1	VA2021-P002-01-0002	2
3	Curved Rafter 2	VA2021-P002-01-0003	10
4	Curved Rafter 3	VA2021-P002-01-0004	2
5	Joist	VA2021-P002-01-0004-1002-2	14
6	Ridge Side Pipe	VA2021-P002-01-0004-1002-3	12
7	Purlin	VA2021-P002-01-0004-1002-4	24
8	Ridge Top Pipe	VA2021-P002-01-0004-1002-5	24
9	Strut	VA2021-P002-01-0004-1002-6	14

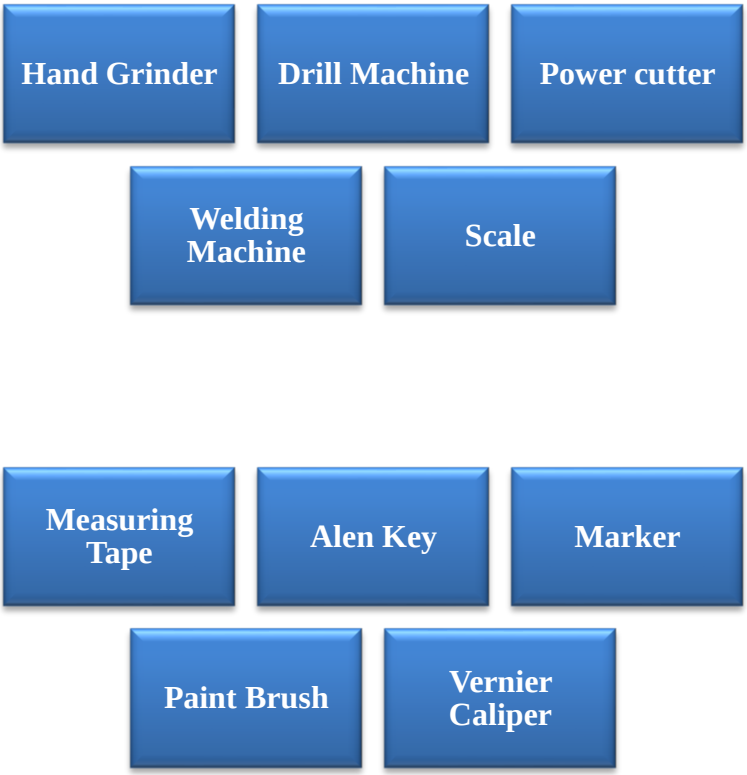
10	Chord(1938mm)	VA2021-P002-01-0004-1002-7	28
11	Chord(1612mm)	VA2021-P002-01-0004-1002-8	28
12	Chord (990mm)	VA2021-P002-01-0004-1002-9	28
13	PAD Holding Structure	VA2021-P002-02-0002-1003-1	1
14	Upper Duct	VA2021-P002-02-0002-1003-2	10
15	Base Duct without hole	VA2021-P002-02-0002-1003-3	5
16	Base Duct with hole	VA2021-P002-02-0002-1003-4	5
17	Gutter	VA2021-P002-02-0002-1003-5	10

7. Parts for purchase

Sr. No.	Part Name	Specification	Qty.
1.	FAN	1.1 Kw, 6.54 Amp	2
2.	PAD	4000*100*1450mm(l*b*h)	6
3.	Basin Passage	1''	5
4.	FTA	1''	9
	MTA	1''	1
5.	Elbow	1''	1
6.	Elbow	1.5''	1
7.	Elbow	2''	1
8.	Tee	1.5''	1
	Tee	2''	2
9.	Reducer	40-63mm	1
10.	Deflector Plate	6m	10
11.	Filter	Water Tank Screen Filter	1
12.	Nipple	1"	2

13.	Flexible Pipe	1”	1
14.	Submersible Sludge Pump	1 HP	1
15.	Storage Tank (IBC)	1000 lit	2
16.	PVC Pipe	1” (6m)	7
17.	PVC Pipe	1.5’’(6m)	1
18.	PVC Pipe	2’’(6m)	1
19.	End Cap	1”	1
20.	LDPE Polyhouse Paper	200 Micron	1

8. Tools required



9. How it works? Polyhouse Fan Pad System

A greenhouse is basically the purpose of providing and maintaining a growing environment that will result in optimum production at maximum yield. Agriculture in a controlled environment is possible in all the regions irrespective of climate and weather. It is an enclosing structure for growing plants; the greenhouse must admit the visible light portion of solar radiation for the plant photosynthesis and, therefore, must be transparent. At the same time, to protect the plants, a greenhouse must be ventilated or cooled during the day because of the heat load from the radiation. The structure must also be heated or insulated during cold nights. A greenhouse acts as a barrier between the plant production areas and the external or the general environment.

A polyhouse is a specially constructed structure like a building for growing plants under controlled conditions. It

is covered with a transparent material like polyethene as such permits the entry of natural light. The polyhouse is covered hence it provides protection to crops from harmful UV rays, excessive rainfall, frost, pests and conserves carbon dioxide for higher yield. Polyhouse provides favorable growing conditions to crop so that we can have maximum yield and as we can have controlled climatic conditions so we can also have off seasonal produce. In polyhouse drip irrigation is used which saves water and also helps in getting a higher yield.

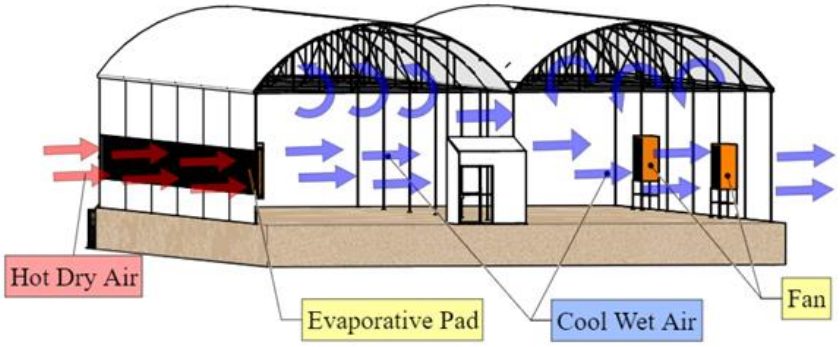
Polyhouse Fan Pad System

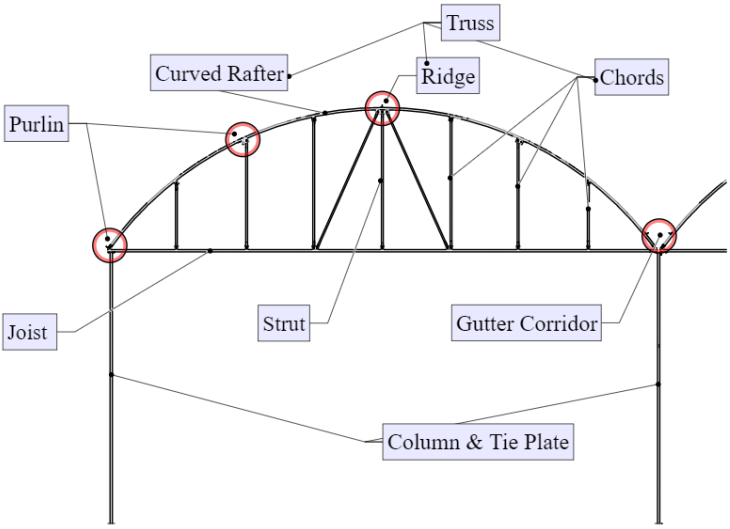
In this system, Cooling pads are mounted in one end wall or sidewall of the Polyhouse. They are supplied with water from a pipe above the pads and excess water is collected in a gutter at the bottom. Air drawn through the wet pads

by slow axial fans mounted in the opposite end wall or sidewall is saturated and cools the greenhouse.

Evaporative cooling, which uses the heat in the air to evaporate water from plants and other wetted surfaces can be used to cool the greenhouse as much as 10 to 12^0 C below the outside temperature. Although evaporative cooling is most effective in dryer climates.

The heat that is needed for evaporation is taken from the air itself. The air that leaves the pad is therefore cooled and humidified simultaneously without any external energy supply for the evaporation process.





Truss:

- Structural component that supports the weight of the greenhouse roof.
- Consists of rafters, struts, and chords.

Purlin:

- Purlins run along the length of the greenhouse.
- Keep the roof trusses aligned.

Ridge:

- Where the roofs come together at the top of the greenhouse.
- Many greenhouses have a ridge vent(s).

Aluminum is the most economical material for constructing the greenhouse frame. It can be shaped as needed to form various structural components of the greenhouse and needs no maintenance after installation. Aluminum framing also has the longest life span and allows for light reflectance.

Steel is commonly used but must be painted or galvanized to resist high moisture conditions within the greenhouse. Steel needs more maintenance than aluminum and is heavier, requiring additional support.

Wood was once a common framing material, but it has steadily lost popularity for a number of reasons. The main disadvantage of wood is that it deteriorates over time. If wood is desired, pressure treated lumber should be purchased and then treated with commercially available coatings.

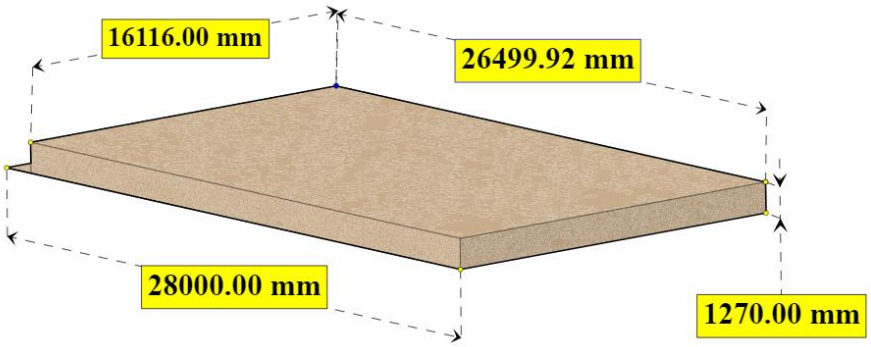
Steel, aluminum is used to build frames for greenhouses. Steel and aluminum are used for posts, beams, girts, purlins, trusses, and arches. Both materials shall be protected from direct contact with the ground to prevent corrosion. Silver paint on either material will improve the light reflection in a greenhouse structure. The rate of heat loss through steel or aluminum is much higher than through wood, so metal frames may need special insulation.

