TENDER DOCUMENT

e-TENDER No: ERO/MMD/620/1109

Tender for “The Repair, Supply & Installation of New Aluminium Composite Cladding for the damaged portion at ESIC RO Building, Salt Lake, Kolkata”

VOLUME – II

Additional Conditions of Contract (ACC), List of Approved Make and Technical Specification

ENGINEERING PROJECTS (INDIA) LIMITED
(A GOVT. OF INDIA ENTERPRISE)
9th floor, 50, Chowringhee Road,
Kolkata – 700 071
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<th>Page No.</th>
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<td></td>
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</table>

Signature of Contractor 2 of 9 EPI
ADDITIONAL CONDITIONS OF CONTRACT (ACC)

1.0 The following Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract. If there are any provisions in these Additional Conditions of Contract, which are at variance with the provisions of General Conditions of Contract, the provisions in these Additional Conditions of Contract shall take precedence.

2.0 SCOPE OF WORK INCLUDED IN THE CONTRACT

The brief scope of work included in this tender shall include (but not limited to) The Repair, Supply & Installation of New Aluminium Composite Cladding for the damaged portion at ESIC RO Building, Salt Lake.

Apart from the above, any other services not covered above but required as per direction of Engineer In-charge of EPI are deemed to be included in the scope of work. The work is to be carried out as per bill of quantities and tender conditions.

3.0 DISQUALIFICATION

The tenderers may note that they are liable to be disqualified and not considered for the opening of Price Bid if;

a) Representation in the forms, statements and attachments submitted in the prequalification document are proved to be incorrect, false and misleading.

b) They have record of poor performance during the past 7 years such as abandoning the work, rescinding of contract of which the reasons are attributable to the non-performance of the contractor, inordinate delay in completion, consistent history of litigation / arbitration awarded against the contractor or any of its constituents or financial failures due to bankruptcy etc. in their on-going /past projects.

c) They have submitted incompletely filled in formats without attaching certified supporting documents and credentials to establish their eligibility to participate in the Tender.
If the tenderers attempt to influence any member of EPI.

3.1 EPI reserves its right to take appropriate action including disqualification of tenderer(s) and forfeiture of the earnest money deposited by him/them as may be deemed fit and proper by EPI at any time without giving any notice to the tenderer(s) in this regard. The decision of EPI in the matter of disqualification shall be final and binding on the tenderers.

3.2 The set of tender documents shall contain tender drawings (one set of hardcopy). The original hard copy of tender drawings shall be returned along with the tender documents duly signed and stamped by the tenderer & shall form part of agreement.

4.0 TAXES AND DUTIES:

Clause no. 13 of GCC shall be amended/deleted as per below:

The bidder/Contractor must be registered with GST and should have valid GSTIN number.

4.1 The bidder/contractor must submit as an compliances of GST Act, the invoices in GST compliant format failing which the GST amount shall be recovered/ adjusted by EPI without any prior notice from the next invoices or available dues with EPI.

4.2 The bidders/Contractors are requested to update/upload the GST/Taxes data periodically so as to avail ITC credit by EPI failing which it shall be recovered/ adjusted by EPI without any prior notice from the next invoices or available dues with EPI.

4.3 Total Amount quoted in this tender are inclusive of all taxes, levies, cess, duties etc. including GST.

4.4 Bidder while quoting the rates in the tender must also consider the ITC credit applicable for the works, if any.

4.5 In case of any reduction in rate of GST or other taxes in future or the
project getting exemption status after last date of submission or afterwards, the subcontractor shall pass on the benefit to EPIL immediately, failing which EPIL shall have right to recover the differential amount from the amounts due to the sub-contractor. Further, in case of any increase in rate of GST or other taxes in future or the project losing exemption status after last date of bid submission or afterwards, the said increase of taxes shall be paid /reimbursed to the sub contractor.

5.0 SECURED ADVANCE AGAINST NON-PERISHABLE MATERIALS –

Clause no. 35.0 of GCC stands deleted.

6.0 The PARTY shall take insurance cover at its own cost towards Workmen Compensation Act for its own worker, employees and for the Plant & Equipment deployed by the PARTY at the project site.

(i) The PARTY shall deploy Technicians having Training Certificate of Level 1 & 2 from IPCA for execution of the work.

(ii) The PARTY shall make the materials available for works at site in sealed Packets which shall be opened in presence of EPI / ESIC engineer. Moreover, the PARTY shall maintain a record of day to day consumption of materials at site with due endorsement of EPI / ESIC engineer, which is required to be submitted along with the work-bills.

(iii) The PARTY shall be fully responsible to complete the works in workmen like manner to the satisfaction of ESIC and EPI by maintaining quality and precision as per manufacturer’s specifications etc. within the stipulated completion period and within their quoted rates / amount.

(iv) The PARTY shall adhere to all safety rules and norms as applicable for execution of similar works in the building premises at no extra cost to EPI.

(v) All statutory deductions shall be made as per relevant act/rules/guidelines.
7.0 PAYMENT TERMS (GCC clause no. 37.0 at page no. 27 is modified as under):

(i) 80% payment on completion of the work.

(ii) 20% payment after final acceptance of the work by EPI / ESIC based on its functional performance over a period of 60 days.

Quantities mentioned in the BOQ cum Quoting Sheet are indicative only. However, payment shall be made on actual work-done basis.

8.0 ARBITRATION:

Modification of arbitrations clause no. 76.0 of General Conditions of Contract (GCC) Sub Clause no.76.1 and 76.3 of Arbitration Clause no.76.0 are amended as given below. Sub Clause no.76.2 will remain the same.

Clause No- 76.0 ARBITRATION

Clause No- 76.1 Before resorting to arbitration as per the clause given below, the parties if they so agree may explore the possibility of conciliation as per the provisions of Part III of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015. When such conciliation has failed, the parties shall adopt the following procedure for arbitration:

a. Except where otherwise provided for in the contract, any disputes and differences relating to the meaning of the Specifications, Design, Drawing and Instructions herein before mentioned and as to the quality of workmanship or materials used in the work or as to any other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the Contract, Designs, Drawings, Specifications, Estimates, Instructions, or these conditions or otherwise concerning the works of the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the Sole Arbitrator appointed by the Chairman & Managing Director (CMD) of Engineering Projects (India) Limited (EPI) or any other person discharging the functions of CMD of EPI. The person approached for appointment as Arbitrator shall disclose in writing circumstances, in
terms of Sub-Section of Section (12) of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015 as follows:

a) such as the existence either direct or indirect, of any past or present relationship with or interest in any of the parties or in relation to the subject-matter in dispute, whether financial, business, professional or other kind, which is likely to give rise to justifiable doubts as to his independence or impartiality; and

b) which are likely to affect his ability to devote sufficient time to the arbitration and in particular his ability to complete the entire arbitration within a period of twelve months.

