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First - insulation works

Insulation: Keeping Heat In or Out

The best insulating material which keeps the most heat in or heat out as we needed. Equipments of any production line must be insulated to prevent the collected heat from flowing back into the atmosphere.

Hot liquids or gases tanks and pipes need insulation too, so that the fluids or gases they contain don't lose its heat.

At the completion of this activity, you should be able to :-

1- Compare different insulating materials for their abilities to keep heat in and to keep heat out.

2- Determine the best material for insulating against heat loss and against heat gain.

Insulating materials: -

Fiberglass Wool Styrofoam Newspaper Aluminum foil

Rubber bands Metric ruler Safety glasses

- A good Insulating materials which reduce heat flow from hot areas to cold areas, in choosing insulation you would also Consider other factors such as cost and safety.

Some materials are good insulators against both heat gain and heat loss.

insulation works

Installation insulation works:-

The insulation consists of heat –resistance mineral wool which is covered with a weather-resistant cladding.

A- heat –resistance mineral wool:-

1 - To fix the insulation use bar iron "fixing iron "Ø5 mm, which is welded to the equipment wall, using minimum 7 per m2.

2- Before insulation is placed on the equipment wall fixing iron "binder" and fixing clamps must be welded in poison.

3- There must be no insulation in the hollow space between plate side and stiffening iron "angle iron" because this would prevent thermal radiation and cause thermal bending of the stiffening iron "angle iron".

4- The first coat of insulation must be placed over the fixing iron 'binder" and locked against the plate side by means of striker plate ,the second coat of insulation is placed over the first coat , the joins must be staggered in both directions.

Timber or any other inflammable material must not be used as support for the insulation.

insulation works

B- Cladding:-

1- The cladding must be plane or corrugated plate, all plate work must be wind and weatherproof, specifically at inspection doors, flanges / tubes and must be carried out with effective overlapping and proofing.

2- The cladding must be mounted flexibly with fixing clamps and fastening steel so as to take up thermal expansion.

3- The fastening steel must have a maximum length of 2 m, with intermediate spacing of 10-20 mm due to the possibility of thermal expansion.

4- The cladding must be fastened to the fastening steel by means of tubular rivets or self cutting screws with sealing rings, the cladding must not be fastened to the fastening steel near the spacing.

5- Fixing clamps must not be welded directly to the equipment; fixing clamps must be welded to the stiffening iron, if available.

6- Fixing clamps must be placed with uniform spacing; maximum space between two fixing clamps depends on the dimensions of the fixing clamps.

insulation works

For example procedures for the insulation of combustion pipes system

- The hot combustion air piping (between the heat recuperator and the burners) is externally insulated with mineral wool lagging. The insulation shall be carried out using:-

1- Refractory fiber, rock wool matted layers, stitched with galvanized wire netting in double thickness.

2- Galvanized annealed iron wire, Ǿ 0, 80 mm.

3- Self threading screws of parker type made of stainless steel.

4- Galvanized finishing sheet-steel, Ǿ 0, 80 mm, for the pipes whose pipe diameter plus the insulating piece thickness is lower than 300 mm and Ǿ 1 mm for the pipes whose Pipe diameter plus the insulating piece thickness is higher than 300 mm.

5- Metal strap supports, properly arranged and insulated.

- Waste gas ducts from the burners to the stack
  The insulation shall be carried out using:-

1- Ceramic fiber thickness 1˝.

2- Ceramic fiber 30 × 1 mm

3- mineral-wool matted, quilted with galvanized wire mesh.

4- Galvanized iron wire, 0.8 mm.

5- Rivets Ø 4, 2 x 13 mm for sheet Thickness 0, 8mm.

6-Parker-type zinc or cadmium-coated self-tapping screws Ø 4, 2 x 13 mm.

insulation works

7- 0.8 mm-thick finishing sheet zinc or aluminum for the pipes having a diameter Less than 300 mm, and 1 mm-thick finishing sheet zinc and or aluminum for those Having a over 300 mm diameter adequately located and insulated metal-strap Supports.
8-Metallic plate 30 x 3 mm will be used in order to make rings and spacers necessary to maintain a uniform insulation thickness on pipe to be insulated, and to make Supporting structures.

- Description of the execution

1- Installation :-

Before applying the insulation materials, oil, water, dust and other contaminations, shall be removed from the pipelines.

a-Supporting structure:-

For all pipes, spacing rings shall be installed in order to maintain a uniform insulation thickness. The supporting rings shall consist of an outer mild steel ring and a certain number of Spacers made of carbon steel plate 30 x 3 mm, using ceramic plats or equivalent Materials to discontinue the thermal bridges,
The outer ring will be riveted on the spacers with an insulation shim made of ceramic Paper/silicarton thickness 2mm,The spacing rings shall be distanced 950mm for all pipeline diameters.

b-Insulation:-

Place the insulating material against the pipe to be insulated according to the Corresponding specification label which show the constitution of the insulation and According to the following instruction:

c- matted layers :-

The matted layers shall be cut according to the outer circumference (including Insulation) and wound on the piping leaving the wire netting towards the exterior and then shall be fastened with galvanized metal wire.

insulation works

- The rock wool matted layers, 60And/or 70 mm thick, shall be installed with all joints Staggered.
- Subsequently, the wire netting edges shall be sewed with galvanized annealed wire.
- The seams will concern also the butt joints between two adjacent matted layers that shall be strictly approached.
- The longitudinal and circumferential joints shall be tight.

- The longitudinal joints shall be staggered and shall be tied 6 times per meter by using Galvanizing wire.

- For horizontal lines, the longitudinal joints shall be above or below the level of the Horizontal centre line.

In case of multi-layer insulation, the adjacent insulation shall be applied joint-staggered to the layer below; the individual layer shall be tied by means of galvanized wire.

In order to avoid sagging of insulation, vertical lines longer than 3000 mm shall be provided with insulation supports spaced at 3000 mm. The supports shall be made from 30 mm wide steel plate straps, thickness 3 mm.

d- Preformed pipe insulation: -

If foreseen, preformed pipe insulation shall be fixed with galvanized wire.

e- Loose fill insulation:-

Loose fill insulation shall only used to a limited extent, i.e. for the insulation of pipe Bends, air space, valves, boxes, etc.

insulation works

Note: -

During the installation of the insulation, remind to leave accessible the sampling points.

- Protection with galvanized cover sheet:-

a - piping:

- Cylindrical sections shall not be longer than 1000 mm.
- Circumferential sections shall not be longer than 2000 mm.

The sheet-steel shall be properly roll-bent, rimmed and kept in place with self-threading screws in AISI 304 spaced 150 mm one from the other, the longitudinal joints shall be rimmed and fixed with screw Ø 4, 2 x 13 mm (the upper edge must always be toward the exterior); for the circumferential joints, the sheet-steel shall be overlapped and male-female folded , every 3 m on the circumferential joints the sheet-steel shall be simply overlapped and shall have at least 100 mm of overlapping. At last six screws per linear meter shall be used.

All circumferential and longitudinal joints shall be arranged and sealed with self compound' in order to avoid penetration of rain water'

For the vertical piping the sheet-steel shall be fixed to the insulation supporting ring.

In the finishing, the sheet-steel shall cover for at least 100 mm the sheet-steel of the adjacent insulation and will be kept in place with lever tie rods directly applied to it

insulation works

b- Pipe bends (elbows):

They shall be made from segments, the number of the segments shall depend upon the diameter of the pipe.

The segments shall be made with bead and counter bead and shall be connected by means of screws.

c- Boxes:

The box will be lined with mattress held in position by metallic clamps made of sheet thickness 1 mm. These clamps will be cut as splinters in scrap of sheet and fixed in the box by means of rivets.

The two parts of the box will be fixed together by means of toggle clips.

In case of boxes in vertical pipe, the box will be equipped of rain water discharge on the upper part.

d- Expansion joints

The covering sheets have to be free at one end only of the expansion joint.

The insulating material thickness shall depend on the section of the pipes to be insulated.

insulation works

Application of insulation for equipment: -

1- Insulation and cladding for equipment up to 750 mm out side diameter shall be applied as described for straight pipe works.

2- The shell sections of vertical and horizontal equipment above 750mm diameter shall comprise preformed, boned rigid mineral fibre slabs applied in the maximum available

sheet sizes commensurate with the equipment diameter, where necessary to assist in conforming to the equipment curvature , the slabs shall be kerfed by the introduction of saw cut slots at the required spacing .