10. Process of Assembly

1. Ground Preparation
2. Truss & Column Assembly
    a. Column & tie plate
    b. Truss Assembly
        i. Curved Rafter
        ii. Joist
        iii. Ridge
        iv. Chords
        v. Strut
    c. Complete Truss & Column Assembly
3. Attaching FAN-PAD to ready to fit Structure
    a. FAN structure
    b. PAD Assembly
        i. PAD Holding Structure
        ii. Upper Duct
        iii. Middle Duct
        iv. Base Duct
            1. Water outlet piping
        v. PAD
4. Final Assembly
    a. Water Distribution Piping
    b. The outer cover of LDPE paper

10.1. Ground Preparation

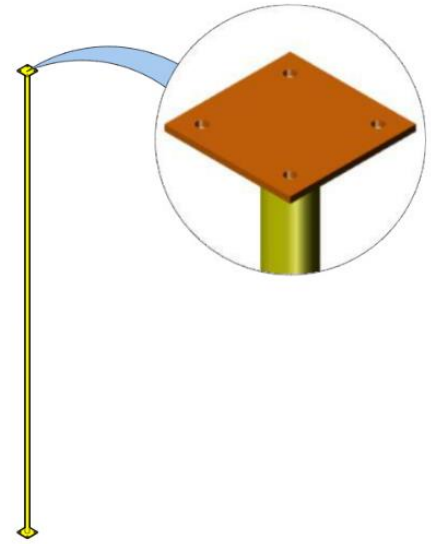
The ground slope for drainage of water is important and may be provided. Greenhouses shall be placed on a gravel base. Swales between greenhouses structures are necessary to direct the water from the area. A topographic map of the area will indicate surface drainage routes. The ideal greenhouse structures site would have a slightly southern facing slope (less than 3 %) for good winter light and protection from northern winds.

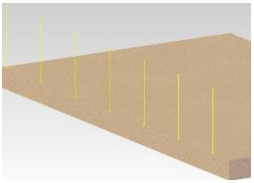


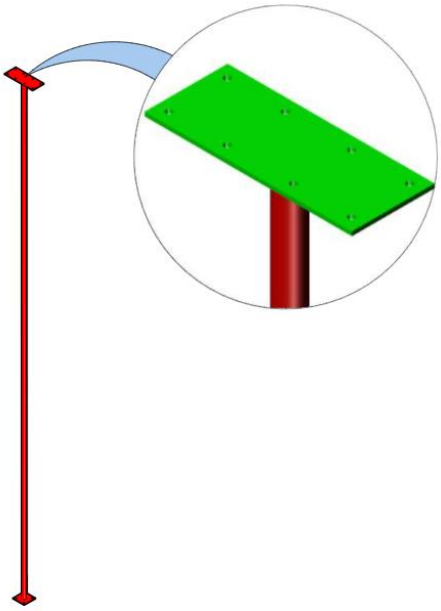
Foundations

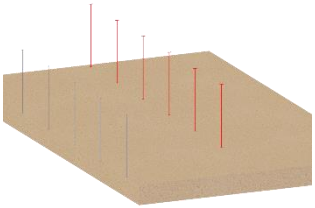
Pier foundation may be adequate for a primary greenhouse frame, consisting of hoops spaced one meter or more. A curtain wall can be used to close the area between the piers. If primary frame members are spaced less than 1.2 m, a continuous masonry or poured concrete wall should be used. The footing should be set below frost level or to a minimum depth of 600 mm below the ground surface whichever is greater. Individual pier footings should be sized to fit the load and soil conditions. Floors Gravel, pea stone, and trap rock make a good floor material. A thickness of 150 to 200 mm is needed for drainage and weed control.

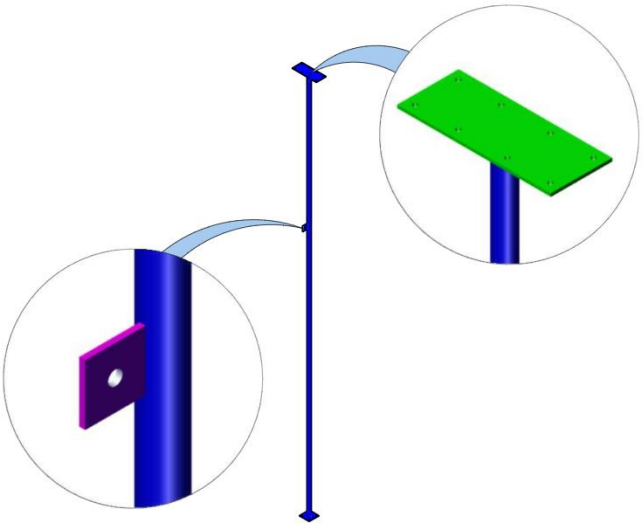
10.2.a. Column & tie plate

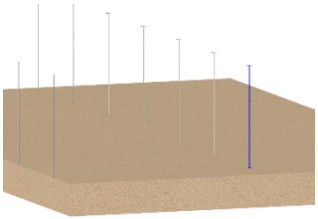


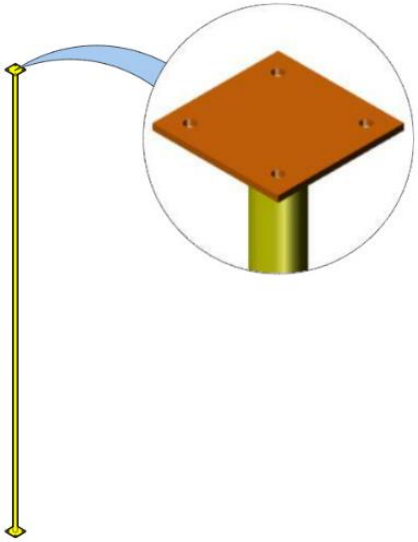


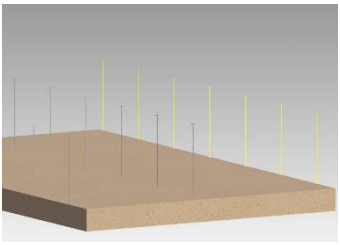


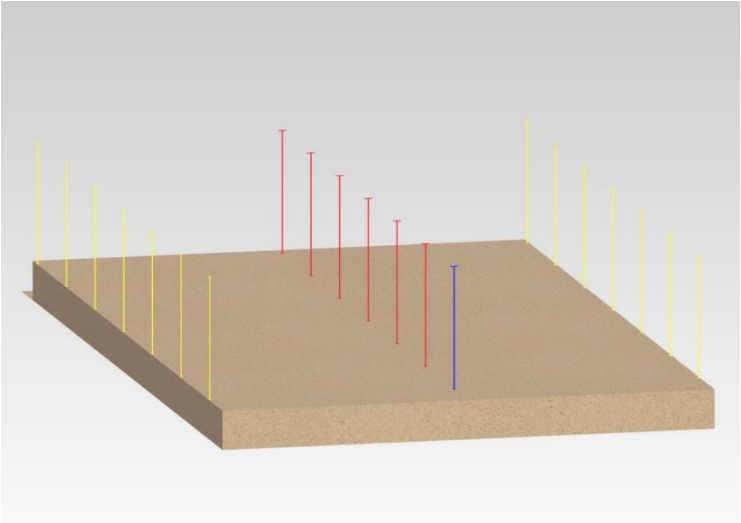












Sr. No.	Dwg. No.	Color
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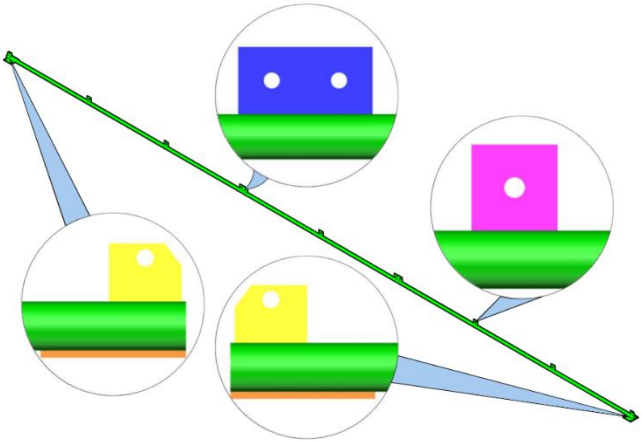
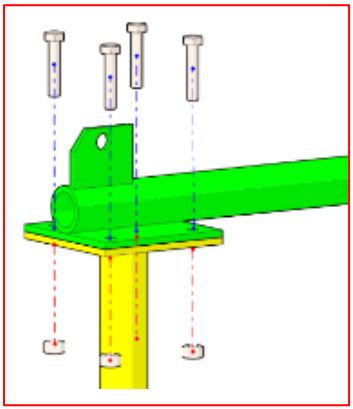
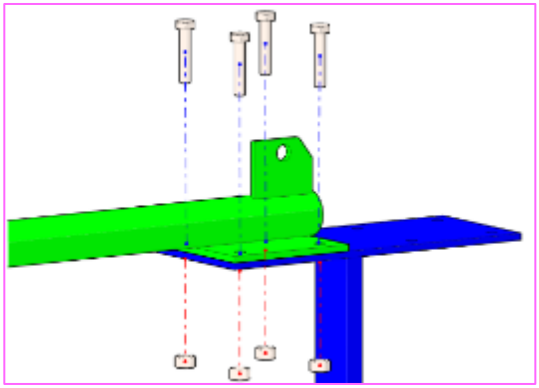
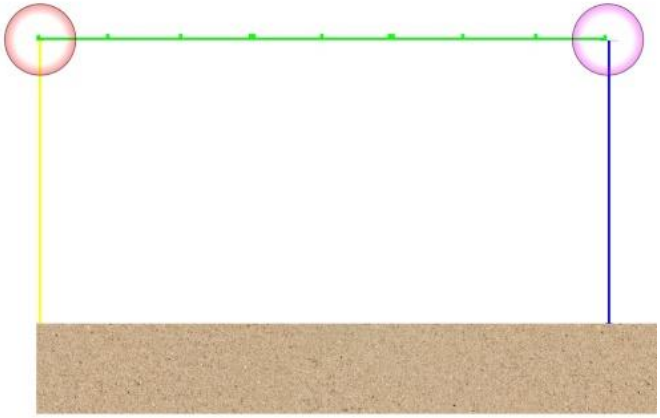
3.	VA2021-P002-01-0001(c)	