The Arbitrator shall be appointed within 30 days of the receipt of letter of invocation of arbitration duly satisfying the requirements of this clause.

b. If the arbitrator so appointed resigns or is unable or unwilling to act due to any reason whatsoever, or dies, the Chairman & Managing Director aforesaid or in his absence the person discharging the duties of the CMD of EPI may appoint a new arbitrator in accordance with these terms and conditions of the contract, to act in his place and the new arbitrator so appointed may proceed from the stage at which it was left by his predecessor.

c. It is a term of the contract that the party invoking the arbitration shall specify the dispute/differences or questions to be referred to the Arbitrator under this clause together with the amounts claimed in respect of each dispute.

d. The Arbitrator may proceed with the arbitration ex-parte, if either party, in spite of a notice from the arbitrator, fails to take part in the proceedings.

e. The work under the contract shall continue as directed by the Engineer-In-Charge, during the arbitration proceedings.
f. Unless otherwise agreed, the venue of arbitration proceedings shall be at the venue given in the “Memorandum” to the “Form of Tender”.

g. The award of the Arbitrator shall be final, conclusive and binding on both the parties.

h. Subject to the aforesaid, the provisions of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015 or any statutory modifications or re-enactment thereof and the Rules made there under and for the time being in force shall apply to the arbitration proceedings and Arbitrator shall publish his Award accordingly.

9.0 JURISDICTION : Clause No.76.3 of GCC, stands modified as under :

The courts in Kolkata alone will have jurisdiction to deal with matters arising from the contract, to the exclusion of all matters.

10.0 COMPLETION PERIOD

The completion period for the total work is 45 (Forty Five) days to be reckoned from the 7th day from the date of issue of LOI.

11.0 MOBILIZATION ADVANCE:-

Clause 8.0 of General Conditions of Contract is deleted.
# LIST OF APPROVED MAKES

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>NAME OF ITEMS</th>
<th>LIST OF APPROVED MANUFACTURERS / BRAND / APPLICATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cement</td>
<td>1. Ultra-Tech</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. ACC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Grasim</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Lafarge</td>
</tr>
<tr>
<td>2</td>
<td>Aluminium Composite Panel</td>
<td>1. Aludecor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Durabuild</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Alucobond</td>
</tr>
</tbody>
</table>
1. General
We can process ALPOLIC and ALPOLIC/fr panels with regular machines and tools for aluminum and wood. We can cut the panels with a circular saw, fold them after grooving with a router, and bend them with a 3-roll bender. In order to join aluminum extrusions to ALPOLIC panels, we can choose a suitable joining method from several alternatives. For installation, various types of fixing methods suitable for Aluminum Composite Material (ACM) have been put forward and improved on for years. We will look over basics of the processing methods and installation methods in this section.

ALPOLIC and ALPOLIC/fr are often simply referred to as “ALPOLIC” or “ALPOLIC panels” in this section, because the fabrication and installation methods applicable to ALPOLIC mostly hold true to ALPOLIC/fr as well. Regarding the product dimension and tolerance required for planning (design) work of fabrication and installation, refer to “11: Panel dimension and tolerance” at the end of this section.

2. Handling
ALPOLIC is a rigid panel, but a physical impact may cause an edge deformation. Inclusion of hard particles such as grains of sand and cutting chips caught between ALPOLIC panels may cause visible dent-damages in one or more adjacent panels. Take note of the following precautions while handling ALPOLIC during fabrication and installation.

(1) Unpacking and repacking

a) Do unpacking and repacking works in a clean place.
b) Remove dusts and chips from ALPOLIC and the packing paper. Any hard particles between panels will cause a dent-damage on ALPOLIC panels.
c) Handle ALPOLIC on a worktable. Do not handle it on the floor.
d) ALPOLIC should always be handled by two people with external face upward to avoid possible rubbing of the ALPOLIC surface during handling.

(2) Transport

a) For transport, lay the packed ALPOLIC horizontally and do not place heavy goods on it.
b) Mark “Handle with Care”, “Keep Dry”, “No Hooks” and “This Side Up” clearly on the packing.

(3) Fabrication

a) Prior to fabrication, clean off the worktable, temporary stand and both sides of ALPOLIC.
b) Ensure that cutting chips generated from saws, routers and drills are completely removed from the interface between ALPOLIC and tools.

(4) Storage
a. Store ALPOLIC panels indoors with a flat rack system or a vertical rack system shown below.
b. In a flat rack system, pile the same size of panels on a rigid palette. Do not pile up different sizes together. Our wooden crates can usually be stacked up to four crates high.
c. In a vertical rack system, lean panels closely against an inclined backing material within 10°. The
total thickness of leaning panels should not exceed 100 mm thick. Use veneer for backing cover and place rubber mat on the bottom. Avoid scratches when pulling out from the rack and restoring it.

**Vertical rack**  
![Fig. 3-2 Proper storing method](image)

**Flat rack**

Within 10°

(5) **Protective film**

The protective film of ALPOLIC, consisting of two polyethylene layers of white and black, withstands outdoor exposure for approx. 6 months. However, store the panels in dry and indoor atmosphere, to minimize the natural-degradation of the protective film by moisture and direct sunlight during storage.

(6) **PVC tape**

Do not use adhesive tapes made of PVC (polyvinyl chloride) on the surface of protective film at any time during storage, fabrication or installation. The plasticizer (an additive) in PVC tape will permeate the film and attack the Lumiflon coating, which causes a gloss change problem on the coating. Any types of PVC tapes may cause this problem, including duct tape, packing tape and insulation tape.

3. **Processing method**

1. **Summary**

We can use wide variety of machines and tools to process ALPOLIC panels. We can classify these machines and tools into conventional ones and automated ones. Generally, automated machines enable high efficiency in large quantity analogous work. On the other hand, conventional machines and tools are versatile and flexible. The former requires a costly investment for the machine, and the latter requires skill for good work. The main machines and tools are as shown in the following table.