Table –dimension of the Insulation thickness

item	Operating temperature	Insulation thickness	Example of plant section
1	Up to about 140 °	30 mm	Mill exhaust air duct
2	Up to about 200°	50 mm	Pipeline after electro-static prcipitator
3	Up to about 260°	80 mm	Cooler exhaust air duct
4	Up to about 310°	100 mm	DOPOL exhaust gas duct
5	Up to about 340°	120 mm	DOPOL exhaust gas duct
6	Up to about 380°	140 mm	DOPOL exhaust gas duct

General erection instruction :-

1 - The purpose of this instruction is to facilitate the erection works, based on the materials referred to in the bill quantities.

2- It has been assumed both that insulation contractor charge of the erection works well have adequate super visors staff , equipment and tools in order to carry out the insulation works and that the super visors staff responsible for the works is well acquainted with the techniques and issues in connection with this trade.

insulation works

3- Thus, especially as regards the insulation description and the appended principally as regards the insulation and the appended principle sketches ,these instructions set out to define the basic concepts rather than to give full details about the methods of implementation of the materials which depend in particular on :-

- The building site equipment and tools
- The storage of the materials,
- The erection staffs qualification
- The completion times, etc.

Scope of the works:-

1- Marking drawings of insulated areas.

2-The areas to be insulated are marked on manufacturers assembly drawings.

Bill of quantities:-

The quantities include the rates for scraps and losses:

Insulating materials:	5 %
Cladding:	20 to 40 depending of the shape of the item to be insulated
Steel sections	7 %
Screws and rivets:	12 %
Miscellaneous:	10 %

insulation works

List of recommended tools: -

1- Machine – tools

- Uncoiler (2 T)
- Folding machine (2 M)
- Hand edging machine with rollers
- Hand rolling machine
- Lever Shears
- Electric edging machine with rollers
- Electric rolling machine
- Bending machine for flat iron (Thickness 4 mm)
- Punching machine with punches and dies (5 holes)
- Shears for flat iron (Thickness 4 mm)
- Welding machine
- Punching machine with punches and dies for flat iron (Thickness 4 mm)

2- Individual electric tools

- Electric shears + blades
- Cross – cut circular saw + blades
- Electric drilling machines
- Electric screwdriver + tips for different screws.

3- Specific hand tools

- Hand shears
- Riveting expanding pliers
- Punching pliers with punches and dies
- Hammers
- Mallet
- Band tensioner
- Riveting hand pliers
- Mechanician dividers (300
- Butcher knives
- Tailor scissors
- Clamp plier

4- Standard hand tools

Tool boxes including all the standard tools for building sites (Measuring)
Tape, flat wrenches, metal cutting saws, etc

5- Consumables for drilling

- Drills of 06-4.2.
- Welding electrodes 0 3.2

- The quantities of tools and consumables shall be defined depending on the staff available and the deadlines.

insulation works

Storage instruction:-

1-Rock wool materials during handling operations, be careful not to damage the packaging which is a product protection, the storage should be in a covered and dry area and the materials should be left in original packing.
The ambient temperature of the storage should not exceed 80°C.
The products should be stored vertically; Stacking should be limited to 2 heights (2.40m).

2- Miscellaneous products

- The storage should be in a covered and dry (free of moisture) area
- An air gap should be provided between the packing and the floor

3- Aluminum jacketing

The coils should be stored up right in a covered and dry (Free of moisture) area the packs (for corrugated sheets) should be fast stored an air gaps should be provided between the packs and the floor.

For example

Our company implemented insulation works for one of the most important project in Egypt is liquidation natural gas project "SEGAS S.A.E" EGYPT LNK project, Damietta, Egypt.

-Tables of insulation and cladding thickness for liquidation natural gas project:-

Piping and equipment in high temperature service shall be insulated according to the following symbols shall be used in designating the insulation type:-

Type 1 - heat conservation and/or process control (21 C to 600C).
Type 2 -Personal protection using insulation (150 C to 600C).
Type 3 - combined sound control/ heat conservation (21 C to 600C).
Type 4 - as type 3 but with high tensrion loss.
Type a - steam traced.
Type B - electric traced.
Type C - hot liquid traced.
Type G - personal protection using guards (60 C to 149C).

insulation works

1: insulation Thickness:-

Table 1 - Insulation type 1
Heat conservation and / or process control
Insulation types A, B and C
Steam, electric and hot liquid traced
Nominal insulation thickness (mm)

Nominal pipe size Inch	Mm	Up to 100 °	101° to 200 °	201° to 300 °	301° to 400 °	401° to 500 °	501° to 600 °
1/2 Inch	15 Mm	25mm	30mm	40mm	50mm	70mm	80mm
3/4	20	25	30	40	50	70	90
1	25	25	30	40	50	70	90
11/2	40	25	40	50	60	80	100
2	50	25	40	50	60	80	110
3	80	25	40	50	70	90	120
4	100	25	40	60	70	90	120
6	150	25	50	60	80	100	130
8	200	25	50	60	80	110	140
10	250	30	50	60	80	110	140
12	300	30	50	60	80	110	150
14	350	30	50	70	80	110	150
16	400	30	50	70	80	120	150
18	450	30	50	70	90	120	160
20	500	30	50	70	90	120	160
24	600	30	50	70	90	120	170
30	750	30	50	70	90	130	170
36	900	30	50	70	90	130	170
42	1050	30	50	70	90	130	180
flat	flat	30	50	70	90	140	200

Table 2 - Insulation type 2

Personnel protection
Insulation type 9 Personnel protection
nominal insulation thickness (mm)

Nominal pipe size Inch	Mm	150° to 200 °	201° to 300 °	301° to 400 °	401° to 500 °	501° to 600 °
1/2 Inch	15 Mm	25mm	25mm	30mm	40mm	60mm
3/4	20	25	25	30	50	60
1	25	25	25	40	50	60
11/2	40	25	25	40	50	70
2	50	25	25	40	50	70
3	80	25	25	40	60	80
4	100	25	30	40	60	80
6	150	25	30	50	60	90
8	200	25	30	50	70	90
10	250	25	30	50	70	90
12	300	25	30	50	70	100
14	350	25	30	50	70	100
16	400	25	30	50	70	100
18	450	25	30	50	70	100
20	500	25	30	50	70	100
24	600	25	30	50	70	100
30	750	25	30	50	80	110
36	900	25	30	50	80	110
42	1050	25	30	50	80	110
flat	flat	25	30	50	80	110

insulation works

Table 3- insulation type 3

Combined sound control / heat conservation

Nominal pipe size Inch	Mm	Up to 100 °	101° to 200 °	201° to 300 °	301° to 400 °	401° to 500 °	501° to 600°
1/2 Inch	15 Mm	100mm	100mm	100mm	100mm	100mm	100mm
¾	20	100	100	100	100	100	100
1	25	100	100	100	100	100	100
11/2	40	100	100	100	100	100	100
2	50	100	100	100	100	100	110
3	80	100	100	100	100	100	120
4	100	100	100	100	100	100	120
6	150	100	100	100	100	100	130
8	200	100	100	100	100	110	140
10	250	100	100	100	100	110	140
12	300	100	100	100	100	110	150
14	350	100	100	100	100	110	150
16	400	100	100	100	100	120	150
18	450	100	100	100	100	120	160
20	500	100	100	100	100	120	160
24	600	100	100	100	100	120	170
30	750	100	100	100	100	130	170
36	900	100	100	100	100	130	170
42	1050	100	100	100	100	130	180
flat	flat	100	100	100	100	140	200

insulation works

2: Metal cladding thickness:-

Outside diameter of insulation thickness of profiled thickness of flat Aluminized or stainless

stainless Mm **Steel sheet (mm)**	Steel sheet (mm)
Pipe up to 200	0, 6
Pipe 201 to 1000	0, 8
Pipe 1001 and over	0, 8
Horiz/ vert vessel up to 200	0, 6
Horiz/ vert vessel 201 to 749	0, 8
Horiz vessel 750 and over	0, 8
vert vessel 750 and over	0,8
removable covers up to 600 mm dia. over insulation	0,8
removable covers 601 mm dia. over insulation and above	1,0
inner mass layer – acoustic Insulation type 3 (all dia.	0,8
outer metal jacketing acoustic insulation Type 3 and type 3s (all dia.)	1,0

insulation works

-The following are some of the projects that have been implemented:-

1- Construction insulation of new cement production lines

1- Constructing Helwan cement company line production "1" May 4, 1981.

2-Constructing line "1" Suez Cement Company in 1981.

3-Constructing line "1" Assuit Cement Company in February 17, 1984.

4- Constructing Helwan cement company line production "2" May 17, 1983.

5- Constructing El kuattamia Cement Company in March, 1984.

6- Constructing Torah cement co. line 8&9 in October 16, 1984-1985.

7- Constructing El menya Cement Company in 1986.

8- Constructing line "2" Suez Cement Company in 1997.

9- Constructing Egyptian cement company line "1" in May 6, 1998.