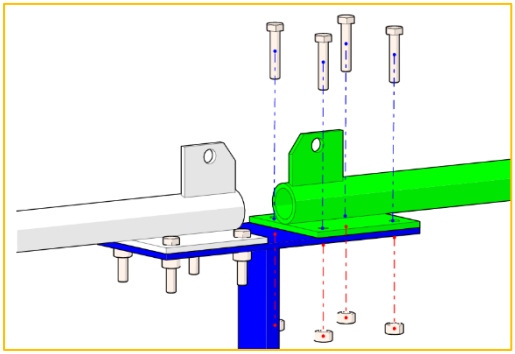
Joist

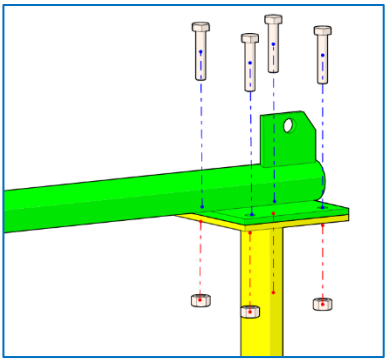


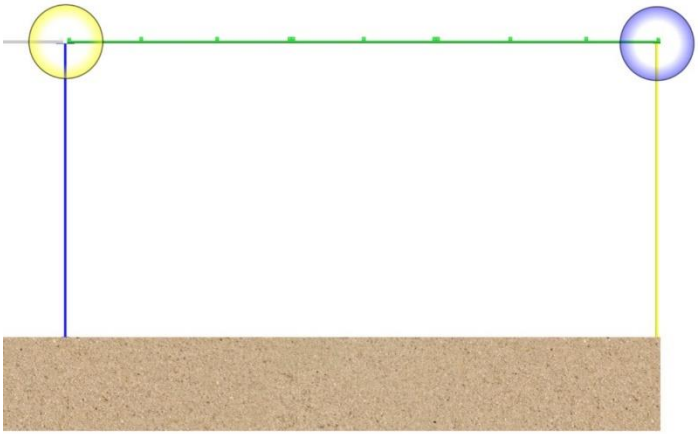


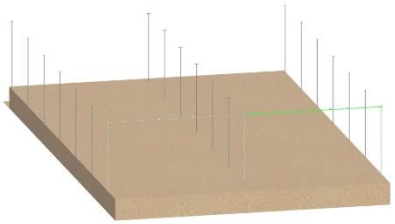


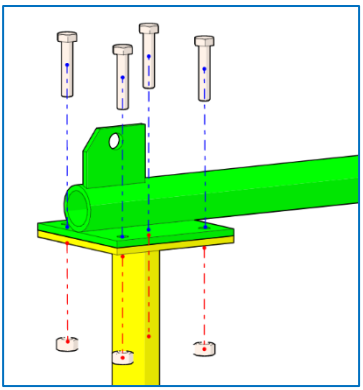


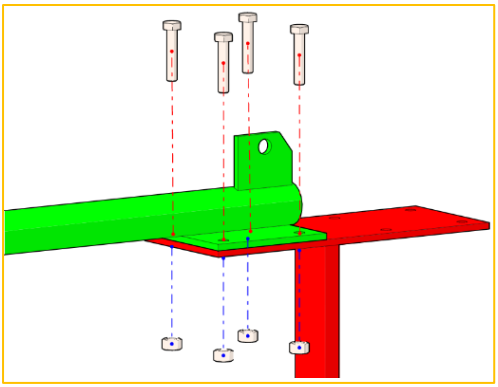


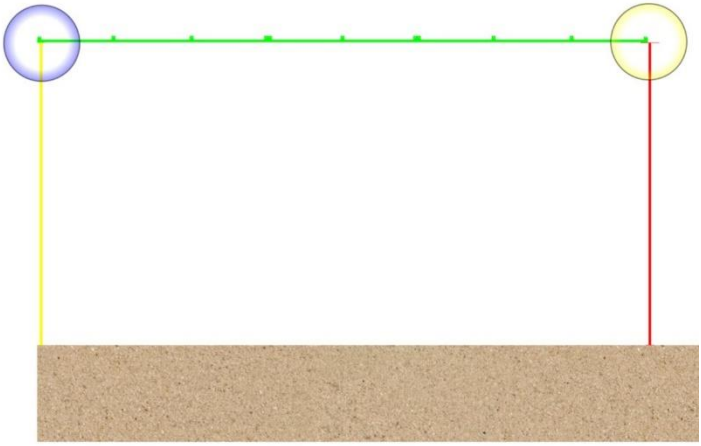


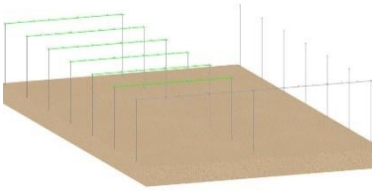


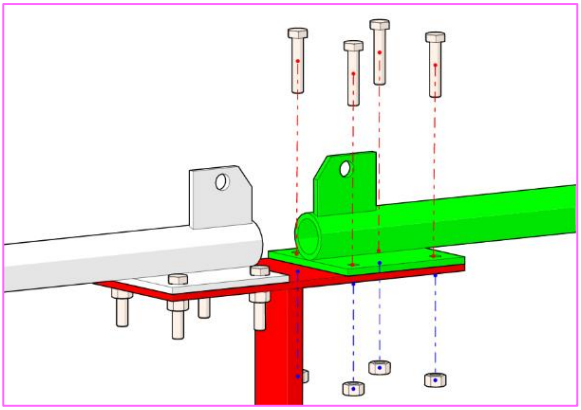


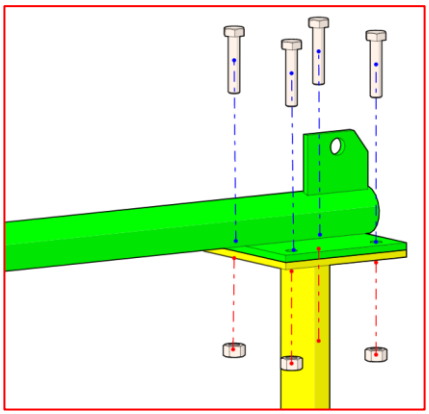


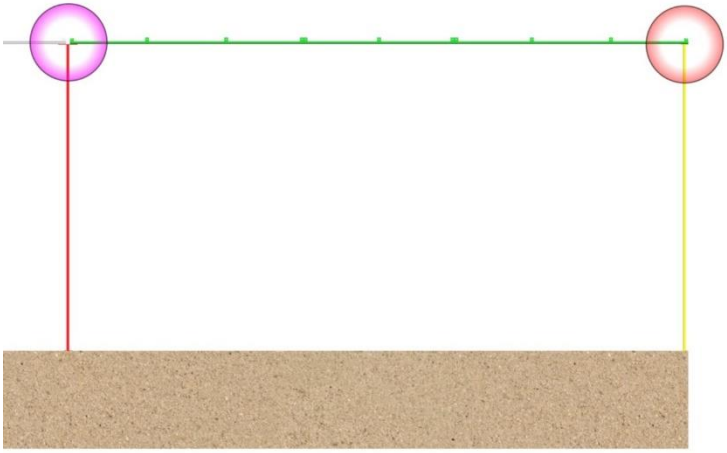


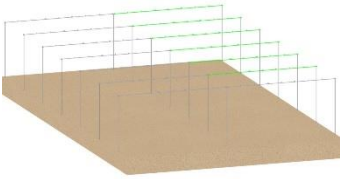




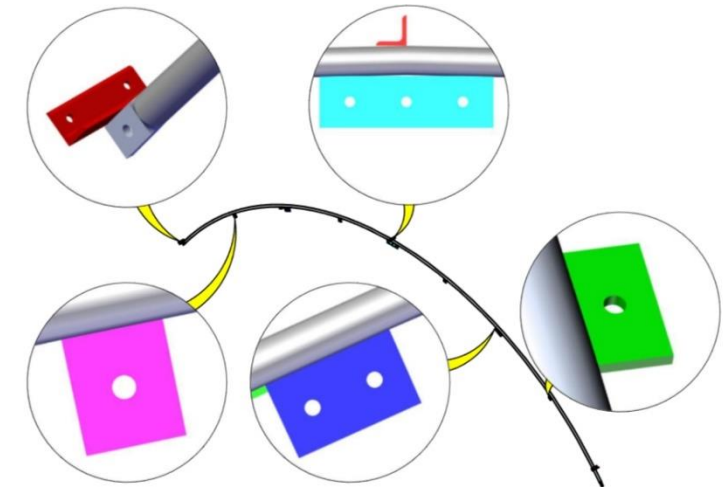


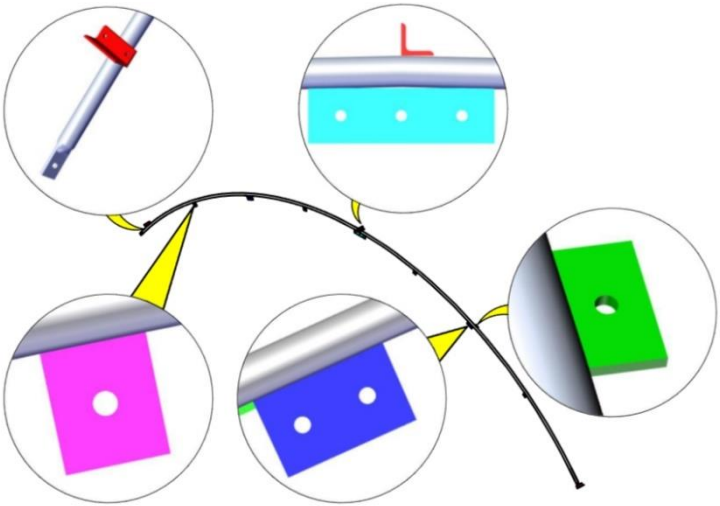


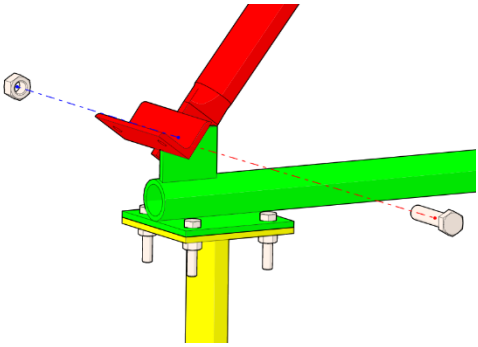


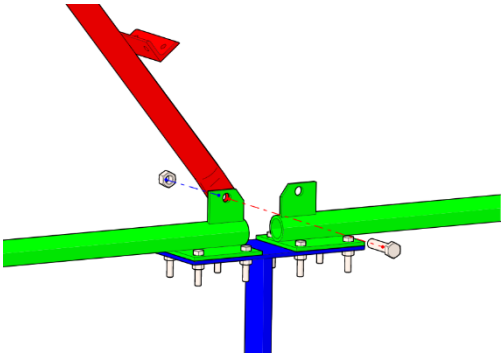


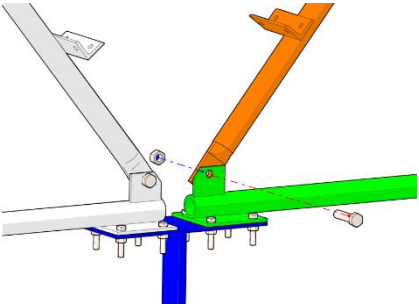
Curved Rafter