<table>
<thead>
<tr>
<th>Conventional tools and machines</th>
<th>Automated machines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Processing</strong></td>
<td><strong>Tools or machines</strong></td>
</tr>
<tr>
<td>Cut</td>
<td>Table saw</td>
</tr>
<tr>
<td>Hand circular saw</td>
<td>2</td>
</tr>
<tr>
<td>Hand router</td>
<td>3</td>
</tr>
<tr>
<td>Hand jigsaw</td>
<td>Grooving machine</td>
</tr>
<tr>
<td></td>
<td>Groove</td>
</tr>
<tr>
<td>Groove</td>
<td></td>
</tr>
<tr>
<td>Hand router</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Chamfer</td>
<td>Hand trimmer</td>
</tr>
<tr>
<td>Plane</td>
<td>7</td>
</tr>
<tr>
<td>Make hole</td>
<td>Hand drill</td>
</tr>
<tr>
<td>Punch</td>
<td>Punching machine</td>
</tr>
<tr>
<td>Notch</td>
<td>Notching tool</td>
</tr>
<tr>
<td>Bend</td>
<td>Press brake</td>
</tr>
</tbody>
</table>
(2) Saw cutting

We can cut ALPOLIC with various types of circular saws such as table saws, hand circular saws and panel saws. A suitable saw blade is a carbide-tipped blade for aluminum or plastic use.

Example of suitable saw blade:

<table>
<thead>
<tr>
<th>Blade diameter</th>
<th>255 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of teeth</td>
<td>80 to 100</td>
</tr>
<tr>
<td>Cut width</td>
<td>2.0 to 2.6 mm</td>
</tr>
<tr>
<td>Rake angle</td>
<td>10°</td>
</tr>
<tr>
<td>Tip</td>
<td>Carbide</td>
</tr>
</tbody>
</table>

Operating conditions

| Rotation of saw blade | 2000-4000 rpm |
| Feed speed           | 10-30 m/min   |

Fig. 3-3 Saw cutting

ALPOLIC
External side upward
10-30 m/min

Notes on saw cutting:

a. Do the cutting operation with the external side facing upward to prevent the panel from scratches and the protective film from peeling off.
b. Remove cutting chips from ALPOLIC carefully after cut, to avoid dents during storage and assembly.
c. Sharpen or replace the saw blade, when it becomes dull. Dull blades will result in a large burr or distortion at the cut edge.

(3) **Shear cutting**
A square shear permits an efficient sizing work. Generally, the most suitable clearance and rake angle are as follows:

<table>
<thead>
<tr>
<th>ALPOLIC thickness</th>
<th>Clearance</th>
<th>Rake angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>3mm</td>
<td>0.04 - 0.1mm</td>
<td>1º</td>
</tr>
<tr>
<td>4mm</td>
<td>0.04 - 0.1mm</td>
<td>1º 30’</td>
</tr>
<tr>
<td>6mm</td>
<td>0.2mm</td>
<td>2º 30’</td>
</tr>
</tbody>
</table>

(4) **Trimming of cut edge**
After saw cutting, a burr appears on both sides of the edges. After shear cutting, either a droop or a burr appears on each edge. If we install the panel with the cut edges exposed, we have to control the edge conditions.

Burr after saw cutting  Droop after shear cutting  Burr after shear cutting

Namely, in saw cutting we should keep the saw blade sharp enough to have a proper edge. In shear cutting, we should adjust the clearance of the die properly. If we need further trimming of the cut edge, we have to trim the edge with a trimmer, plane or sandpaper.

In Solid, Metallic, Sparkling Colors, deep trimming like chamfering may have an aesthetic effect. Use a trimmer with a ball bearing chamfering bit or a plane for woodwork. In working with plane, a guide ruler will help to ensure a uniform edge.

In Stone and Timber, generally, deep trimming is not suitable, because deep trimming harms the appearance of Stone and Timber. If it is possible that passers-by may hurt their fingers on the cut edges in Stone and Timber, make the edges dull with fine sandpaper. Normally, droop edges by shear cutting are mild enough to ensure the safety of cut edges.

(5) **Curving cut**
Hand routers and trimmers can cut ALPOLIC in
curving lines. A guide template will help you to stabilize this work. Jigsaws are also useful for cutting complex shapes.

Notes on guide template:
a. Put the guide template on the external side of ALPOLIC, to do the routing work through the guide template.
b. Remove the particles caught between the template and ALPOLIC surface, to prevent dents and scratches.

(6) U-grooving
We can fold ALPOLIC after U-grooving in the backside. Two types of machines are available for U-grooving. One is a circular cutter type and the other is a router type. The former includes hand grooving machines and panel saws, and the latter includes hand routers and CNC routers.

U-groove shape
The diagram (in Fig. 3-8) shows a typical U-groove shape suitable for folding ALPOLIC panels. It is important to leave 0.2-0.4 mm of core. We recommend 90-110° grooves for 90° bending.

Hand grooving machine
Hand grooving machines can groove ALPOLIC. Use a cutter blade having the proper groove shape as shown in Fig. 3-8. An example of suitable cutter blades and operating conditions are as follows:

<table>
<thead>
<tr>
<th>Fig. 3-9 Hand groove machine and groove cutter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutter blade:</td>
</tr>
<tr>
<td>Outside diameter</td>
</tr>
<tr>
<td>Number of teeth</td>
</tr>
<tr>
<td>Material</td>
</tr>
<tr>
<td>Operating conditions</td>
</tr>
<tr>
<td>Rotation</td>
</tr>
<tr>
<td>Feeding speed</td>
</tr>
</tbody>
</table>

Hand router
Hand routers can groove both straight lines and curving lines. Use a custom router bit having the groove shape shown in Fig. 3-8. The suitable bit and operating conditions are as follows:

<table>
<thead>
<tr>
<th>Fig. 3-10 Handy router and router bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router bit:</td>
</tr>
<tr>
<td>Number of teeth</td>
</tr>
<tr>
<td>Material</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fig. 3-11 Panel saw and groove cutter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel saw and groove cutter:</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Operating conditions:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation</td>
<td>20,000-30,000 rpm</td>
</tr>
<tr>
<td>Feeding speed</td>
<td>3-5 m/min</td>
</tr>
</tbody>
</table>

**Panel saw**

Panel saws enable efficient and precise grooving. Typical conditions are as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside diameter</td>
<td>220 mm</td>
</tr>
<tr>
<td>Number of teeth</td>
<td>8</td>
</tr>
<tr>
<td>Material</td>
<td>Carbide tip</td>
</tr>
</tbody>
</table>

(7) **Folding**

After U-grooving, we can fold ALPOLIC with a folding jig. The typical folding procedures are as follows.