10- Constructing cement factory Arish .Sinai in May 15, 2000.

11- Constructing Egyptian cement company line "2" in June 11, 2000.

12- Constructing Egyptian cement company line "3" in June 11, 2000.

13- Constructing line "1" miser Beni suef for cement in March 21, 2001.

14- Constructing Egyptian cement company line "4" in July 12, 2001.

15- Constructing Qena Cement Company in 2002.

16- Constructing El meriya cement company line "3 " February 3 , 2003 .

19-Constructing the first production line for Algerian cement company in Algeria in august 1, 2003.

20- Constructing the first production line for Arab union cement company at Libya in August 1, 2004.

insulation works

21-Constructing the second production line for Algerian cement company at Algeria In March 2, 2005.

22-Constructing Egyptian cement company line "5" in February, 2006.

23-Constructing the first production line for Arab Emirates cement company for Cementech in November 20, 2006.

24-Constructing production line Ciba white, grey in Algeria in April 28, 2007.

25- Constructing El Arabia cement company in July, 2007.

26- Constructing of a cement factory in Nigeria in 2008.

27- Constructing El menya white cement production line in 2008.

28- Starting the Constructing of a cement factory El Safwa in Saudi Arabia In 2009.

29- Starting the Constructing of a cement factory beni suef "titan" line" 2" In 2009.

insulation works

2- The insulation works &complete and partial insulation rehabilitation

1- Executing the thermal insulation works in RKTA Company for paper in October, 1980.

2- Executing the thermal insulation works in national company for Paper Company September 30, 1981.

3- Executing the thermal insulation works for nitro glycerin plant in Abu Zaabal fertilizer & chemical company in June 7 , 1982 .

4- Executing the thermal insulation works in Abu Zaabal fertilizer & chemical company in February 23, 1983.

5- Executing the thermal insulation works supply and erection in el kuatamia Cement Company about 12000 m2 in January 3, 1984.

6- Executing the thermal insulation works in Nasr Company for the manufacture of coke in January 3, 1984.

7- Executing the thermal insulation works in the American Egyptian Company for paints 12-1986.

8- Executing the thermal insulation works in Autoclave at Aboroash October 8 , 1988 .

9- Executing the thermal insulation works gypsum plant in Ras malab , Sinai in November 9 ,1987.

10- Executing the thermal insulation works in boiler for el Ameriya petroleum, Alexandria. In November 6, 1989.

11- Executing the thermal insulation works in el Talbet plant for iron and steel complex in December 11, 1989.

12- Executing the thermal insulation works in RKTA .Company in august 20, 1990.

13- Executing the thermal insulation works for boiler in El Ameriya petroleum, Alexandria. In December 5, 1990.

14- Executing the thermal insulation works for international for steel in El sadat town in Oct.1 ,1995 .

insulation works

15- Achievement the thermal insulation works in Helwan cement company in October, 1999.

16-Executing the thermal insulation works in Egyptian fertilizer company in Suez in October, 1999.

17- Executing the thermal insulation works for E.C.C in 6-2000.

18- Executing the thermal insulation works for electric power station. Ain Sukhna , October 2001.

19- Executing the thermal insulation works for electric power station. East port said, October 2001.

20- Executing the thermal insulation works for S.C.C, El Katamia in 2001

21- Executing rehabilitation for the thermal insulation works in Egyptian Fertilizer Company in Suez 2001.

22- Executing the thermal insulation works for Amoke for oils in 2002.

23- Executing the thermal insulation works for Damietta LNG insulation project in may 29. 2004.

24 -Executing all replacing insulation damaged in Helwan Cement Company since the beginning of dealing till now.

25 - Executing all replacing insulation damaged in Beni suef Cement Company since the beginning of dealing till now.

26 - Executing all replacing insulation damaged in Suez Cement Company since the beginning of dealing till now.

27 - Executing all replacing insulation damaged in Egyptian cement company since the beginning of dealing till now..

28 - Executing all replacing insulation damaged in El kuattamia Cement Company since the beginning of dealing till now.

29 - Executing all replacing insulation damaged in Ameria Cement Company since the beginning of dealing till now.

insulation works

30 - Executing all replacing insulation damaged in Alexandria Portland Cement Company since the beginning of dealing till now.

31 - Executing all replacing insulation damaged in Turha Cement Company since the beginning of dealing till now.

32 - Executing all replacing insulation damaged in Misr Beni suef cement company since the beginning of dealing till now .

Second - Refractory works

Cement Kiln Refractory

The Plant include the rotary kiln, pre-heater, mill, raw mill, cooler , dust collector, DCS …… etc.

General Instructions for installation refractory: -

1- Supervision, site management, superior site management:-

a- drawings and installation instructions is the only manner of execution on the site.
b- if in special cases additional instruction become necessary , such additional instruction must be laid down in writing .

2- Material control:-

a - It must be checked by means of the delivery notes and part lists whether all materials, by random tests the suitability of the materials shall be ascertained.
b- The material consumption must be checked continuously by means of part lists.
c- Materials are to be handled economically and with great care ,inaccurate execution of work will entail increased material consumption .

3 -Control of the steel construction:-

Prior to the installation of the refractory material must check some points of the steel construction about it are correctness:-
a- Internal dimensions of the plant.
b- Arrangement and correct executed dimension of the brackets.
c- Arrangement of the sight holes , measuring and access opening.
d- Arrangement and dimensions of the tube passages.
e- Arrangement / dimensions and direction of fixing elements for the refractory lining.

4-Preparation of the plant sections to be lined:-

Prior to the installation of the refractory materials loose rust, scale, dust and other impurities on the surfaces of the steel construction to be lined must be removed by cleaning with compressed air or a strong water jet , it is not necessary to clean the surface metallic bright .only in cases where harmful substance such as lime ,mortar and chemical agents stick to the surface of the steel construction cleaning by blasting with an appropriate blasting agent may be necessary .

Refractory works

Instructions for installation refractory for kiln: -

1- General rule: lining patterns are staggered.

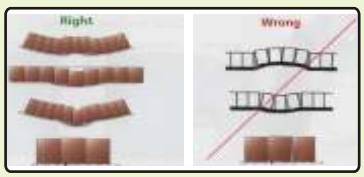
2 - Use a rubber hammer for brick installation.

3- Ensure the kiln shell surface is clean and smooth.

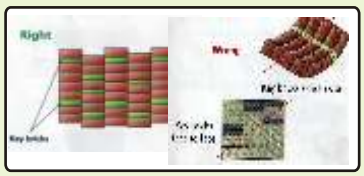
4 - Mixing ratio is adjusted.

5- No brick upside down check hot face marking.

6 - Mortar is used to correct deformed shell / welding.



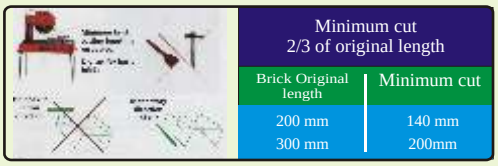
7 - Key bricks are not in one line.



8 - Shims are not installed close to key bricks.

9 - Rings are closed using hydraulic jack

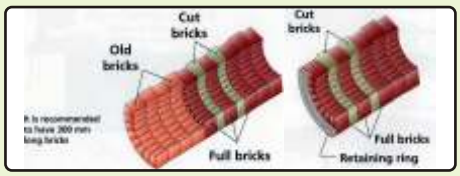
10- Bricks are cut with brick cutting machine.



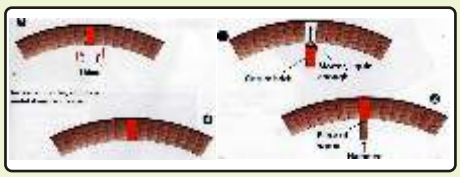
Minimum cut
2/3 of original length

Brick Original length	Minimum cut
200 mm	140 mm
300 mm	200mm

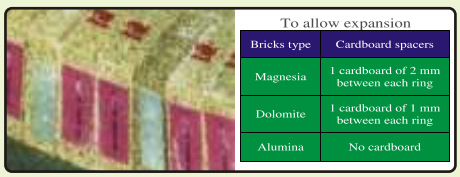
11- Cut bricks are always in between full bricks.



12-Closing of the last ring is done properly.



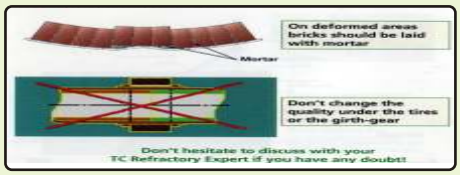
13 - Cardboard spacers are placed adequately.



To allow expansion

Bricks type	Cardboard spacers
Magnesia	1 cardboard of 2 mm between each ring
Dolomite	1 cardboard of 1 mm between each ring
Alumina	No cardboard

14 - additional guideline



Refractory works

General comments for installation refractory:-

1- The interior surface has to be even and smooth.