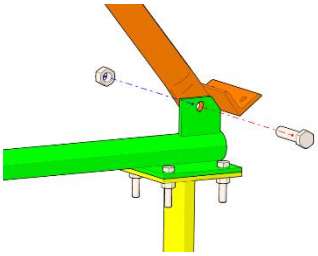


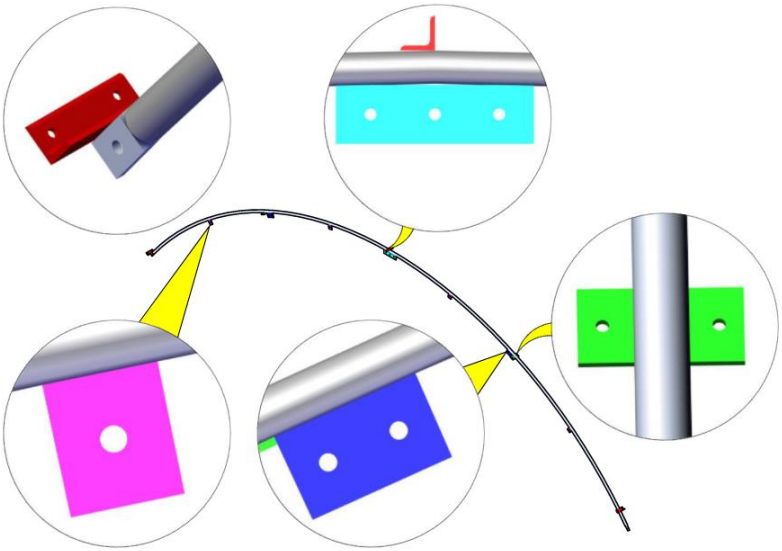


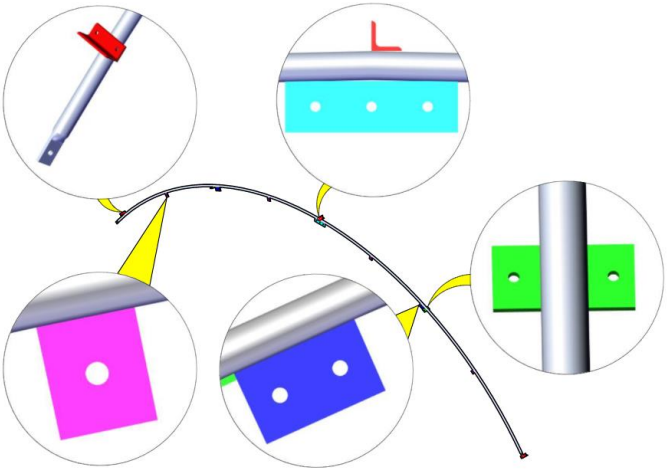


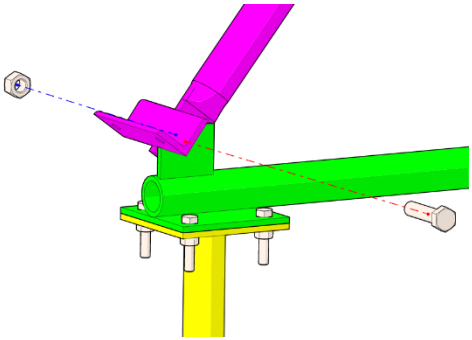


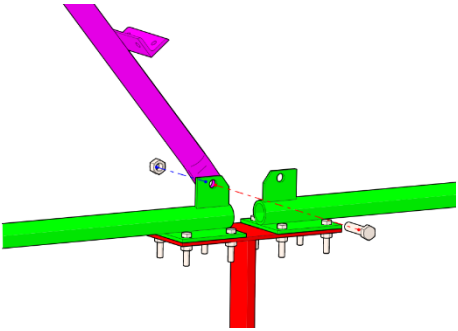


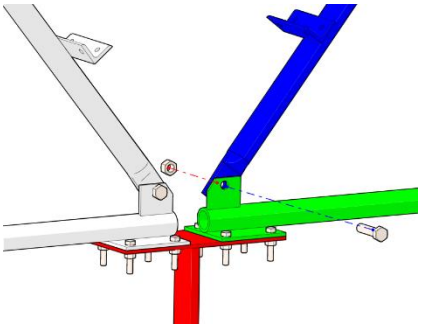


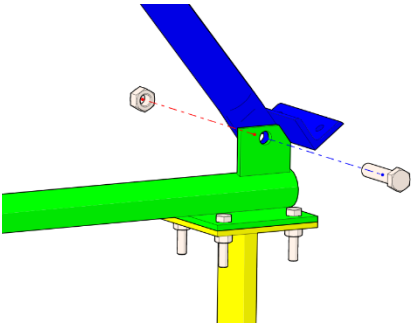


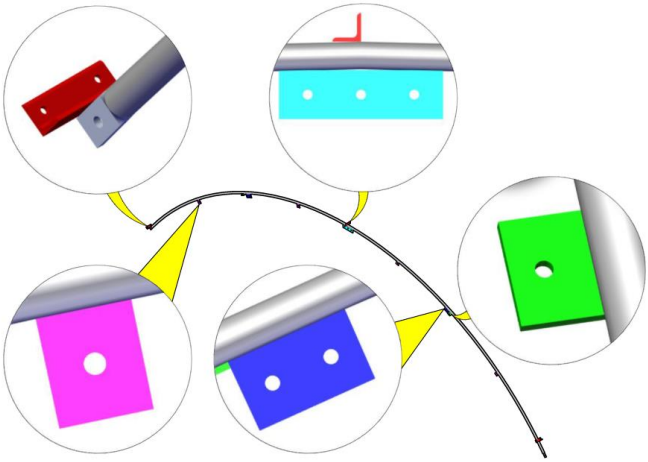


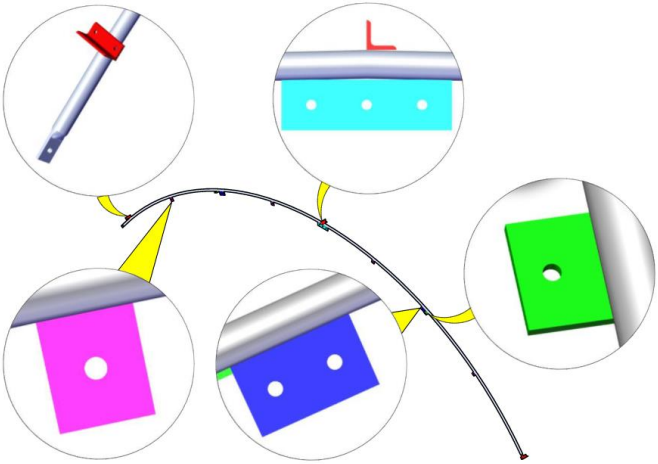


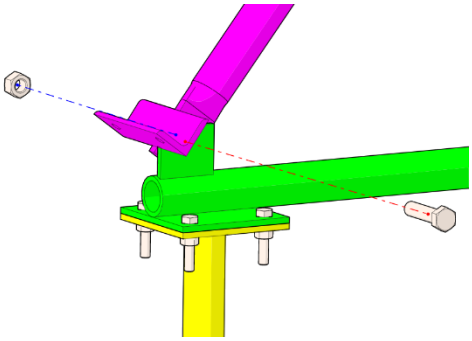


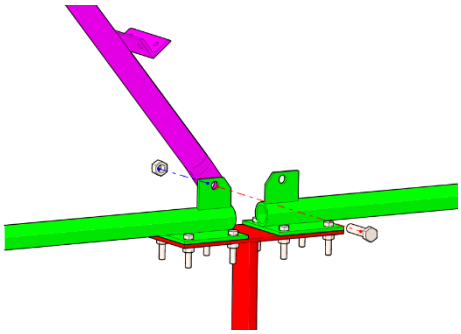


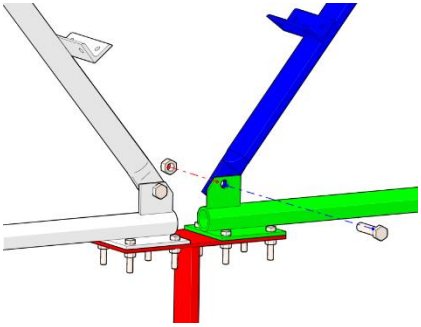


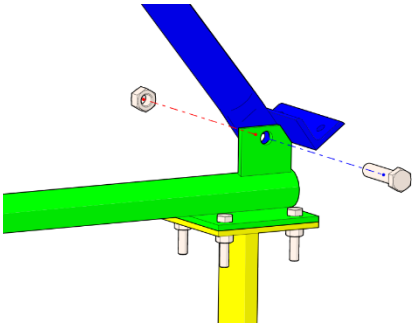




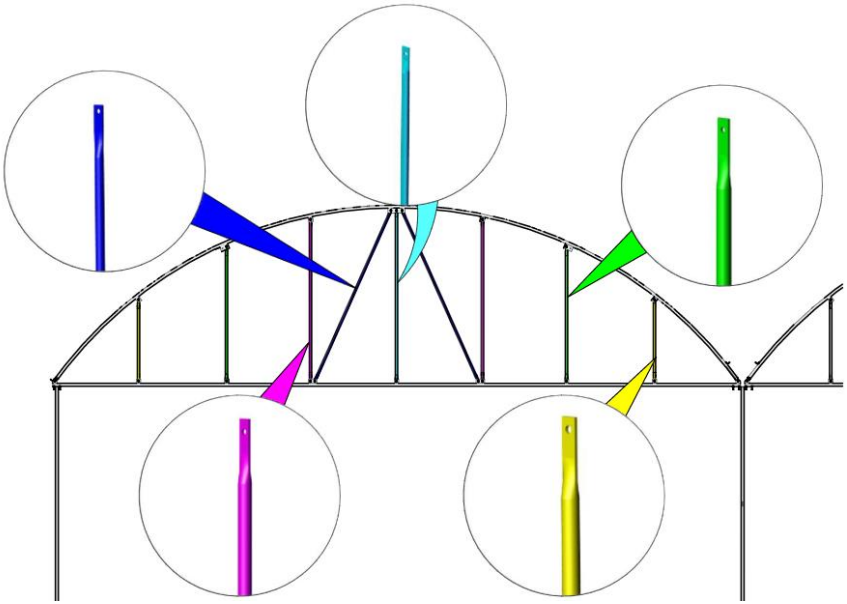


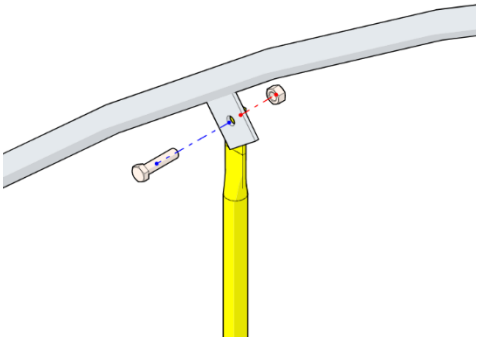


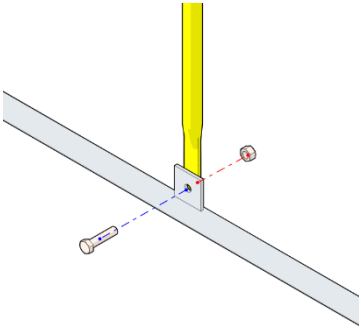


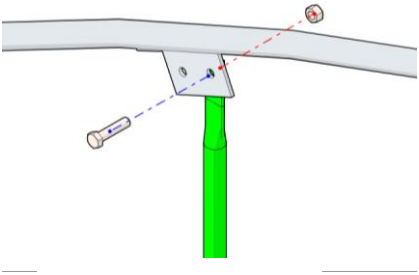


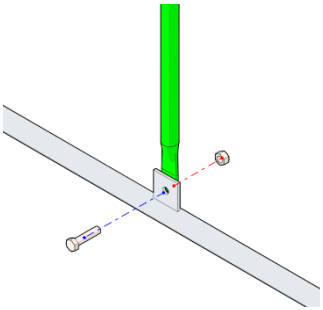