**Fig. 3-12 Folding procedures**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>U-groove</td>
</tr>
<tr>
<td></td>
<td>Leave 0.2-0.4 mm core.</td>
</tr>
<tr>
<td>2.</td>
<td>Folding jig</td>
</tr>
<tr>
<td></td>
<td>Use a folding jig made of aluminum or steel angle.</td>
</tr>
<tr>
<td>3.</td>
<td>Fold</td>
</tr>
<tr>
<td></td>
<td>Use a jig nearly fits to the folding length.</td>
</tr>
<tr>
<td>4.</td>
<td>Roundness</td>
</tr>
<tr>
<td></td>
<td>Suitable roundness is 2-3 mm R.</td>
</tr>
<tr>
<td>5.</td>
<td>Support</td>
</tr>
<tr>
<td></td>
<td>Support with aluminum angle, if necessary.</td>
</tr>
</tbody>
</table>

**Notes on folding:**

a. Fold ALPOLIC panels on a flat and rigid worktable, because, if we fold a warping panel, the folding centerline will not be straight.

b. The folded corner should have a suitable roundness of 2-3 mm in radius. If the roundness is too small, the coating may have a crack on the folded corner. Check your U-shape and grooving depth.

c. Cracks may occur when we carry out the folding work at a low temperature. Have your folding work at 10°C or higher.

d. Folding after U-grooving entails slight elongation. The elongation is 0.5-1.0mm per fold. Pre-adjust the position of the grooving line in your fabrication drawing.

**Fig. 3-13 Making a hole**

(8) **Making hole with drill**

We can make holes with a hand drill or a drill press, equipped with a drill bit, a hole-saw and a circle cutter. Use drill bit for metals. Making a hole from the external side will reduce the burr.

(9) **Punching and notching**

We can use a punching press for notching and cutting out. Suitable clearance between punch and die is 0.1mm or smaller (material thickness × approx. 2%). A small droop will appear at
the punched edge. We can also use a notching tool for removing the corner.

(10) Bending with a press brake
We can bend ALPOLIC/fr and ALPOLIC with a press brake. The bend-ability depends on the thickness and the core material. ALPOLIC/fr has a larger bendable limit than ALPOLIC has. The smallest bendable radius (internal radius) with press brake is as follows:

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Smallest bendable radius (internal radius) mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPOLIC/fr</td>
<td>ALPOLIC</td>
</tr>
<tr>
<td>Traverse</td>
<td>Parallel</td>
</tr>
<tr>
<td>3mm</td>
<td>50</td>
</tr>
<tr>
<td>4mm</td>
<td>80</td>
</tr>
<tr>
<td>6mm</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes on press brake bending:
a. “Traverse” and “Parallel” show the bending direction toward the rolling (coating) direction printed on the protective film.
b. The smallest bendable radius means the limit at which visible wrinkles appear on the aluminum surface of ALPOLIC. Cracks will appear at a slightly smaller radius than this value.
c. Use the top die (punch) with an almost similar radius to the desired radius. If the radius is much smaller, the bending radius partially goes beyond the above limit, and cracks may occur.
d. Use a urethane pad for the bottom die, or place a rubber mat between ALPOLIC and the bottom die.
e. Use a scratch-free top die. Polish and wipe the top die. Do the bending work without peeling off the protective film of ALPOLIC.
f. When we carry out the bending work at a low temperature e.g. 15°C, the coating surface may change to a haze-like appearance. Warm the panel to 20º or higher, and the haze-like appearance will disappear.
g. In metallic colors, slight color difference can be seen between bent and flat surfaces due to the difference of reflection angle.

(11) Bending with 3-roll bender
We can use manual or electric-drive 3-roll benders for bending ALPOLIC. The smallest bendable radius of ALPOLIC 4mm is approx. 300mm in 2500mm long machines. The exact bendable limit depends on the bending roll diameter, roll length and the type of bending machine.

Notes on 3-roll bending:
a. Prior to a bending operation, wipe the roll
surface carefully.
b. Remove any burrs at the ALPOLIC edge that
may cause dents while rolling.
c. Remove the cut particles stuck on ALPOLIC and smooth any wrinkles on the protective film, which
may cause dents.
d. Do not constrict ALPOLIC panel between rolls (in thickness direction). Extreme compression may
cause a physical damage of the core. Adjust the clearance between rolls to be the panel thickness
plus some allowance (approx. 0.5 mm).
e. If a notch is desired in the panel, cut the notch after
bending. Cutting the notch before bending will result in a
distorted curving.
f. Generally, small radii will need gradual bending by
adjusting the elevation of the bending roll several times.
g. In most 3-roll benders, the curve near the edge tends to be
straight. We can reduce this straight portion to some extent
by overlapping another auxiliary sheet material and
bending together with ALPOLIC. If we require a
consistent curve near the edge, we have to do additional
edge bending after regular bending. Refer to Fig. 3-17.
h. When we carry out the bending work at a low temperature e.g. 15°C and with small radius e.g.
250mmR, the coating surface may change to a haze-like appearance. Warm the panel to 20° or
higher, and the haze-like appearance will disappear.
i. In metallic colors, slight color difference can be seen between bent and flat surfaces due to the
difference of reflection angle.

Fig. 3-17 Additional edge bending
Top: Before, Bottom: After

Fig. 3-18 CNC router

(12) CNC router
We can cut and groove ALPOLIC panels with CNC routers. As all
the procedures are computer-controlled by a program, CNC router
is suitable for repetition of analogous work. The suitable bit and
operating conditions are the same as those for hand routers.

Fig. 3-19 Turret puncher and perforation

Turret puncher

(13) Turret puncher
Turret puncher, also
computer-controlled, can be used for
perforation of ALPOLIC.
The suitable clearance between punch
and die is 0.1mm or smaller (material
thickness × 2%). A small droop will
appear at punched edge.
Regarding the perforated panels of
ALPOLIC, refer to “Appendix 3:
Perforated panel” in Section 4.

(14) Others
**Water-jet cutting:** A plunge cut (piercing at the starting point) in water-jet cutting may cause a certain degree of de-lamination between the aluminum skin and the core material. Therefore, we have to plunge at a disposable area or start at panel edge. After penetrating through panel, a water jet can cut ALPOLIC.

**Laser cutting:** According to our tests, we have so far concluded that ALPOLIC is not suitable for laser cutting, because the fumes generated from ALPOLIC might harm the sophisticated optical instrument in the laser system.

Fig. 3-20 Rivet work with blind rivet
4. Joining method
(1) Rivet and bolt/nut
We often use rivets, bolts/nuts and tapping screws for joining between ALPOLIC and other material like aluminum extrusions. For rivets, use aluminum blind rivets. We can do riveting work from one direction as shown in Fig. 3-20. For screws, use bolts/nuts and tapping screws made of aluminum or stainless steel.