2-Pay attention to expansion joints, keep free of mortar.

3-Thickness of mortar joints max. 2mm.

4-Door openings should be loosely bricked up with standard bricks, manhole cover, access door lining filled in with refractory castable.

5- In parts of monolithic lining shuttering joints in distance of 0, 8 -1,0 meter are to be considered.

6- The placement of shuttering fields to be determined on site.

7- In sections where no ceramic anchors can be installed auxiliary metallic anchors have to be welded.

8- The exact placement of the anchors in the range of the openings is to be determined by installation.

9 - In parts of monolithic lining the insulation is to be provided with a bitumen painting.

10 - For correct drying of the castable in monolithic lined areas evaporating holes are to be considered according guidelines for preparation and installation of monolithic materials.

11- The placement of anchors is to be determined on site. 12- To be cut on site.

13- Expansion material for compensator to be provided by plant operator.

14 - The brackets TB 70x… are only designated to support the refractory lining .the is not additional anchoring.

15 - To be fixed with mortar or assembly glue respectively.

16 - The insulating plats are to be, if needed, fixed with mortar.

Note:-

1- The bricks will be lined with 2mm + 0.5 mortar joints, except indicated on the drawings.
2- The castable lined areas will have dry joints every 800mm about, except where indicated on the drawings.
3- The anchors for the castable will be staggered with a pitch 12/m2 on the cylinder, 16/m2 on the wall and 25/m2 on the roof , except where indicated on the drawings.
4- All supports, ducts, flats and other metallic pieces in contact with castable will be covered with "denzo" bands or equivalent material or fiber blanket.
5- All anchor tips will be covered with a plastic cap.
6- Welding stick material must be compatible with material to be welded.
7- Fill all expansion gaps with low bio-persistence fiber thickness 25 mm compressed at 20 density 128 kg /m3.

Refractory works

Refractory insulation design specifications and main installation chacteristics :-

1- Insulation degree of static parts

Quality and thickness of insulation shall permit to obtain temperature levels on the shells as per the following values:-

- Cooler and tertiary air duct: less than 75° c.
- calciner and pre-heater tower : between 70° and 100° c "depending on local ambient conditions ".

2-Setting up of dense unshaped materials

As a rule refractory cast materials shall be set up casting.

Gunning is acceptable only for suspended horizontal or sloped walls when casting is not feasible.

3- Anchorage of refractory lining

Anchors are employed to set up dense shaped these anchors shall and unshaped materials. be constructed in AISI 310 steel.

Reference density for anchors shall be the following:-

- Straight bricks walls 230mm"9" in thickness: 5 point of anchorage each m2 of
- Straight bricks walls 114mm"4, 5" in thickness: 7 points of refractory lining. anchorage each m2 of refractory lining.
- Suspended roof 180- 250 mm"7-10" in thickness built with unshaped materials: 16 metal anchors each m2 or ceramic anchors m2.
- Suspended roof 114 - 180 mm"4,5 -7 " in thickness built with unshaped materials :25 metal anchors each m2 or ceramic anchors m2 .
- Vertical walls with a thickness higher than 150mm"6" built with unshaped materials: 10 metal anchors each m2 of wall or 5 ceramic anchors each m2 of wall.
- Vertical walls with a thickness higher than 150mm"6" built with unshaped materials: 15 metal anchors each m2 of wall or 7 ceramic anchors each m2 of wall.

4- Load support flanges

Some load support flanges shall be employed placing them each 1-2,5 m in the vertical direction to guarantee an acceptable stability of refractory linings .

5- Construction of non-deformable insulating plates on curve surfaces

Non – deformable insulating plates shall be applied to curved surfaces, i.e , calcium silicate plates .

If this plates are not preliminarily prepared to reach the correct curving of shell, they shall be machined before putting them in place .

Refractory works

6-Tolerances on wall thickness made of dense unshaped refractory materials "cast ,vibrated or gunned "

Tolerances on thickness of walls built using dense unshaped refractory materials are 5%.

7- Tolerances on formed materials "bricks"

Tolerance on bricks shall be + 1,5 mm independently of size and type.

8-Thickness of mortar joints

-Thickness of mortar joints shall be normally in the range 1-2 mm.

-Thickness of this type of joints up to 3mm shall be acceptable only if dimensional compensations should result necessary, this would oblige to realize a joint with a variable thickness.

Refractory Cements and Raw Materials:-

Refractory Cements and Raw Materials by Specification:

Material Type:

- Alumina / Aluminum Oxide
- Calcium Aluminate
- Graphite

Silicate and Clay Based Material Type:

- Silica / Silicate Materials
- Aluminum Silicate (Mica, Sillimanite, etc.)
- Silica / Fused Silica

Specialty Ceramic Type:

- Aluminum Nitride
- Boron Nitride
- Magnesia / Magnesite
- Zirconia
- Other

Refractory equipments and tools :-

- Lining machine for kiln.
- Electric castable mixers.
- Electric castable vibrators.
- Cutting bricks machine.
- Electric wood saw.
- Bricklayer tools.
- Welding machines.
- Cutting machines.
- Various hand tools.

Refractory works

-The following are some of the projects that have been implemented

1- Construction refractory of new cement production lines :-

1- Constructing Helwan cement company line production "1" May 4,1981.

2- Constructing line "1" Suez Cement Company in 1981.

3- Constructing line "1" Assuit Cement Company in February 17, 1984.

4- Constructing Helwan cement company line production "2" May 17, 1983. `

5- Constructing El kuattamia Cement Company in March, 1984.

6- Constructing Torah cement co. line 8&9 in October 16 ,1984-1985 .

7- Constructing El menya Cement Company in 1986.

8- Constructing line "2" Suez Cement Company in 1997.

9- Constructing Egyptian cement company line "1" in May 6, 1998.

10- Constructing cement factory Arish .Sinai in May 15, 2000.

11- Constructing Egyptian cement company line "2" in June 11, 2000.

12- Constructing Egyptian cement company line "3" in June 11, 2000.

13- Constructing line "1" miser beni suef for cement in march 21, 2001.

14- Constructing Egyptian cement company line "4" in July 12, 2001 .

15- Constructing Qena cement company in 2002.

16- Constructing El meriya cement company line "3 " February 3 , 2003 .

19-Constructing the first production line for Algerian cement company in Algeria in august 1, 2003.

20- Constructing the first production line for Arab union cement company at Libya in August 1,04.

Refractory works

21 - Constructing the second production line for Algerian cement company at Algeria In March 2, 2005.

22 - Constructing Egyptian cement company line "5" in February, 2006.

23 - Constructing the first production line for Arab Emirates cement company for cementech in November 20, 2006.

24 - Constructing production line Ciba white, grey in Algeria in April 28, 2007.

25 - Constructing El Arabia cement company in July, 2007.

26 - Constructing of a cement factory in Nigeria in 2008.

27 - Constructing El menya white cement production line in 2008.

28 - Starting the Constructing of a cement factory El Safoa in Saudi Arabia in 2009

29 - Starting the Constructing of a cement factory beni suef "titan" line" 2" in 2009

30 - Starting the Constructing of a cement factory al takamol , Sudan in 2009

Refractory works

2-The refractory works & complete and partial refractory rehabilitation

1- Executing the refractory works in RKTA Company for paper in October, 1980.

2- Executing the refractory works in national company for Paper Company in September 30, 1981.

3- Executing refractory works in boiler for El Ameriya for oils, Alexandria in November 6,1989.

4- Executing the refractory works in RKTA Company for papers in on august 20 , 1990

5- Executing the refractory works in electric power station in Damanhor.

6- Executing the refractory works for kilns in Cairo bakeries.

7- Executing the refractory works in boiler national Company for paper in September 18,1997.

8- Executing the refractory works for national company for paper in boiler in 2001.

9- Executing the refractory works in Persil Company in 2000.

10 – Executing all refractory works ' kiln. Pre- heater. Cooler ….. So on ' for every complete or partial rehabilitation do in Beni suf Cement Company.

11 – Executing all refractory works ' kiln. Pre-heater. Cooler ….. So on ' for every complete or partial rehabilitation do in Assuit Cement Company.

12 – Executing all refractory works ' kiln. Pre-heater . Cooler ….. So on ' for every complete or partial rehabilitation do in Egyptian Cement Company

13– Executing all refractory works ' kiln. Pre-heater. Cooler ….. So on ' for every complete or partial rehabilitation do in helwan cement company.

14– Executing all refractory works ' kiln. Pre-heater. Cooler….. So on ' for every complete or partial rehabilitation do in Suez Cement Company.