Strut & Chords

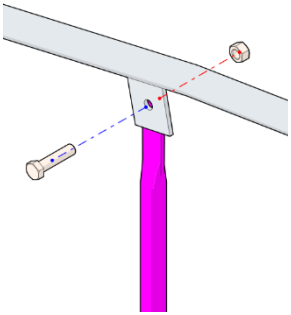


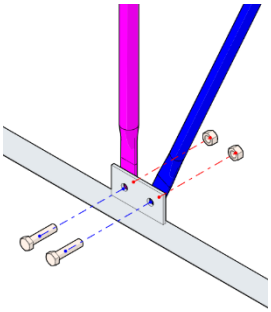


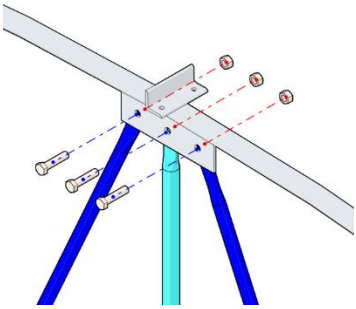


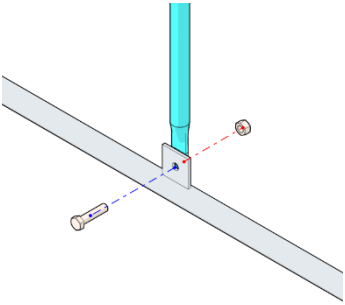


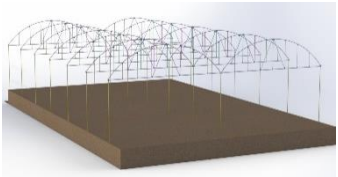




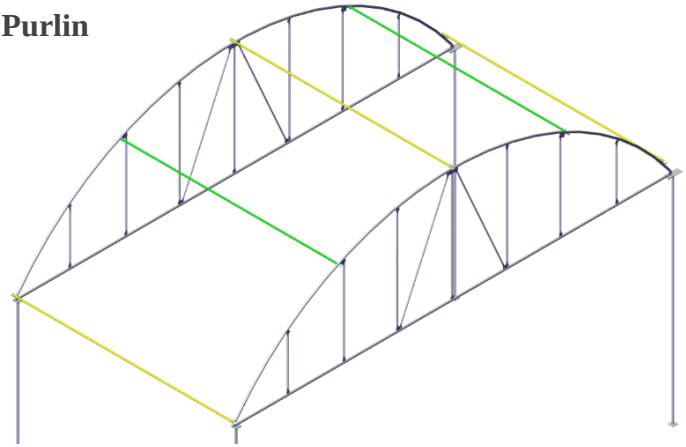


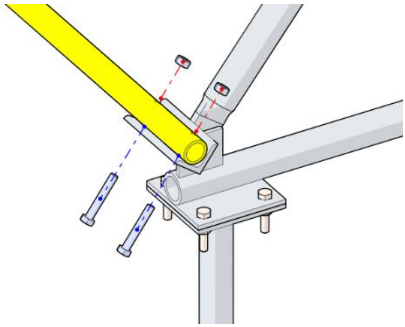


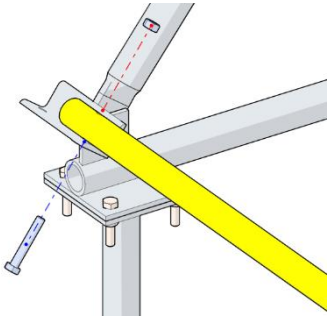


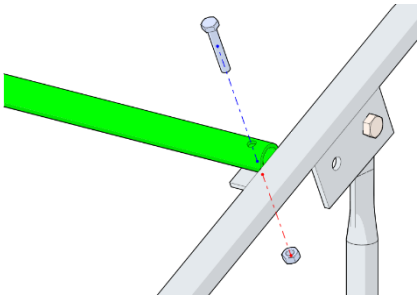


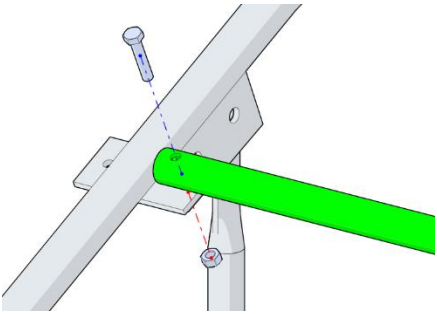
Ridge & Purlin

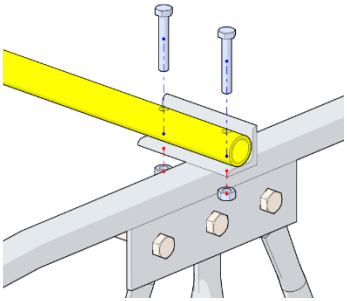


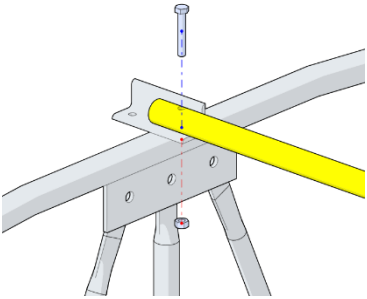


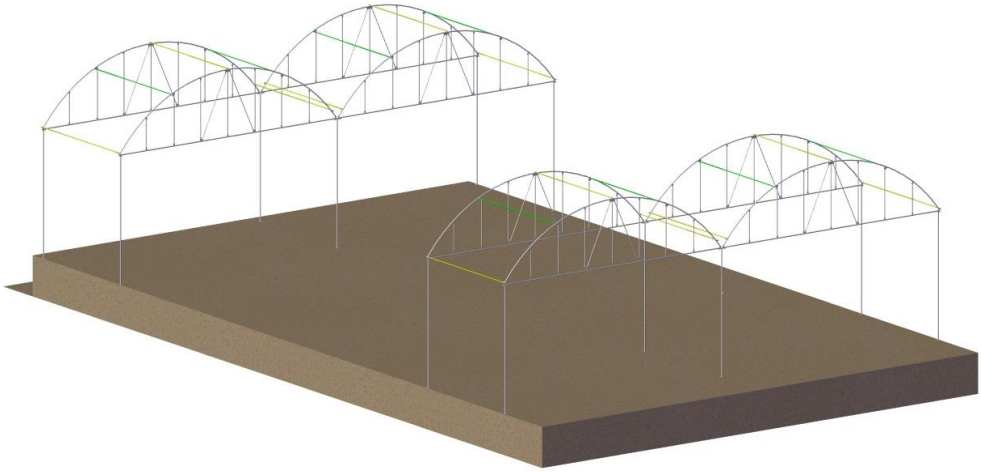


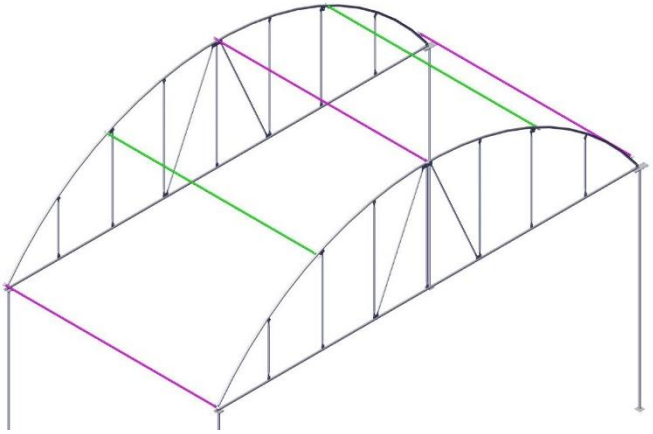


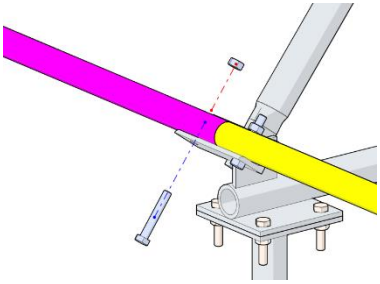


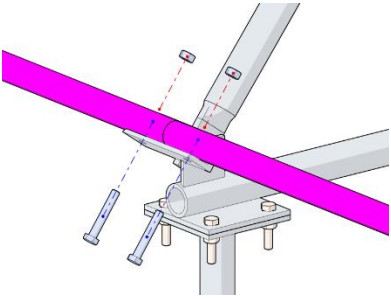


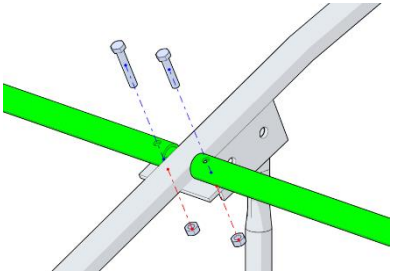