**Strength of joining hole**
A joining hole of 4mm in diameter withstands approx. 500-800 N (50-80kgf) per point depending on ALPOLIC thickness. The strength of the joining point depends on the position of the hole. The joining hole located near the panel edge will easily tear and will not show a sufficient strength.

According to our test, the distance from the panel edge to the hole-center (e) should be larger than twice the hole-diameter (D) for sufficient strength, which is expressed with the equation, e>2D. In actual assembly work, we have to choose the position of the joining holes based on this idea. Refer to “Appendix 6: Strength of joining hole” in Section 4 for details.

In the installation of interior, countersunk rivets and screws will be used more often than round-headed ones. The strength may lessen with countersunk rivets and screws.

**Prevention from galvanic corrosion**
If ALPOLIC contacts a dissimilar metal in a humid atmosphere, the galvanic (electrolytic) corrosion may accelerate the corrosion of aluminum skin. To prevent this, the contact surface of the dissimilar metal like steel should have a paint coating thicker than 25 microns, galvanized coating or electric insulation, before fixing ALPOLIC panel onto the metal surface.

(2) Modified non-penetrating rivet
A non-penetrating rivet is applicable for joining if the surface finish is low-gloss (30% gloss or less). Non-penetrating rivets are an alternative method to double-sided tapes and...
functions like a mechanical fixing, ensuring the design strength of approx. 300 N/piece. Therefore, this rivet is suitable for areas where a reliable fixing is indispensable even in the event of fire or other accidents.

It is important that this non-penetrating rivet is usable only on low-gloss finishes as shown in Table 3-3, because the fastened trace is visible from the front side in medium and high-gloss finishes. Refer to “Appendix 7: Modified non-penetrating rivet” in Section 4 for details.

<table>
<thead>
<tr>
<th>Table 3-3 ALPOLIC products suitable for non-penetrating rivet</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPOLIC thickness</td>
</tr>
<tr>
<td>4mm, 6mm</td>
</tr>
<tr>
<td>3mm</td>
</tr>
</tbody>
</table>

(3) Adhesives

We can use a wide variety of commercial adhesives for joining and assembling ALPOLIC. However, some types of adhesives may corrode aluminum and do not suit ALPOLIC. For example, vinyl acetate type, widely used for timber and styrene foam, corrodes aluminum. The main adhesives suitable to adhesion between ALPOLIC and other materials are as follows.

<table>
<thead>
<tr>
<th>Table 3-4 General adhesives applicable to ALPOLIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesive type</td>
</tr>
<tr>
<td>Example of commercial brand</td>
</tr>
<tr>
<td>Metal</td>
</tr>
<tr>
<td>Material to</td>
</tr>
<tr>
<td>Concrete board</td>
</tr>
<tr>
<td>Styrene foam</td>
</tr>
</tbody>
</table>

Apart from the above adhesives, we have successfully used the following adhesives for fabrication and assembly work of ALPOLIC. However, these adhesives are only locally available in Japan. If you are interested in these adhesives, please contact local distributors or our office.

<table>
<thead>
<tr>
<th>Table 3-5 Adhesives used for assembling work of ALPOLIC in Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand name</td>
</tr>
<tr>
<td>Diabond SG350</td>
</tr>
<tr>
<td>Super X No.8008</td>
</tr>
</tbody>
</table>

Notes on adhesives:

a. Prior to adhesion work, remove all the foreign matter such as dust, particles, grease, water, etc. from the area to be adhered.

b. Select the most appropriate adhesive that ensures the necessary adhesion power in the atmospheric conditions. The adhesion power depends on the surface conditions of the substrate. Follow the adhesive manufacturer’s instructions.

c. When ALPOLIC is adhered to a dissimilar material, it is possible that ALPOLIC will show a
deflection due to the thermal expansion difference or dimension change of the material. Pre-test the adhesive before fabrication and installation.

d. Some adhesives may cause a distortion after hardening, as shown in the diagram. Some epoxy adhesives, polyurethane adhesives and silicone adhesives may show this kind of distortion. This distortion is usually very slight, and its visibility depends on the gloss level of the finish, the visual angle and the circumstances.

![Fig. 3-23 Distortion due to adhesive](image)

(4) **Welding of core**
One end of ALPOLIC can be adhered to another end of ALPOLIC by welding the core with hot melt adhesive (glue). Prior to heating a glue stick, we have to preheat the core surfaces for good adhesion. Normally, mechanical reinforcement is necessary after welding.

![Fig. 3-24 Welding of core with hot melt glue](image)

(5) **Double-sided tape**
Double-sided tape like 3M’s VHB tape is widely used in assembling work of ALPOLIC. Generally, VHB tape simplifies the joining work. The thicker ones even allow movement of the adhered two materials to some extent. The adhesion test shows that 3M’s VHB Y-4920 (0.4mm thick) is compatible with both topside and backside of Lumiflon-based fluorocarbon coated ALPOLIC.

(6) **Hook/loop fastener**
Hook/loop fasteners like Velcro tape is useful for guide signs and displays. This type of fastener is removable and restorable.

(7) **Sealing material**
In order to ensure waterproofing of joints between panels, normally a sealing material is used. The sealing material shall meet the performance required for the atmospheric conditions.

Table 3-6 below shows general performance of sealing materials. Silicone, modified silicone and polysulfide sealant are often used for outdoor installation. The compatibility tests with these sealing materials have shown a good adhesion with Lumiflon-based fluorocarbon coated ALPOLIC, but some of the sealing materials need primer for good adhesion. In addition, some are 2-component type that consists of a base component and a curing agent. Regarding the joint design such as proper joint width and thickness, please follow the sealant manufacturer’s specifications.