15 – Executing all refractory works ' kiln. Pre-heater. Cooler….. So on ' for every or partial rehabilitation do in Alexandria Portland cement company.

16– Executing all refractory works ' kiln. Pre-heater. Cooler….. So on ' for every complete or partial rehabilitation do in el Amerea cement company

Refractory works

17– Executing all refractory works ' kiln. Pre-heater. Cooler ….. So on ' for every complete or partial rehabilitation do in kuatamia Cement Company.

18– Executing all refractory works ' kiln. Pre-heater. Cooler ….. So on ' for every complete or partial rehabilitation do in Qena Cement Company.

19– Executing all refractory works ' kiln. Pre-heater . Cooler….. So on ' for every complete or partial rehabilitation do in el menya cement company.

20– Executing all refractory works ' kiln. Pre-heater . Cooler….. So on ' for every complete or partial rehabilitation do in el Arish cement company .

21– Yearly maintenance contracts for refrctory in third, forth and Russian ' kiln. Pre-heater . cooler ….. So on "for rehabilitation do in national cement company between 1993 – 1999 .

22— Executing all refractory works ' kiln. Pre-heater . Cooler ….. So on ' for every complete or partial rehabilitation do in Miser Beni suf Cement Company.

Third -Sand blast and painting

The main task of protective coatings is to prevent or control corrosion.
Uncontrolled corrosion can cause serious damage to capital investments and can endanger human life.
Therefore, optimum selection and application of protective coatings is of tremendous importance.

Cleaning of steel and removal of rust:-

De-rusting methods:-

The effective lifetime of a coating applied onto a steel surface is dependent, to a very large extent, on how thoroughly the surface has been prepared prior to painting.
Surface preparation consists of primary preparation which aims to remove mill scale, rust and foreign matter from a steel surface prior to the application of a shop primer or primer.
Secondary surface preparation aims to remove rust and foreign matter, if any, from a steel surface coated with a shop primer prior to application of the anticorrosive paint system.
A steel surface can be de-rusted in the following ways:-

1-Wire brushing:-

usually done with rotating wire brushes, is a conventional method, not suitable for the removal of mill scale, but suitable for the preparation of weld seams.

The main disadvantage is that treated surfaces are often not completely freed from corrosion products and tend to become polished and contaminated with oil.
This decreases the adhesion of priming paints and performance of a paint system.

2-Chipping

Chipping or mechanical chipping is usually done in combination with wire brushing.
It is sometimes suitable for local repairs and conventional or special formulated paint systems.
It is not suitable for general preparation of surfaces to be coated with epoxy or chlorinated rubber paints.
It can be used for the removal of thick rust scale and economizes in later blasting operations.

3-Flame cleaning

Flame cleaning involves de- rusting by thermal treatment making use of burning equipment (acetylene or propane and oxygen).
It removes almost all mill scale, but rust to lesser extent.
Therefore this method cannot meet the requirements of modern paint systems.

Sand blast and painting

4- Disc sanding

Disc sanding involves use of rotating discs covered with abrasive material.
It is used for local repairs or for the removal of small barnacles.
The quality of these discs has very been much improved, and these can give good standards of preparation.

5 -Sweep blasting

A hand operated from of superficial blast cleaning in which a primed or coated steel surface is freed from almost any contamination
A: Light sweep for roughening of intact coating
Abrasive: small (0,2to 1,5mm)
B: Heavy sweep for removing defective coating layers
Abrasive: small (0,2to 1,5mm)

6-Blast cleaning

The impingement of high kinetic energy stream of abrasive onto the surface to be prepared.
It is either hand operated by jet or automatically by impeller and is the most thorough method of de- rusting.
Types are centrifugal blast cleaning, compressed air blast cleaning and vacuum blast cleaning.

7-Shot

The particles are as far as practicable spherical and should not contain more than the minimum practicable amount of "tails" and irregular shapes.
Primers to be used for shot blasted steel should be checked on performance.

8-Grit

The particles show good angularity from with sharp cutting edges and should be substantially free from "half-rounds"
(i.e. shot split in half).
Unless otherwise stated in the specifications mineral grit should be used.

9-Water (abrasive) cleaning/jetting

Ultra high pressure water jetting (UHPWJ)
Pressure = more than 1700 bar
Use: Complete removal of old coatings and rust.
The result is comparable with dry abrasive blast cleaning, but with flash rust after drying
High pressure water jetting (UHPWJ)
Pressure = from 700 to 1700 bar
Use: Most paints and corrosion products will be removed, Magnetite (black iron oxide) and hard tightly adherent coating may be left but can be removed with difficulty.

Sand blast and painting

1 - Surface cleanliness and roughness

Abrasive-blasted surfaces are characterized by two kinds of information that are both essential but fundamentally different, although sometimes mistaken for each other: cleanliness and roughness.

Cleanliness reflects the degree of presence of undesirable residual contaminants on the surface, whereas roughness refers to the micrometric shape of the surface, called the surface profile.

Rust grades :-

- A - steel surface covered completely with adherent mill scale and with little if any rust.
- B - Steel surface which has started to rust and from which the mill scale has begun to flake.
- C - steel surface where the mill scale has rusted away or from which it can be scraped, but with little pitting visible to the naked eye.
- D - steel surface where the mill scale has rusted away and where pitting is visible to the naked eye.

Grade A is normally the condition of the steel surface a short time after rolling.

Grades B,C and D are normally the states of the surface after it has been exposed outdoor without protection against rusting to a fairly corrosive atmosphere –for two or three month then a year or so ,and about three years ,respectively .

Preparation grades – blast cleaning :-

"SA" indicates sand blasting "st" indicates wire brushing}

It is assumed that the steel surface has been cleaned of dirt and grease and that the heavier layers of rust have been removed by chipping.

SA 0 : no preparation of surface.

SA 1 : light blast cleaning. The nozzle is passed rapidly over the surface so that loose mill scale, rust and foreign matter are removed .

SA 2 : through blast cleaning .the nozzle is passed over the the surface long enough to remove all mill scale and rust and practically all foreign matter .finally the surface is cleaned with a vacuum cleaner, clean and dry compressed air or a clean brush .

SA 2.5 : very thorough blast cleaning .mill scale ,rust and foreign matters shall be removed to such an extent that traces only appear as shades on the surface .finally , the surface is cleaned with a vacuum cleaner ,clean and dry compressed air or a clean brush .

SA 3 : blast cleaning to white metal , the jet is passed over the surface long enough to remove all mill scale ,rust and foreign matter , finally ,the surface is cleaned with a vacuum cleaner , clean and dry compressed air or a clean brush ,it should then have a uniform metallic colour .

Sand blast and painting

The large variety of applications creates the need for a diversity of equipment:-

- Portable blast equipment (aka blast pot): Dry abrasive blasting applications are typically powered from a diesel air compressor, most applications involve a pressurized vessel that contains the abrasive and meters it into the compressed air stream, wet blasting is accomplished by injecting the abrasive into a pressurized water stream or creating a slurry of abrasive and water that is pressurized or introduced into a compressed air stream, wet blasting is often used in applications where the minimal dust generation is desired, portable applications may or may not recycle the abrasive and portable dry blasting generally does not attempt to contain or minimize the dust generated from the operation.

- Blast cabinet: A blast cabinet is essentially a closed loop system that allows the operator to blast the part and recycle the abrasive, a typical blast cabinet consists of four components; the containment (cabinet), the abrasive blasting system, the abrasive recycling system and the dust collection, the operator blasts the parts from the outside of the cabinet by placing his arms in gloves attached to glove holes on the cabinet, viewing the part through a view window and, typically, turning the blast on and off using a foot pedal or treadle. Automated blast cabinets are also used to process large quantities of the same component and may incorporate multiple blast nozzles and a part conveyance system.

- There are three types of blast systems used in a blast cabinet. Two systems (siphon and pressure) are dry and one is wet:

- A siphon blast system (aka suction blast system) uses the compressed air to create vacuum in a chamber (known as the blast gun), the negative pressure pulls abrasive into the blast gun where the compressed air directs the abrasive through a blast nozzle.

- A pressure blast system incorporates a pressurized vessel, the abrasive is stored in the pressure vessel then sealed, the vessel is pressurized to the same pressure as the blast hose attached to the bottom of the pressure vessel, the abrasive is metered into the blast hose and conveyed by the compressed gas through the blast nozzle.

- Blast room: This is a larger version of a blast cabinet with the exception that the blast operator works inside the room, a blast room always has three of the four components of a blast cabinet: the containment, the abrasive blasting system and the dust collector. Most blast rooms have recycling systems ranging from manual recycling (sweeping and shoveling the abrasive back into the blast pot) to full reclaim floors that convey the abrasive pneumatically or mechanically to a device that cleans the abrasive prior to recycling.