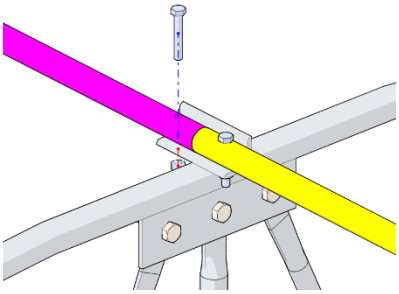


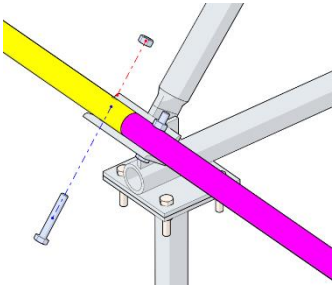


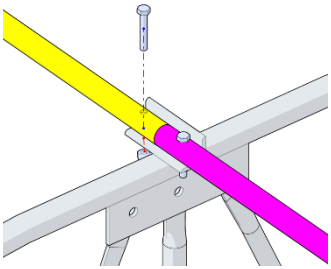


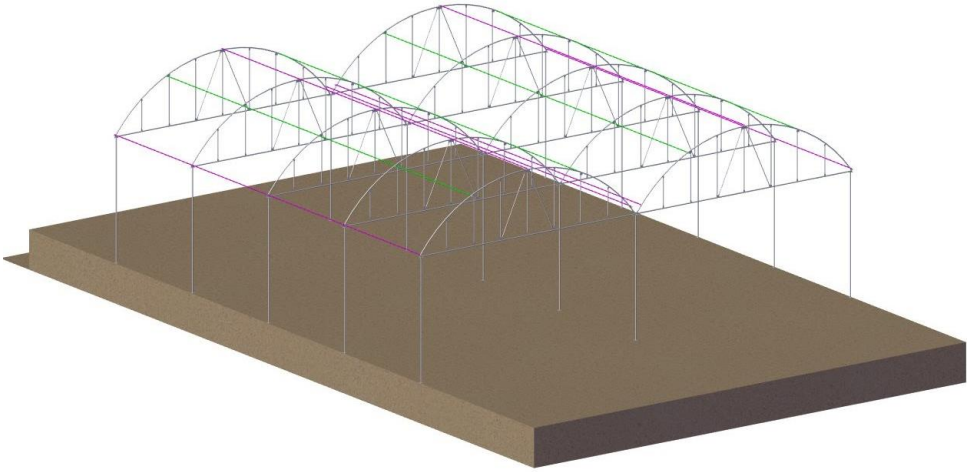


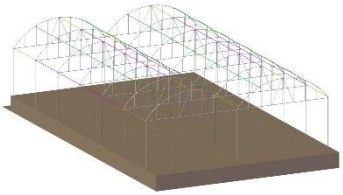






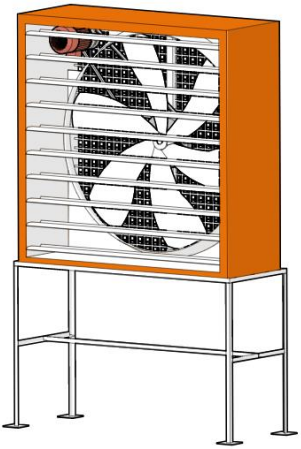


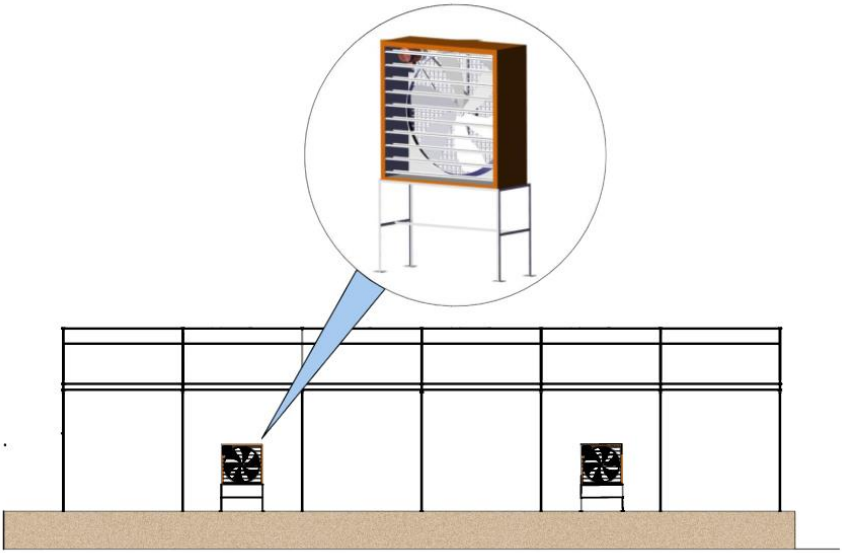


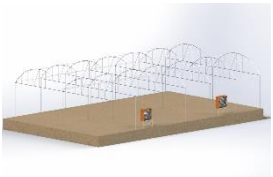


10.3. FAN-PAD assembly

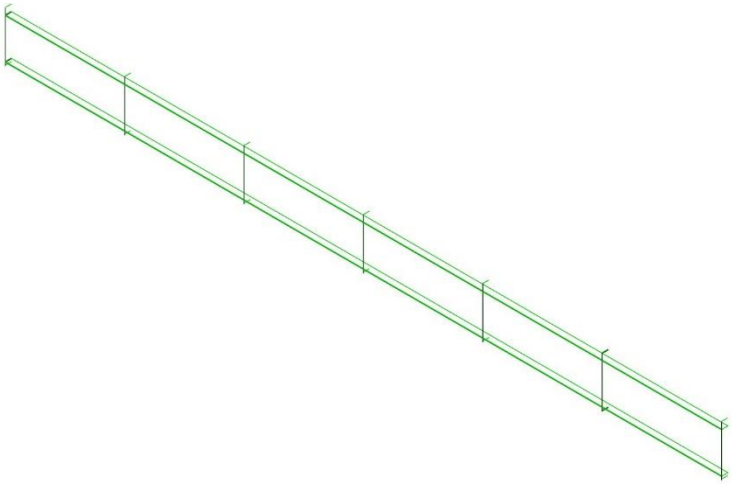
10.3.a. FAN structure

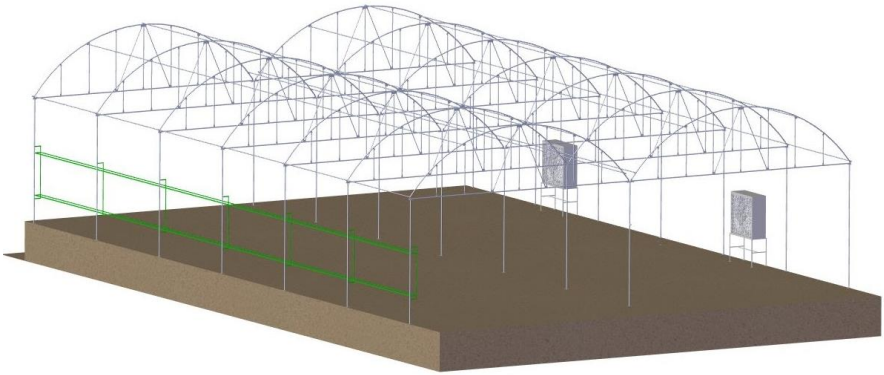




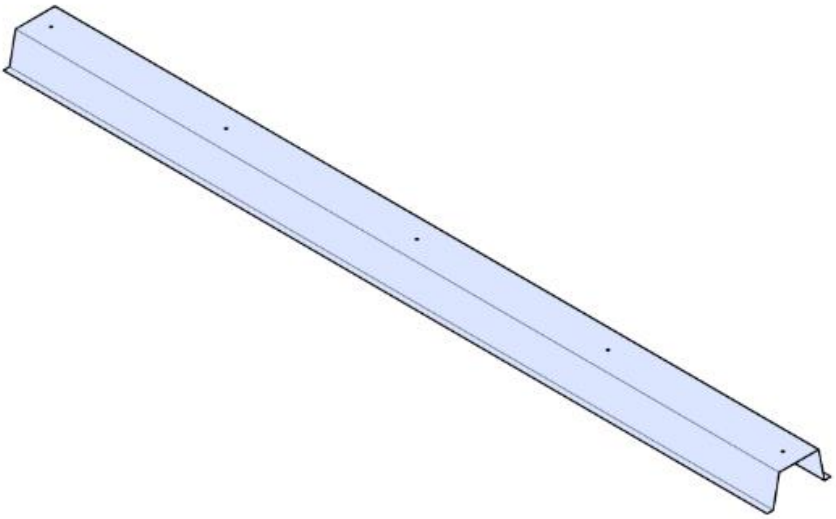


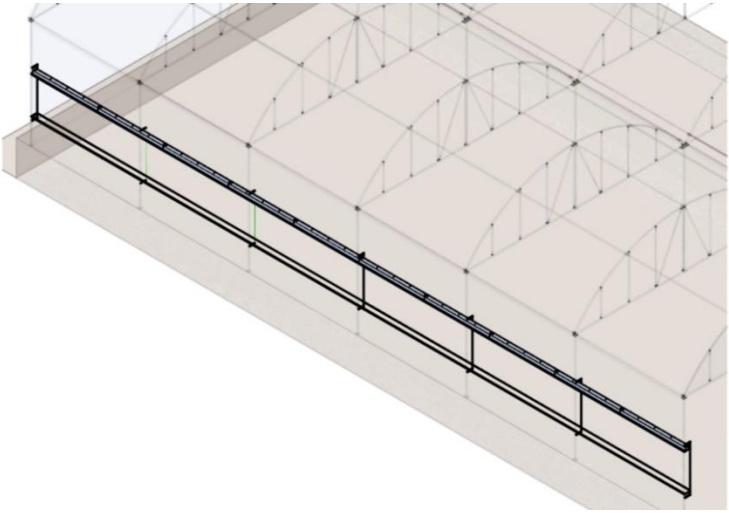
PAD Holding Structure



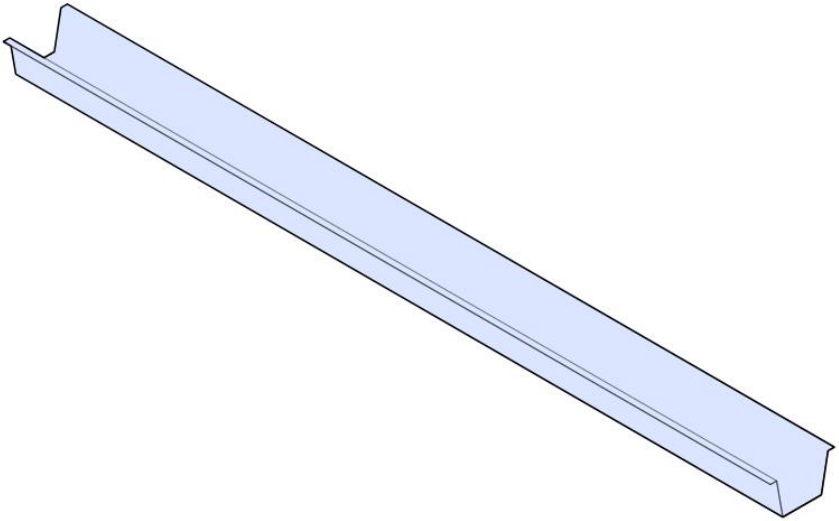


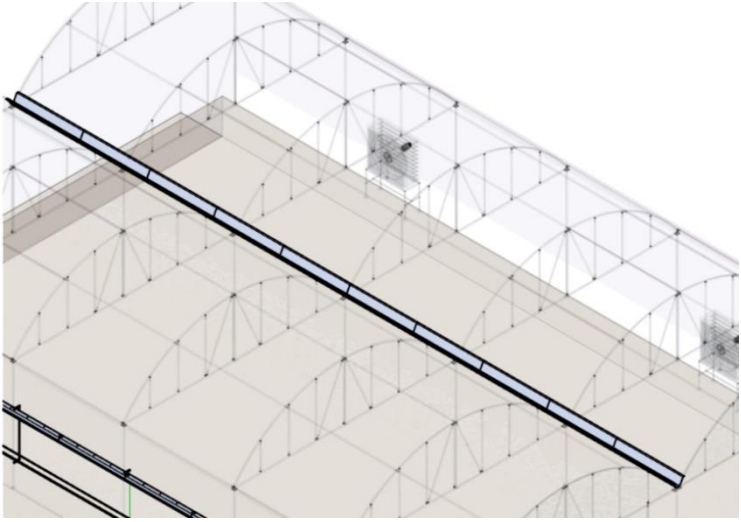
Upper Duct



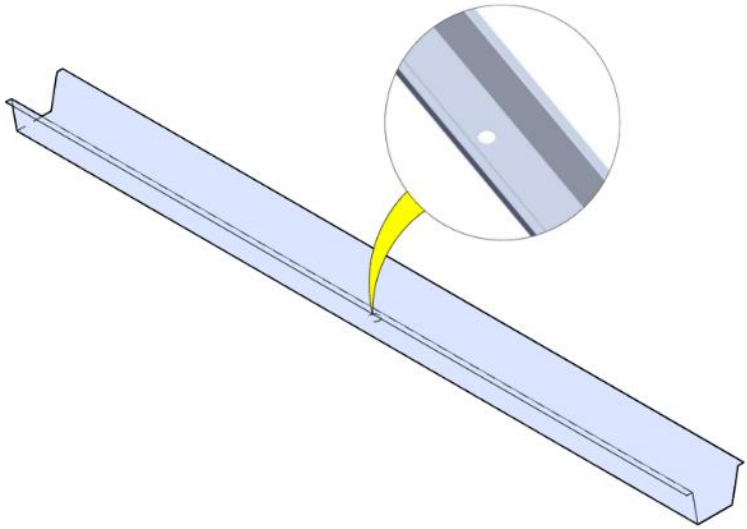


Middle Duct