**Note: Gloss increase due to plasticizer of modified silicone and polyurethane sealant**
In tooling work of modified silicone and polyurethane sealant, do not smear the protective film of ALPOLIC with surplus sealant. The plasticizer, an additive in these sealing materials, permeates the protective film and causes a gloss increase on the Lumiflon-based fluorocarbon coating.
Table 3-6 General performance of sealing materials

<table>
<thead>
<tr>
<th>General performance</th>
<th>Sealing Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicone Modified Polysulfide</td>
<td>Polyurethane</td>
</tr>
<tr>
<td>Restoring ability</td>
<td>A</td>
</tr>
<tr>
<td>Due to aging Degradation</td>
<td>VS</td>
</tr>
<tr>
<td>Due to temperature</td>
<td>VS</td>
</tr>
<tr>
<td>Shrinkage after filling</td>
<td>S</td>
</tr>
<tr>
<td>Serviceable temperature (long-term)</td>
<td>40/120°C</td>
</tr>
<tr>
<td>Weather-ability</td>
<td>A</td>
</tr>
<tr>
<td>Fatigue resistance</td>
<td>A</td>
</tr>
</tbody>
</table>

**Note 1:** A: Excellent  B: Good  C: Normal  VS: Very small  S: Small  M: Medium  L: Large  

**Note 2:** The above is excerpt from Sealing Material Handbook, Japan Sealant Manufacturers’ Association.

**Fig. 3-25 Screen-print on ALPOLIC**

**5. Surface processing**

**1) Screen-printing**

In screen-printing, 1-component vinyl type or 2-component polyurethane type inks are suitable for all the finishes of ALPOLIC. We obtain normal adhesion with these inks after drying at 80°C for 30 min and curing at room temperature for 24 hrs. The typical printing procedures are as follows:

a. Remove all dust and dirt with a soft cloth. Oily dirt, if remaining, causes printing defects.

b. Cure or dry under proper conditions. Follow instructions from the ink manufacturer.

**Notes on screen-printing:**

a. Keep the curing temperature below 90°C for less than 30 min. If the curing temperature is higher, deflection of the panel may occur.

b. Select the ink suitable for the atmospheric conditions where the panel is to be located.

**2) Cutting film**

Various types of cutting films are applicable to the ALPOLIC surface. If you are going to fold the ALPOLIC panel after you apply the film, the film may change color at the folded corner. Confirm it with pre-testing.

**3) Digital print with ink jet printer**

Various types of decorative films and wallpapers printed with ink jet printers can be applied on ALPOLIC. Confirm the fire approval conditions of the film. Direct digital printing is also possible with special ink jet printers.
6. Overall fabrication works

(1) Typical fabrication process

Actual fabrication work of an ALPOLIC panel is an integrated work consisting of various machining procedures, assembling and inspection. Fig. 3-27 is a typical fabrication process for a standard tray type (rout and return) ALPOLIC panel.

Fig. 3-27 Typical fabrication process

1. Cut Check fabrication drawings

Check fabrication drawings and confirm the details.

2. Check raw ALPOLIC

Confirm raw ALPOLIC panels for size, color and quantity with the drawings.

3. Marking on panels

Mark cutting and grooving lines on the back of panels, based on the drawings.

4. Cut the panel with a hand circular saw, based on marked lines.

5. Groove extrusions

Adjust the remaining thickness with pre-tests. punching press.

6. Corner-notch

Remove the panel corner with a notching tool or a necessary.

7. Punch hanging holes

Make hanging holes with a punching press, if necessary.

8. Cut aluminum extrusions, based on the drawings.

9. Fold pieces

Fold the panel with a folding jig. Check 90-degree after folding.

10. Cut off protective film

Peel and cut off the protective film edge with a utility knife.

11. Fix corner angle

Fix the corner with corner angle piece and rivets.

12. Fix aluminum flange bars with rivets, to complete a tray type panel.

13. Apply sealant on panel corners

Apply sealant on panel corners from the back, if necessary.

14. Final check

Inspect the completed panels.

Fig. 3-27 (Continued) Typical fabrication process

(2) Fabrication drawing

We have to prepare fabrication drawings prior to every fabrication work. Fabrication drawings specify
details of processing and assembly method of each ALPOLIC panel. Normally, we specify the following items in fabrication drawings.

a. Raw ALPOLIC panel (thickness, color, dimension) to be used for the fabrication
b. Panel name, shape, dimensions and quantity of the completed panel
c. Cutting, grooving and other processing details including its coating direction

![Fabrication Drawing Example](image)

In addition to the above items, we can get unspecified information about subsidiary materials from fabrication drawings through simple calculations. Thus, we can use fabrication drawings not only for processing and assembly of ALPOLIC panel but also for preparation of subsidiary materials, final inspection work of completed panels and some office work including inventory control of raw ALPOLIC panels.

Fig.3-28 above shows an example of a fabrication drawing and the actual panels based on the drawing. Fabrication drawings are normally prepared for internal use, and so, many other forms are successfully used. However, every form should facilitate the drawing work and should be easily understood without confusion.

(3) **Adjustment of dimensions**

ALPOLIC panels elongate through folding and bending. Generally, we find the following elongations:

In folding after grooving: 0.5-1.0 mm per point
In 3-roll bending; 0.3-0.4 % of arc length (300-700 mm R)

In order to compensate the elongation, we have to adjust (shorten) the cutting and grooving position based on the fabrication drawing. Thus, the actual cutting and grooving dimensions are smaller than those of the complete panel. As the elongation values depend on the grooving shape and bending method, we have to determine the exact values by pre-testing.

(4) Panel details
When we work with fabrication drawings, we have to determine the fabrication details of ALPOLIC panels. Normally, the details applicable to ALPOLIC are slightly different from solid aluminum panels, mainly because ALPOLIC panels are pre-coated products, while solid aluminum panels are post-coated products. Some panel details may need approval from customers with the fabricated samples showing the details. We will look over some of the main details below.

Corner detail
In a tray type (rout and return) panel, we can select a corner detail from two alternatives: 90 deg square and 45 deg diagonal. After cutting, grooving and notching 4-corners in the respective manner below, fold the perimeter and fix the four corners with aluminum angle pieces and aluminum rivet. Refer to Fig.3-29 below.

Outside angle
In outside angle panels, we need additional notches at the top and bottom of the outside angle line. After assembling the grooved panel in the same manner as a regular tray panel, we finally fold the outside angle line. Check the folding angle and reinforce the outside angle with support plates made of aluminum on the top and bottom of the outside angle line. Refer to Fig.3-30 below.
Curving panel

There are several alternative methods for designing curved panels, depending on the curve radius. However, the slit method below is versatile and applicable to a wide range of curving radii from 300 to 3000 mm R. In this method, prior to bending, we make 3mm-wide slits on the top and bottom at a certain interval. The suitable interval depends on the curving radius and it is 30 to 85 mm (in 300 to 3000 mm R). We use an equation to calculate the suitable interval of slits. If the curving radius is larger than 3000 mm R, we can bend the panel without slits with a regular 3-roll bender. Refer to Fig.3-31 below.

Slits, 3mm wide, 30-85mm interval depending on curving radius

Special panel details

We sometimes encounter unusual designs including 3-dimensional shapes. Mostly, the required quantity is only several pieces, but we wish to try to fabricate the ALPOLIC panels in such a manner that they achieve long-lasting performance with satisfactory appearance. Several examples are attached in “Appendix 8: Examples of complicated panels” in Section 4 for your reference. If you have similar difficulties in an actual project, please contact local distributors or our office. We would like to study together.