Sand blast and painting

Abrasives:-

Silica sand: Silica sand is the most commonly used abrasive and typically has the most negative impact. The silica sand quickly breaks up and creates large quantities of dust, which when exposed to the operator can cause Silicosis, a debilitating lung disease. When silica sand is sold for the purpose of blasting, it is often coated with resins to control the dust from the breaking sand.

Note: Larger silica sand companies will not sell sand for the purpose of sandblasting due to high volume of dust creating by the sand breaking when hitting the object. i.e. U.S. Silica Co.

Coal or smelter slag: Coal or smelter slag contains low silica content and therefore does not cause Silicosis. However, these abrasives have been reported to release other Hazardous Air Pollutants (HAP's) into the air.

Metallic, synthetic, and mineral: These other types of abrasives are growing in popularity due to the low dust creation and reclamation of material, each of these abrasives report significantly less dust and waste than sand and coal/slag abrasives.

Setup and Equipment:-

The most common used are commercial bench-mounted units, the setup consists of a power supply and mixer, exhaust hood, nozzle, and gas supply, the nozzle can be hand-held or fixture mounted for automatic operation. Either the nozzle or part can be moved in automatic operation.

Equipment for sandblasting usually consists of but is not limited to a hand-held nozzle that directs a stream of sand particles or other material toward a work piece. The sand is mixed with air in a mixing chamber in order to transport the sand to the nozzle where it is subject to a high velocity air stream that propels it toward the work piece.

Safety:-

Cleaning operations using abrasive blasting can present risks for workers' health and safety, especially in air blasting applications. Although many abrasives used in blasting booths do not have a hazardous component (steel shot and grit, cast iron, aluminum oxide [aka corundum], garnet, plastic abrasive and glass bead), other abrasives (silica sand, copper slag, nickel slag, and staurolite) have varying degrees of hazard (typically free silica or heavy metals). However, in all cases their use can present serious danger to operators, such as burns due to projections (with skin or eye lesions), falls due to walking on round shots scattered on the ground, exposure to hazardous dusts, heat exhaustion, creation of an explosive atmosphere, and exposure to excessive noise. Blasting booths and portable blaster's equipment have been adapted to these dangers. OSHA (Occupational Safety and Health Administration) mandates engineered solutions to potential hazards, however lobbying has allowed silica sand to continue to be used even though most commonly used blast helmets are not sufficiently effective at protecting the blast operator (respiratory protection is approved by NIOSH - National Institute for Occupational Safety and Health).

Typical safety equipment for operators that are open air blasting or blasting in a blast room includes the following:

Sand blast and painting

Typical safety equipment for operators that are open air blasting or blasting in a blast room includes the following:-

- Positive pressure blast hood or helmet - The hood or helmet includes a head suspension system to allow the device to move with the operator's head, a view window with replaceable lens or lens protection and an air feed hose.
- Grade D air supply - The air feed hose is typically attached to a grade D pressurized air supply. Grade D air is mandated by OSHA to protect the worker from hazardous gases. It includes a pressure regulator, air filtration and a carbon monoxide alarm.
- Ear protection - ear muffs or ear plugs.
- Body protection - Body protection varies by application but usually consists of gloves, and overalls or apron (minimal), leather coat and chaps, or cordura/canvas blast suit.
- Originally, sandblasting was always performed as an open-air job, which exposed the worker to risk of injury from the flying material and lung injury from inhaling the dust, the silica dust produced in the sandblasting process caused silicosis after sustained inhalation of dust.

Sand blasting:-

Man sandblasting a stone wall Device used for adding sand to the compressed air (top of which is a sieve for adding the sand) Diesel powered compressor used as an air supply for sandblasting

Sandblasting or bead blasting is a generic term for the process of smoothing, shaping and cleaning a hard surface by forcing solid particles across that surface at high speeds; the effect is similar to that of using sandpaper, but provides a more even finish with no problems at corners or crannies. Sandblasting can occur naturally, usually as a result of particles blown by wind causing Aeolian erosion, or artificially, using compressed air.

Sandblasting equipment typically consists of a chamber in which sand and air are mixed. The mixture travels through a hand-held nozzle to direct the particles toward the surface or work piece. Nozzles come in a variety of shapes, sizes, and materials. Boron carbide is a popular material for nozzles because it resists abrasive wear well.

Media:-

Historically, the material used for artificial sandblasting was sand that had been sieved to a uniform size, it was initially assumed that sharp-edged grains provided the best performance though this was later demonstrated to not be correct.

Other materials for sandblasting have been developed to be used instead of sand; for example, carborundum grit, steel shots, copper slag, powdered slag, glass beads (bead blasting), metal pellets, dry ice, garnet, powdered abrasives of various grades, and even ground coconut shells, corncobs, walnut shells, and baking soda (soda blasting) have been used for specific applications and can produce distinct surface finishes, some commercial grade blasters are specially designed to handle multiple blast abrasives, these blasters are commonly referred as multi-media blasters.

Sand blast and painting

Sand Blasting Considerations:-

If you are considering using sand blasting for a hard surface cleaning method, there are certain things you need to keep in mind.
First, always wear the proper clothing and breathing apparatus. Because minute particles will be entering the air, it will be very easy to breathe them in, and sometimes, depending on what you is sand blasting, these particles can be dangerous to health.
Look for alternatives to using a sand blaster that uses sand. It has been proven that inhalation of dust created by sand can cause a lung disease called silicosis.
Therefore, look for one that uses a different type of abrasive, like powdered abrasives, steel grit, copper slag, coconut shells or other like that :-

a -Steel Shots
Steel shots have high abrasion resistance and long life.

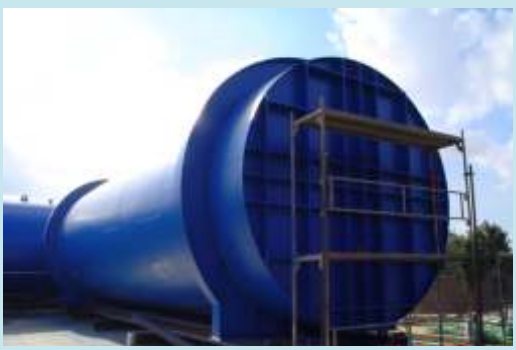
b -Steel Grits
Steel grits are crushed steel shots, they are used for different application (ship building, pipe building, steel construction, granite cutting, tank manufacturing etc.).

2 - Painting system:-

Painting work is in accordance technical companies producing paints, as well as in accordance with the data sheet of the type used paint.

Which paint system should use :-

When choosing paint and paint systems there are several things to take into account, the paints can be divided into two groups:
1- Standard type.
2- Sophisticated.
sophisticated coating are more durable than standard paints ,but on the other hand require much more careful application in order to achieve good results, to change from a standard existing system to a sophisticated system is not generally practical unless extensive surface preparation is carried out , weather condition and low temperatures must be taken into account when considering this type of system.



Sand blast and painting

Cost of application :-

The cost of application of any coating system is based primarily on productivity, the following are recommended rates for a single package alkyd material taking the above in to account

Method	rate- sq.meter /hour
Spray	30 – 60 M2
Roller	20 – 40 M2
Brush	10 – 20 M2

Estimating cost of materials :

The following formula can be used for calculating the cost of the paint per coat per square meter, waste or paint loss should also be estimated, this is normally between 20 – 50 % but depends upon the method of application

Cost per square meter = price per liter × dry thickness microns / % solid contents ×10

As mention above, a waste factor must be taken into account.

Film thickness :-

1 mil = 25, 4 microns

1 micron = 0, 0394 mil

Type of coating :-

ACR = acrylic

AK = alkyd

BIT = bitumen

CR = chlorinated rubber

EP = epoxy

PU =polyurethane

V = vinyl

IOZ = inorganic zinc

Sandblast&paint equipments

SPEEFLO Paint Equipment Pinch Valve, Brushes, Metering Valve, GRACO Paint Equipment

Rollers, Naps, and Hose Fittings

Sandblast Nozzles

Blast Equipment

Sand blast and painting

The following are some of the projects that have been implemented :-

1 - Executing the sandblast and painting works in pre-heater and kiln for El Ameriya Cement Company on 2002.

2- Executing the sandblast in the kiln body of both Assuit Cement Company and Beni Suef cement company in 2000.