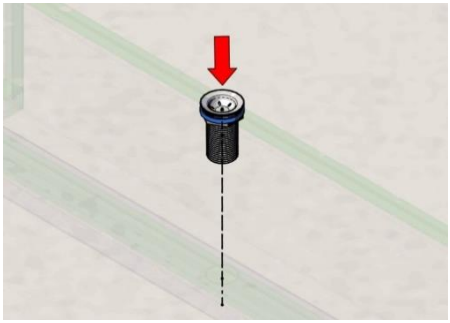


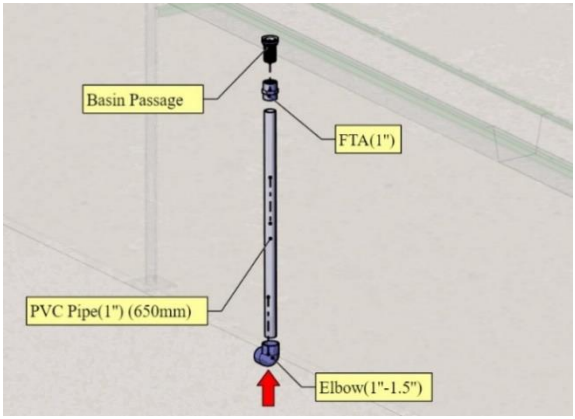
Middle Duct with & without

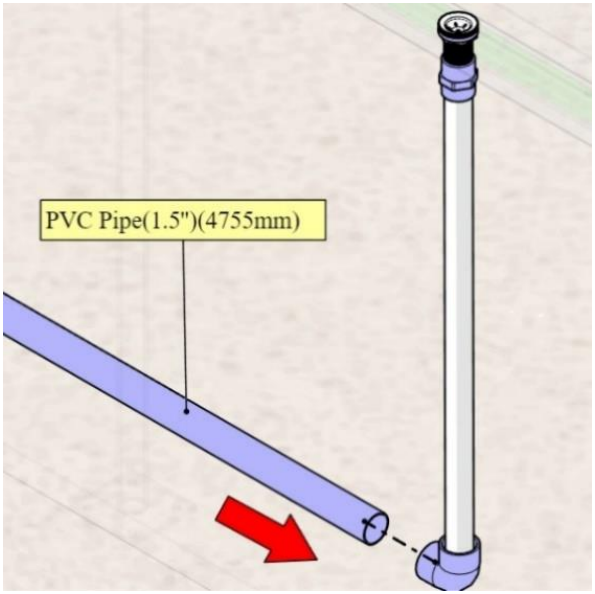


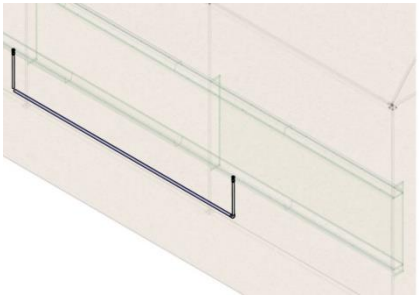
Water outlet piping

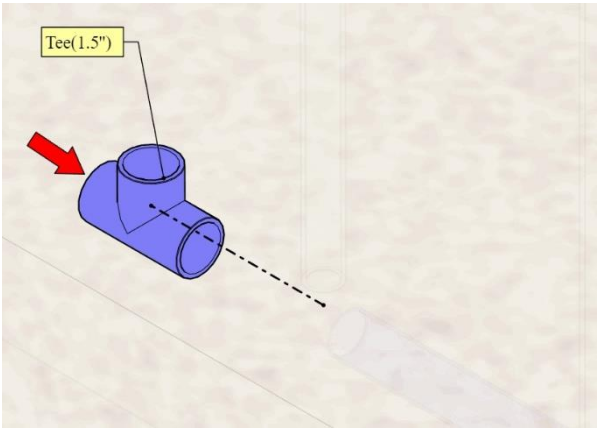
Basin Passage

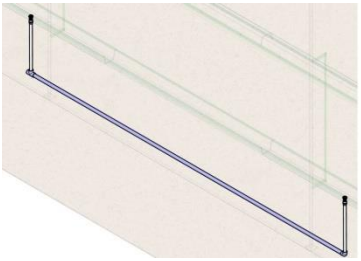


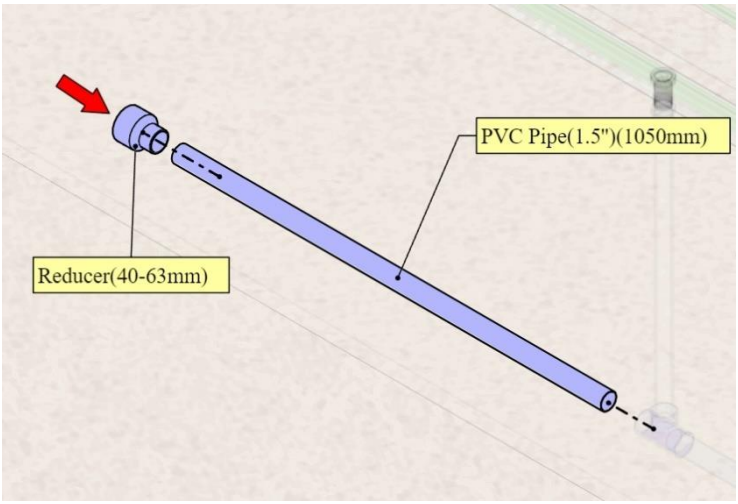


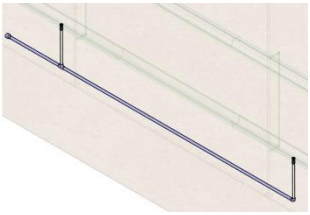

PVC Pipe(1.5")(4755mm)

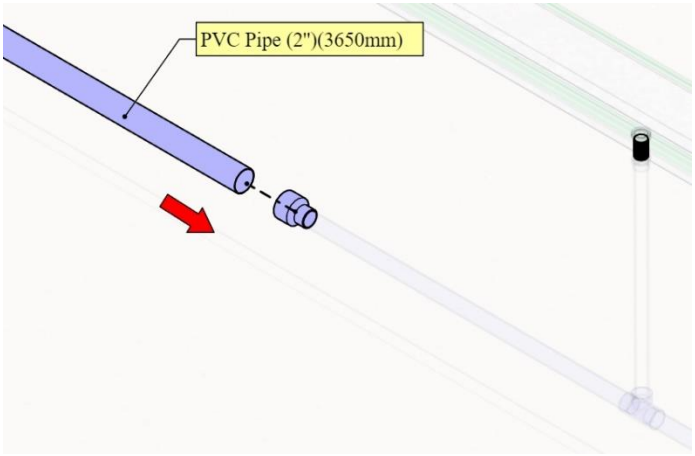


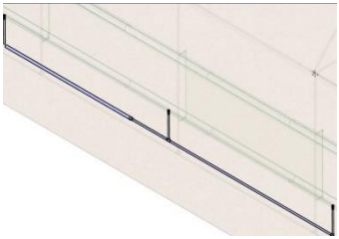

Tee(1.5")

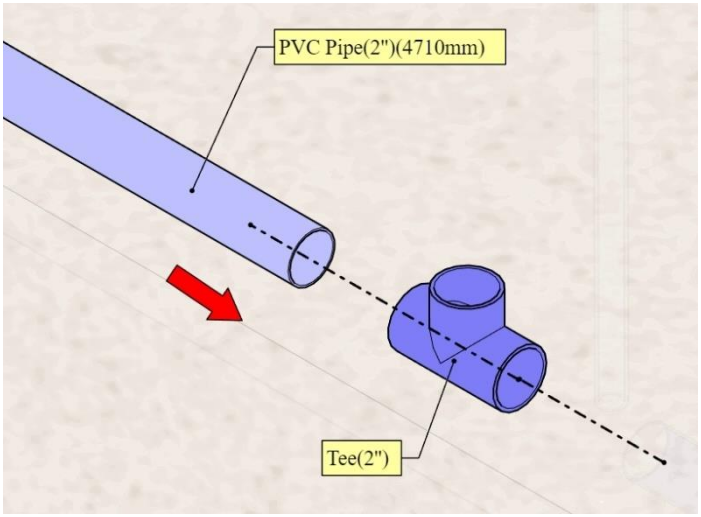


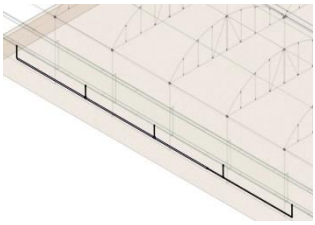

PVC Pipe(1.5")(1050mm)
Reducer(40-63mm)

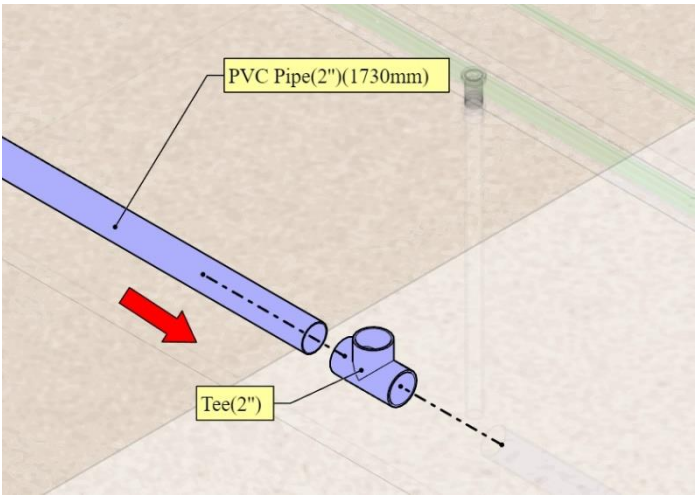


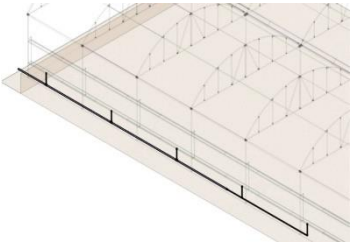

PVC Pipe (2")(3650mm)