7. Examples of fixing method

As for the installation of Aluminum Composite Material (ACM), many advanced methods have been proposed and improved on for years. We will introduce some of the most common methods suitable for ALPOLIC below.
Contents of drawing:

(1) External wall cladding – wet sealant joint
(2) External wall cladding – hanging method
(3) External wall cladding – dry gasket joint
(4) External wall cladding – narrow open joint
(5) Roof covering
(6) Back panel of glass curtain wall
(7) Sunshade or cornice
(8) Ceiling panel with non-penetrating rivet
(9) Parapet and soffit, renovation
(10) Corporate shop front signboard
(11) Roof of pedestrian passage

(1) **External wall cladding - wet sealant joint**

This installation system, with tray type (rout and return) panels and sealing joints, is one of the most common methods and it is available for a wide range of new buildings and renovation projects. After fixing ALPOLIC panels on the substructure, we apply a suitable sealing material to the joints in order to ensure water-tightness.
Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk.

Mitsubishi Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

(2) External wall cladding - hanging method

The hanging system is also one of the most common fixing methods. It simplifies the installation work at the construction site and hence we can shorten the installation period. It is easy to loosen the movement due to thermal expansion/contraction with this method, because panels are not tightly fastened to the sub-frame but are simply suspended.

Horizontal section

Vertical section
Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk.

Mitsubishi Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

(3) External wall cladding - dry gasket joint
In this method, we use gaskets in the joints instead of sealants. The durability of EPDM gaskets is comparable to that of the sealant, in addition, the gasket joint reduces the amount of dirt or stain on ALPOLIC surface.
estimate by technically skilled persons, with any use thereof to be at their own discretion and risk.

Mitsubishi Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

(4) External wall cladding – narrow open joint
Generally, this kind of method is suitable for Stone and Timber-patterned ALPOLIC panels in which narrow joints between the panels are aesthetically effective. According to need, we apply a sealing material or EPDM gasket to the joints.

Horizontal section

![Horizontal section diagram]

Vertical section

![Vertical section diagram]
(5) Roof covering
ALPOLIC has been used for roof covering in prestigious projects such as airports and stadiums. In roof applications, we install a water gutter or waterproof sheets behind ALPOLIC panels so that leaked water can drain outside.

Typical section

Gutter system

Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk.

Mitsubishi Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

(6) Back panel of glass curtain wall
Glass curtain walls sometimes need an opaque spandrel panel (back panel) behind glass for aesthetic and energy-saving purpose. The spandrel back panels behind the glass must be very durable especially to UV exposure, because it is hard to replace them after the building is completed. ALPOLIC is the perfect material for such applications.
Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk.

Mitsubishi Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

(7) Sunshade or cornice

ALPOLIC is sometimes used for sunshade or the cornice of a building wall. In this type of application, normally steel or aluminum frames are used as reinforcement behind ALPOLIC.
Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk. Mitsubishi Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

(8) Ceiling panel with non-penetrating rivet
When we use ALPOLIC for indoor ceilings or soffits, non-penetrating rivets simplify the panel details. Non-penetrating rivets are usable only on low-gloss finishes (30% or less). If we use these rivets on medium to high gloss products, the trail of the concealed rivet is visible from front. The design strength of the non-penetrating rivet is approx. 300 N/piece not including the safety factor. Refer to “Appendix 7: Modified non-penetrating rivet” in Section 4. In this method, we install fabricated ALPOLIC panels on lightweight suspension bar ceiling systems.
Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk.

Mitsubishi Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

(9) Parapet and soffit, renovation

ALPOLIC is widely used for parapets and soffits in building renovation. ALPOLIC is used for the water drip, parapet and soffit in the following detail.
Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk. Mitsubishi Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

(10) Corporate shop front signboard

This corporate signboard is a shop front sign of a countrywide newspaper company in Japan. The signboard has signs by 3M’s Scotchcal film. The aluminum flanges are coated with the same color as ALPOLIC.

Elevation

B-B section

1. ALPOLIC 4mm having signs (logotype, letterings) by Scotchcal film
2. Aluminum flange coated with the same color of ALPOLIC
3. Water drip
4. Drain hole
5. Steel sub-structure, L-30x30, coated
6. Anchor
Data embodied herein is intended only for estimate by technically skilled persons, with any use thereof to be at their own discretion and risk. Mitsubishi Chemical shall have no responsibility or liability for results from such use or infringement of any patent or other proprietary right.

(11) Roof of pedestrian passage

ALPOLIC has been used as roof panels of public pathways and bus stations. Refer to an application photograph in P. 11. ALPOLIC panels are just clamped between sub-frames and aluminum extrusions. In most projects, the curving panels can be naturally curved without a mechanical bending.
8. Overview of installation work

(1) General
Installation work accounts for a substantial part of the entire ALPOLIC work. Supposedly, the best installation procedures will be chosen from many aspects including quality, construction period and its cost. In this chapter, we would like to look over the basics of installation procedures of ALPOLIC, taking a small to medium scale external cladding project as an example.

When we install fabricated panels at project site, we implement the installation work in accordance with the drawings and specifications of the project. In the event that we find some discrepancy between drawings and the actual conditions at project site, we have to report to and consult with the project controller.

(2) Installation procedures
General installation work consists of the following procedures:

<table>
<thead>
<tr>
<th>Install</th>
<th>Unloading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck and crane</td>
<td>Unloading</td>
</tr>
<tr>
<td>Scaffold</td>
<td>Marking</td>
</tr>
<tr>
<td>Ditto</td>
<td>Substructure work</td>
</tr>
<tr>
<td>Ditto</td>
<td>Rust inhibiting coating</td>
</tr>
<tr>
<td>Ditto</td>
<td>ALPOLIC work</td>
</tr>
<tr>
<td>Ditto</td>
<td>Accessories work</td>
</tr>
<tr>
<td></td>
<td>Joint sealing</td>
</tr>
</tbody>
</table>
(3) Comments on each procedure

a. Unloading
Unload ALPOLIC panels on the roof, on each floor or suitable places on site. The unloaded panels on each floor will be just those required for the relevant floor. Fasten the panels together with rope and a covering sheet for protection.

b. Marking
Confirm the reference line in the presence of a superintendent. Mark the installation line, based on the reference line and the approved shop drawing.