3 - Executing the sandblast and painting works in Asec company for casting and heat treatment and " ARESCO " projects such as:-

- Sandblast and painting works for all manufacture equipments for Helwan Cement Company.
- Sandblast and painting works for all manufacture equipments for Qena Cement Company.
- Sandblast and painting works for all manufacture equipments for el Arish Cement Company in Sinai.
- Sandblast and painting works for all manufacture equipments for Assuit Cement Company.
- Sandblast and painting works for all manufacture equipments for north Cairo electric power station.
- Sandblast and painting works for all manufacture equipments for Cement factory in Qatar.
- Sandblast and painting works for all manufacture equipments for cement factory in Kostarica, South America.
- Sandblast and painting works for all manufacture equipments for Cement factory at Yamen .
- Sandblast and painting works for all manufacture equipments for Cement factory in Pennsylvania U S A.
  Sandblast and painting works for all manufacture equipments for Jordan Cement Company.
- Sandblast and painting works for all manufacture equipments for On electric power station in Puerto Rico city in south America.

4 - Executing the sandblast and painting works for reliance heavy Industries company projects such as :-

- Sandblast and painting works for all manufacture equipments for Qatar Cement Company.
- Sandblast and painting works for all manufacture equipments for El Qassim Cement Company.

5 - Sandblast and painting works for all manufacture equipments for five stars mill. Suez.

6 - Executing sand blasting for kilns and many fans during our work for every complete or partial rehabilitation do in different cement plants.

Fourth-Scaffolding works

- Executing safety scaffolding in all projects we do inside Egypt and outside at various Arabian and foreign states.

General requirements for all scaffolds:-

1- Scaffolds shall be furnished and erected in accordance with this standard for persons engaged in work that cannot be done safely from the ground or from solid construction, except that ladders used for such work.

2- The footing for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement, Unstable objects such as barrels, boxes, loose brick, or concrete blocks shall not be used to support scaffolds or planks.

3- Scaffolds and their components shall be capable of supporting without failure at least four times the maximum intended load.

4- Scaffolds and other devices mentioned or described in this section shall be maintained in safe condition, Scaffolds shall not be altered or moved horizontally while they are in use or occupied.

5- Any scaffold damaged or weakened from any cause shall be immediately repaired and shall not be used until repairs have been completed.

6-Scaffolds shall not be loaded in excess of the working load for which they are intended.

7 - Nails or bolts used in the construction of scaffolds shall be of adequate size and in sufficient numbers at each connection to develop the designed strength of the scaffold, Nails shall not be subjected to a straight pull and shall be driven full length.

8 - All planking or platforms shall be overlapped (minimum 12 inches) or secured from movem

9 - An access ladder or equivalent safe access shall be provided.

10 - Scaffold planks shall extend over their end supports not less than 6 inches or more than 18

scaffolding works

11 -The poles, legs, or uprights of scaffolds shall be plumb, and securely and rigidly braced to prevent swaying and displacement.

12 -Overhead protection shall be provided for men on a scaffold exposed to overhead hazards.

13 - Employees shall not work on scaffolds during storms or high winds.

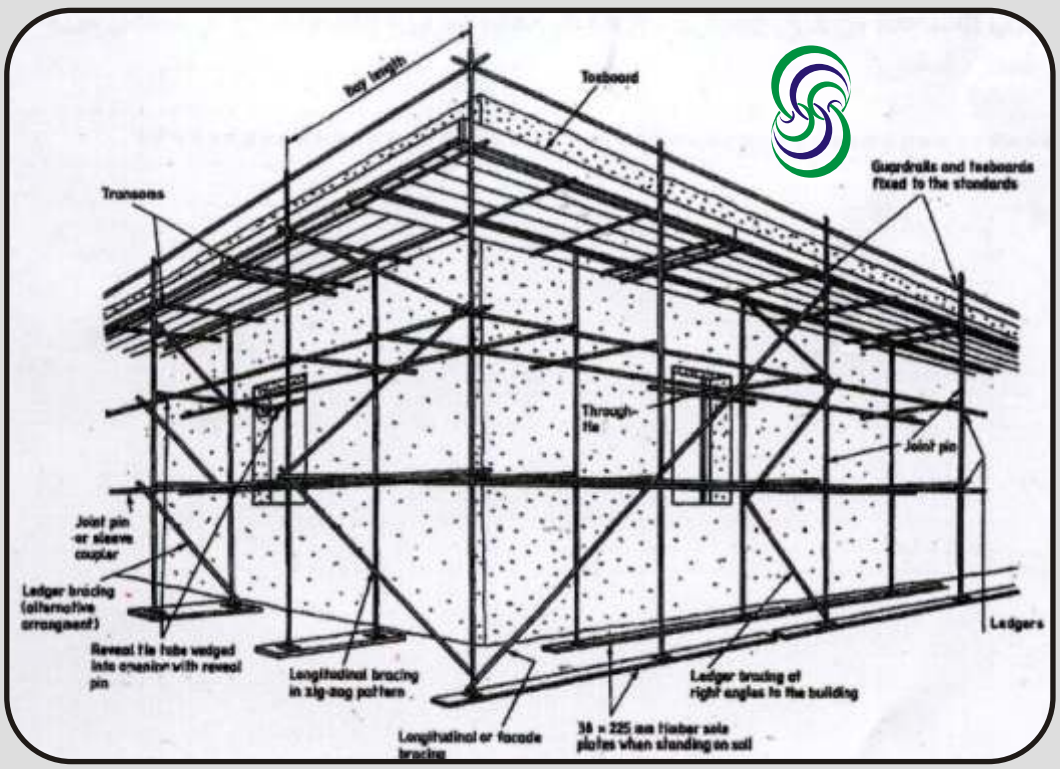
14 -Employees shall not work on scaffolds which are covered with ice or snow, unless all ice or snow is removed and planking sanded to prevent slipping.

15 -Tools, materials, and debris shall not be allowed to accumulate in quantities to cause a hazard.

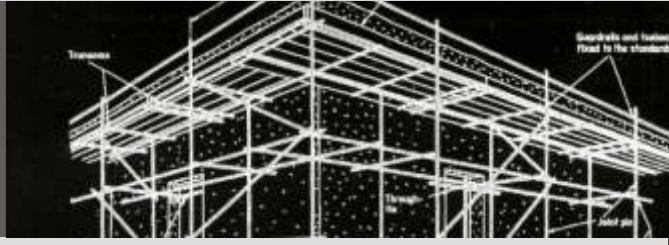
16 - Only treated or protected fiber rope shall be used for or near any work involving the use of corrosive substances or chemicals..

17 - Scaffolds shall be secured to permanent structures, through use of anchor bolts, reveal bolts, or other equivalent means, window cleaners' anchor bolts shall not be used.

18 - Special precautions shall be taken to protect scaffold members, including any wire or fiber ropes, when using a heat-producing process.



scaffolding works



General requirements for wood pole scaffolds :-

1- Scaffold poles shall bear on a foundation of sufficient size and strength to spread the load from the poles over a sufficient area to prevent settlement, all poles shall be set plumb.

2- Where wood poles are spliced the ends shall be squared and the upper section shall rest squarely on the lower section, wood splice plates shall be provided on at least two adjacent sides and shall not be less than 4 feet 0 inches in length, overlapping the abutted ends equally, and have the same width and not less than the cross-sectional area of the pole, splice plates of other materials of equivalent strength may be used.

3- Independent pole scaffolds shall be set as near to the wall of the building as practicable.

4- All pole scaffolds shall be securely guyed or tied to the building or structure, where the height or length exceeds 25 feet, the scaffold shall be secured at intervals not greater than 25 feet vertically and horizontally.

5- Every wooden putlog on single pole scaffolds shall be reinforced with a 3/16 x 2-inch steel strip or equivalent secured to its lower edge throughout its entire length.

6- Ledgers shall be long enough to extend over two pole spaces, ledgers shall not be spliced between the poles, and ledgers shall be reinforced by bearing blocks securely nailed to the side of the pole to form a support for the ledger.

7 -Diagonal bracing shall be provided to prevent the poles from moving in a direction parallel with the wall of the building, or from buckling.

8-Cross bracing shall be provided between the inner and outer sets of poles in independent pole scaffolds, the free ends of pole scaffolds shall be cross braced.

9- Full diagonal face bracing shall be erected across the entire face of pole scaffolds in both directions; the braces shall be spliced at the poles.

10- Platform planks shall be laid with their edges close together so the platform will be tight with no spaces through which tools or fragments of material can fall.

11- Where planking is lapped, each plank shall lap its end supports at least 12 inches, where the ends of planks abut each other to form a flush floor, the butt joint shall be at the centerline of a pole, the abutted ends shall rest on separate bearers, intermediate beams shall be provided where necessary to prevent dislodgment of planks due to deflection, and the ends shall be nailed or cleared to prevent their dislodgment.

scaffolding works

12- When a scaffold turns a corner, the platform planks shall be laid to prevent tipping, the planks that meet the corner putlog at an angle shall be laid first, extending over the diagonally placed putlog far enough to have a good safe bearing, but not far enough to involve any danger from tipping, the planking running in the opposite direction at right angles shall be laid so as to extend over and rest on the first layer of planking.