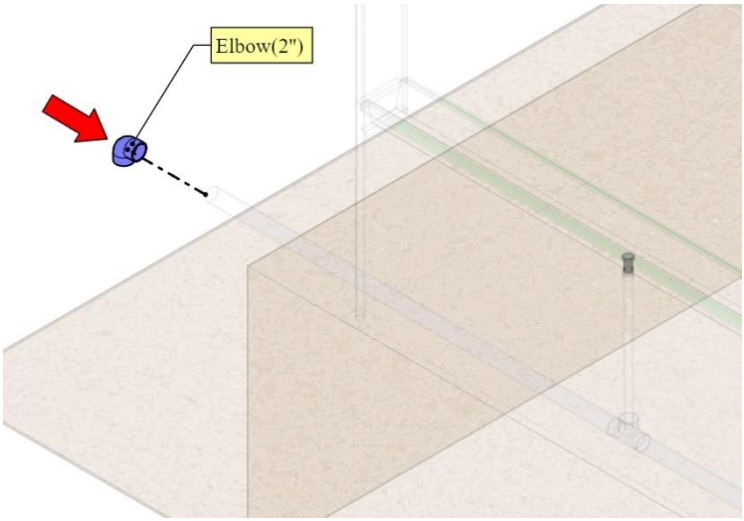


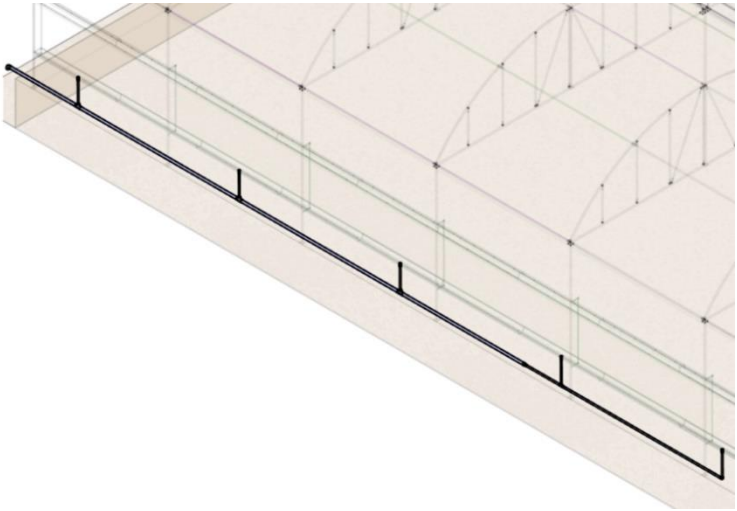

PVC Pipe(2")(4710mm)
Tee(2")



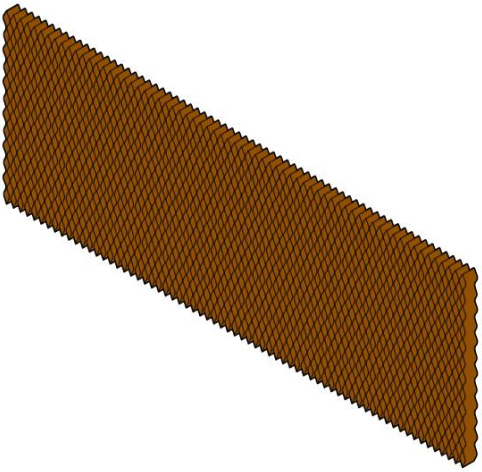

PVC Pipe(2")(1730mm)
Tee(2")

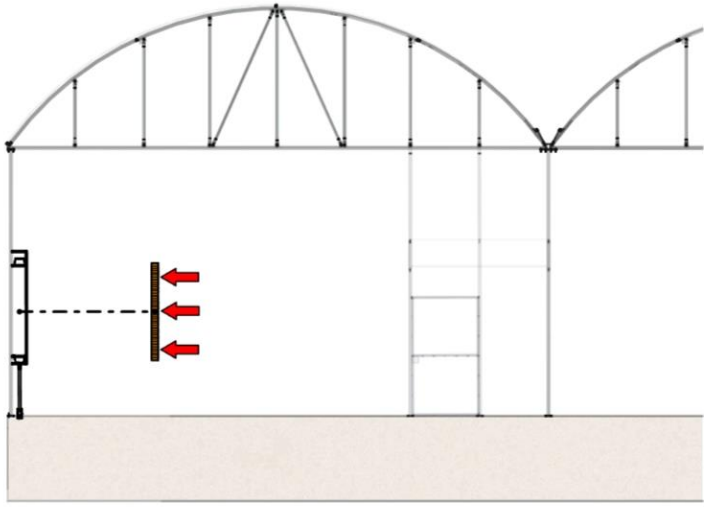



Elbow(2")

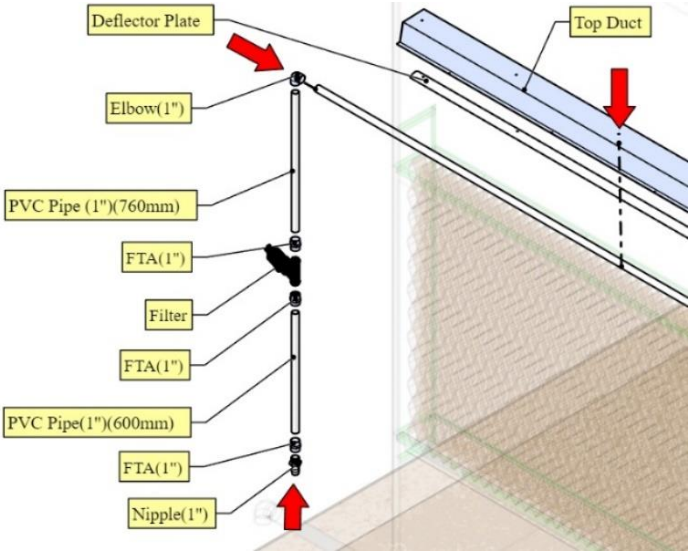


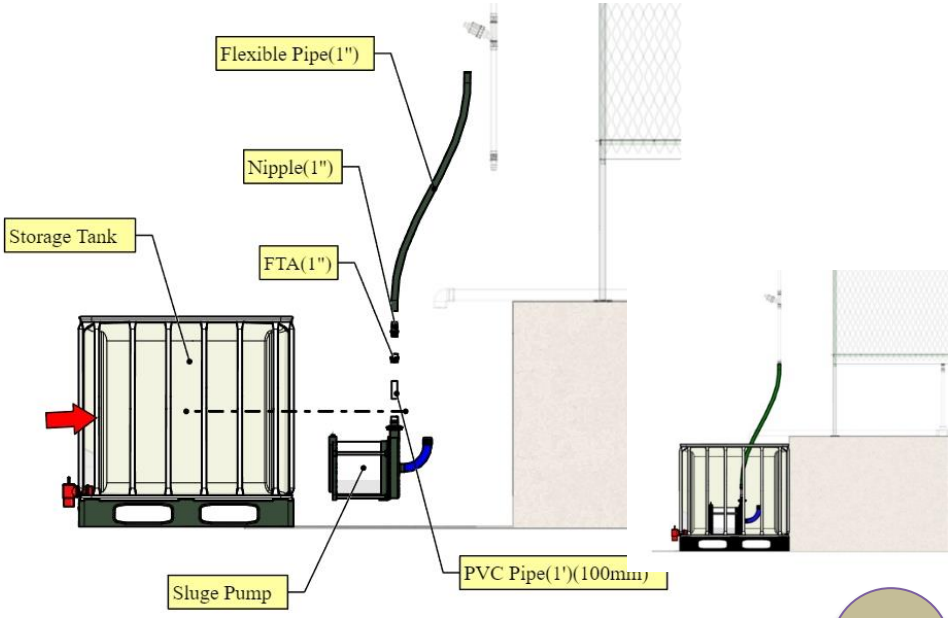
PAD



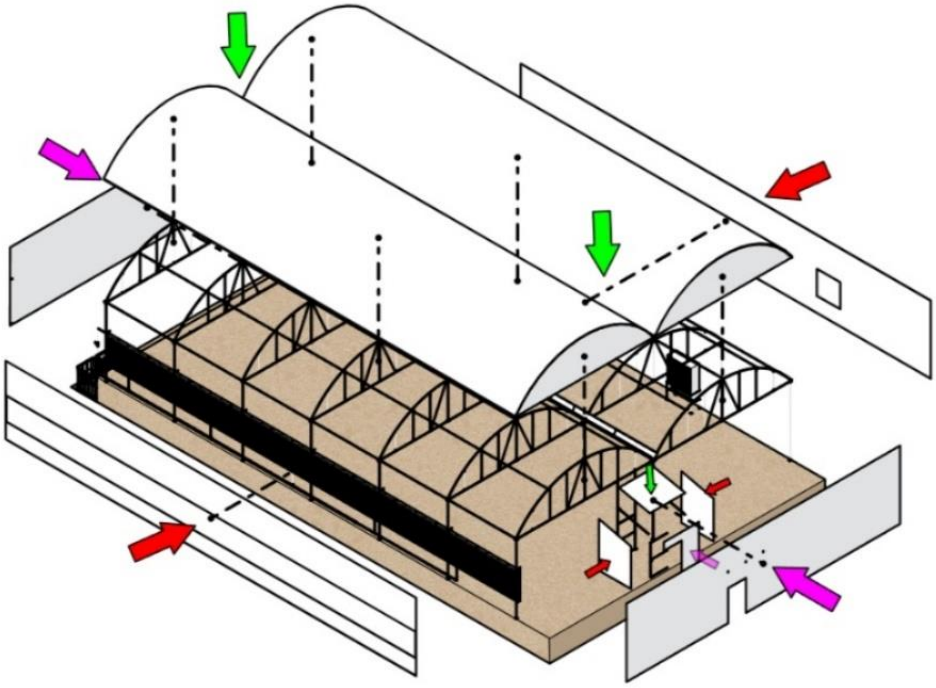


10.4.a. Water Distribution Piping





10.4.b. The outer cover of LDPE paper



LOW density polyethylene film is the most common covering material because of low cost and large sheet size. Agricultural grades arc good for covering for less than six months period. Ultraviolet inhibited, stronger plastic may also be used, as it has 2-to-3-year life. IR absorbing films reduce heat loss.

- Make a welding properly for fabrication of column pipes, tie plates, Truss & PAD Holding Structure.
- Make holes on Pipes properly at specified positions.
- Polyhouse structural design should be sound enough to withstand wind speed of 130km/hr.
- As per requirement structural design verified from the structural engineer because the proposed design based on the functional requirements and field experience.
- Maintenance/ Damage of structure may be after one year.
- Make holes on PVC Pipes properly at specified positions.
- Plumbing as shown in the diagram of pipe connections must be proper to avoid leakages from joints.
- Check electrical supply for proper functioning of water pump.

12. Disclaimer

The content in this DIY manual is the developed by Vigyan Ashram. All instructions are merely for educational purpose and to create a sharable open-source D-I-Y document.

While the information in this document has been verified to the best of our abilities, we cannot guarantee the performance. All the observation and data are taken from various experiments on system at Vigyan Ashram.

We reserve the right to change the design. Please contact our website or our expert team for any clarification.