c. Substructure work
In order to install the substructure, weld steel bracket pieces onto hole-in anchors (example of bracket: L=50x50x4mmt, L=70mm). Weld continuous steel angles onto the brackets (example of continuous angle: L=40x40x3mmt). All the angles will be finished with rust inhibiting coating, which conforms to the project standard. To prevent fire during welding, pay attention to sparks that drop on the cover sheet and veneer. During the substructure work, check the level with a flush thread and plumb-bob line, or water level, if necessary.

d. Rust inhibiting coating
Apply rust inhibiting paint onto all the welded points including the back and edge. The paint and coating thickness must conform to the project standard.

e. ALPOLIC work
Mark the installation line in accordance with the shop drawing. Fix ALPOLIC panel onto the substructure with self-tapping screws, 4mm in diameter, after confirming the position of the panel (left, right, top and bottom). The fixing interval will be normally 300-400mm depending on the strength calculation. After confirming the fixed conditions, peel off the protective film and clear the removed film.

f. Accessories work
Bring the accessories to the scaffold passage, as indicated in the shop drawing. The quantity of accessories brought to the scaffold passage must be kept to a minimum to avoid dropping and other accidents. Lay large accessories diagonally on scaffold passage.

Mark the installation line onto the substructure to meet the position of the window frame. Fix the accessory with self-tapping screws, 4mm in diameter, with @=300mm interval. After installation, check the installed level and precision. After the check, peel off the protective film. Clear the removed film.

g. Joint sealing
Use the sealing material as specified in the project and apply the joint design (width and height) as
instructed from the sealant manufacturer. Typical sealing work includes cleaning of the joints, inserting back-up material, applying masking tape, applying primer, filling with sealant, tooling with palette knife, removing masking film and curing. As improper sealing work will affect the appearance and the waterproofing performance of the joint, the sealing work must be conducted exactly based on the instructions from sealant manufacturer.

h. Clearing and cleaning
Clear and clean the working area everyday after work. Especially, when the work is complete in a zone, clear, clean and transfer the area smoothly to the next location, in order to avoid hindering the next stage. Collect and clear unnecessary remains to the dump point everyday or transport out of the site immediately.

9. Touch-up coating method
When we need to repair scratches on the coating surface of ALPOLIC, we can repair (touch-up) them at room temperature. We use an air-cured type of Lumiflon-based fluorocarbon paint for repair coating. The air-cured type paint consists of 2 components: main agent and hardener. Mix them with 13:1 ratio (main agent : hardener) and stir the mixture before use.

After application, the air-cured type paint will reach surface dry in 1 hour and will show a satisfactory coating performance in a couple of weeks. However, the touched-up portion may show a slightly different appearance, because the coating appearance depends on the coating method. Especially in Metallic Colors and Sparkling Colors, even an exactly matched paint may show a slightly different appearance. In Stone, Timber and Metal finishes, we use an intermediate solid color diluted with a clear paint for touch-up. The suitable dilution rate is, depending on the color, 10-90% of clear content. Regarding the touch-up procedures, refer to “Appendix 9: Touch-up coating method” in Section 4.

10. Cleaning method
(1) Removal of light surface soiling
Prior to applying a cleaner, we recommend a forceful water rinse cleaning from top to bottom. Low water volume with moderate pressure is better than considerable water volume with little pressure. Simultaneous physical rubbing is also effective. Use a soft sponge or soft rags fully soaked in water.

a. Apply a water rinse with moderate pressure to dislodge the soiling. If this does not remove the soiling, test a simultaneous water rinse with a sponge. If the soiling is still adhering after dry, test a diluted mild detergent.

b. When you use a diluted mild detergent, use it with soft sponges or soft rags. Wash the surface with uniform pressure and clean the surface in a horizontal motion first and then in a vertical motion.

c. Minimize the drip and splash of the mild detergent and rinse the rundown immediately to avoid streaking. Clean the surface from top to bottom and follow with a thorough rinse with clean water.

(2) Cleaning of medium to heavy surface soiling
In order to remove medium to heavy soiling caused by grease and sealing material, some type of alcohol such as IPA (Isopropyl Alcohol), ethanol or N-hexane is used. Dilute these alcohols by 50%
with water. Strong solvents or solvents-containing cleaners may have a detrimental effect on the coating surface. Do a spot test on a small unseen area. Wash the residues with mild soap and rinse with water.

(3) Caution
a. Strong solvents and strong cleaner may cause damage to the coating. Do a spot test on a small unseen area.
b. Avoid abrasive cleaner. Do not use household cleaners containing abrasives.
c. Do not rub excessively as it may change the coating appearance.
d. Avoid drips and splashes. Remove the rundown as soon as possible.
e. Avoid extremely high and low temperatures. Extremely high temperatures will accelerate the chemical reaction, evaporate water from the solution and cause streaking. Extremely low temperatures will result in a poor cleaning effect. Perform cleaning work on a shaded side of the building under moderate temperatures.
f. Do not use paint removers, strong alkali or acid cleaners. Do not use strong organic solvents such as MEK (Methyl Ethyl Ketone), MIBK (Methyl Isobutyl Ketone), Treclene (Tri-chloroethylene) or thinner.
g. Make sure that cleaning sponges and rags are grit free.
h. Do not mix cleaners.

(4) Practical cleaning method
Cleaners and detergents are normally local products. A cleaner or a detergent widely available in one country may not be available in another country. We attached an example of a practical cleaning method in “Appendix 10: Example of practical cleaning method” in Section 4. To confirm the harmlessness of your cleaner, contact local distributors or our office. We will perform a test with your cleaner sample.

11. Panel dimension and tolerance
For your planning (design) work of fabrication and installation, we excerpt the panel dimensions and tolerances here from the product specifications.

(1) Product dimension

<table>
<thead>
<tr>
<th>ALPOLIC/fr</th>
<th>ALPOLIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>3mm</td>
</tr>
<tr>
<td>Weight</td>
<td>6.0 kg/m²</td>
</tr>
<tr>
<td>Width</td>
<td>965, 1270 or 1575mm (for user’s selection)</td>
</tr>
<tr>
<td>Length</td>
<td>Less than 7200mm (for user’s selection)</td>
</tr>
</tbody>
</table>

**Note 1:** Custom width is available between 914 mm and 1575 mm subject to minimum quantity. Contact local distributors or our sales office.

**Note 2:** (Edge condition) ALPOLIC has cut edges without aluminum sheet displacement or core protrusion.

(2) Product tolerance
Width: ±2.0 mm
Length: ±4.0 mm
Thickness: ±0.2 mm in 3 and 4 mm thick, ±0.3 mm in 6 mm thick
Bow: Maximum 0.5% (5mm/m) of the length or width
Diagonal difference: Maximum 5.0 mm