13- When moving platforms to the next level, the old platform shall be left undisturbed until the new putlogs or bearers have been set in place, ready to receive the platform planks.

14- Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1 x 4-inch lumber or equivalent, and toe boards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor, toe boards shall be a minimum of 4 inches in height.

15- All wood pole scaffolds 60 feet or less in height shall be constructed and erected in accordance to safety requirements , if they are over 60 feet in height they shall be designed by a registered professional engineer and constructed and erected in accordance the design, a copy of the typical drawings and specifications shall be made available to the employer and for inspection purposes.

16- Wood-pole scaffolds shall not be erected beyond the reach of effective firefighting apparatus.

scaffolding works

Two-point suspension scaffolds swinging scaffolds:-

1-Two-point suspension scaffold platforms shall be not less than 20 inches no more than 36 inches wide overall, the platform shall be securely fastened to the hangers by U-bolts or by other equivalent means.

2-The hangers of two-point suspension scaffolds shall be made of wrought iron, mild steel, or other equivalent material having a cross-sectional area capable of sustaining four times the maximum intended load, and shall be designed with a support for guardrail, intermediate rail, and toe board.

3-When hoisting machines are used on two-point suspension scaffolds, such machines shall be of a design tested.

4-The roof irons or hooks shall be of wrought iron, mild steel, or other equivalent material of proper size and design, securely installed and anchored. Tie-backs of three-fourth inch manila rope or the equivalent shall serve as a secondary means of anchorage, installed at right angles to the face of the building whenever possible and secured to a structurally sound portion of the building.

5-Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1- x 4-inch lumber or equivalent, and toe boards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor, toe boards shall be a minimum of 4 inches in height, wire mesh shall be installed

6-Two-point suspension scaffolds shall be suspended by wire or fiber ropes.

7-The blocks for fiber ropes shall be of standard 6-inch size, consisting of at least one double and one single block, the sheaves of all blocks shall fit the size of rope used.

8-All wire ropes, fiber ropes, slings, hangers, platforms, and other supporting parts shall be inspected before every installation, periodic inspections shall be made while the scaffold is in us

9-On suspension scaffolds designed for a working load of 500 pounds no more than two men shall be permitted to work at one time, on suspension scaffolds with a working load of 750 pounds, no more than three men shall be permitted to work at one time, each workman shall be protected by a safety lifebelt attached to a lifeline, the lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the workman in case of a fall.

10-Where acid solutions are used, fiber ropes are not permitted unless acid-proof.

11-Two-point suspension scaffolds shall be securely lashed to the building or structure to prevent them from swaying, window cleaners' anchors shall not be used for this purpose.

scaffolding works

Stone setters' adjustable multiple-point suspension scaffolds:-

1-The scaffold shall be capable of sustaining a working load of 25 pounds per square foot and shall not be overloaded, scaffolds shall not be used for storage of stone or other heavy materials.

2-The hoisting machine and its supports shall be of a type tested and listed.

3-The platform shall be securely fastened to the hangers by U-bolts or other equivalent means.

4-The scaffold unit shall be suspended from metal outriggers, iron brackets, wire rope slings, or iron hooks which will safely support the maximum intended load.

5-Outriggers when used shall be set with their webs in a vertical position securely anchored to the building or structure and provided with stop bolts at each end.

6-The scaffold shall be supported by wire rope of this section, suspended from overhead supports.

7-The free ends of the suspension wire ropes shall be equipped with proper size thimbles, secured by splicing or other equivalent means ,the running ends shall be securely attached to the hoisting drum and at least four turns of rope shall remain on the drum at all times.

8-Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail , all scaffolds more than 10 feet above the ground or floor, toe boards shall be a minimum of 4 inches in height, wire mesh shall be installed.

9-When two or more scaffolds are used on a building or structure they shall not be bridged one to the other but shall be maintained at even height with platforms butting closely.

10-Each scaffold shall be installed or relocated in accordance with designs and instructions of a registered professional engineer, and such installation or relocation shall be supervised by a competent designated person.

scaffolding works

Single-point adjustable suspension scaffolds :-

1-The scaffolding, including power units or manually operated winches, shall be a type tested and listed by a nationally recognized testing laboratory.

2-All power-operated gears and brakes shall be enclosed.

3- In addition to the normal operating brake, all-power driven units must have an emergency brake which engages automatically when the normal speed of descent is exceeded.

4-Guards, mid-rails, and toe boards shall completely enclose the cage or basket. Guardrails shall be no less than 2 by 4 inches or the equivalent installed no less than 36 inches or more than 42 inches above the platform, mid-rails shall be 1 by 6 inches or the equivalent; installed equidistant between the guardrail and the platform, toe boards shall be a minimum of 4 inches in height.

5-The hoisting machines, cables, and equipment shall be regularly serviced and inspected after each installation and every 30 days thereafter.

6-The units may be combined to form a two-point suspension scaffold.

7- The supporting, cable shall be straight for its entire length, and the operator shall not sway the basket and fix the cable to any intermediate points to change his original path of travel.

8-Equipment shall be maintained and used in accordance with the manufacturers' instructions.

Boatswain's chairs :-

1-The chair seat shall be not less than 12 by 24 inches, and of 1-inch thickness. The seat shall be reinforced on the underside to prevent the board from splitting.

2-The two fiber rope seat slings shall be of 5/8-inch diameter, revved through the four seat holes so as to cross each other on the underside of the seat.

3-Seat slings shall be of at least 3/8-inch wire rope when a workman is conducting a heat producing process such as gas or arc welding.

4-The workman shall be protected by a safety life belt attached to a lifeline, the lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines.

5-The tackle shall consist of correct size ball bearing or bushed blocks and properly spliced 5/8-inch diameter first-grade manila rope.

6-The roof irons, hooks, or the object to which the tackle is anchored shall be securely installed; tiebacks when used shall be installed at right angles to the face of the building and securely fastened to a chimney.

scaffolding works

Carpenters' bracket scaffolds :-

1-The brackets shall consist of a triangular wood frame not less than 2 by 3 inches in cross section, or of metal of equivalent strength, each member shall be properly fitted and securely joined.

2-Each bracket shall be attached to the structure by means of one of the following:-

a- Bolt no less than five-eighths inch in diameter which shall extend through the inside of the building wall.
b- A metal stud attachment device
c- Welding to steel tanks
d- Hooking over a well-secured and adequately strong supporting member.
The brackets shall be spaced no more than 10 feet apart.

3-No more than two persons shall occupy any given 10 feet of a bracket scaffold at any one time, tools and materials shall not exceed 75 pounds in addition to the occupancy

4-The platform shall consist of not less than two 2- by 9-inch nominal size planks extending not more than 18 inches or less than 6 inches beyond each end support.

5-Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1- by 4-inch lumber or equivalent, and toe boards. Shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor, toe boards shall be a minimum of 4 inches in height, wire mesh shall be installed.

scaffolding works

Bricklayers square scaffolds :-

1-The squares shall not exceed 5 feet in width and 5 feet in height.

2-The squares shall be reinforced on both sides of each corner with 1- by 6-inch gusset pieces. They shall also have braces 1 by 8 inches on both sides running from center to center of each member, or other means to secure equivalent strength and rigidity.

3-The squares shall be set not more than 5 feet apart for medium duty scaffolds, and not more than 8 feet apart for light duty scaffolds, bracing 1 x 8 inches, extending from the bottom of each square to the top of the next square, shall be provided on both front and rear sides of the scaffold.

4 -Platform Planks shall be at least 2- by 9-inch nominal size, the ends of the planks shall overlap the bearers of the squares and each plank shall be supported by not less than three squares.

5 -Bricklayers' square scaffolds shall not exceed three tiers in height and shall be so constructed and arranged that one square shall rest directly above the other, the upper tiers shall stand on a continuous row of planks laid across the next lower tier and be nailed down or otherwise secured to prevent displacement.

6 - Scaffolds shall be level and set upon a firm foundation.

Horse scaffolds :-

1- Horse scaffolds shall not be constructed or arranged more than two tiers or 10 feet in height.

2 - Horses shall be spaced not more than 5 feet for medium duty and not more than 8 feet for light duty.

3 - When arranged in tiers, each horse shall be placed directly over the horse in the tier below.

4 - On all scaffolds arranged in tiers the legs shall be nailed down to the planks to prevent displacement or thrust and each tier shall be substantially cross braced.

5 - Horses or parts which have become weak or defective shall not be used.

6 - Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high with a mid-rail, when required, of 1- by 4-inch lumber or equivalent and toe boards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor, toe boards shall be a minimum of 4 inches in height, wire mesh shall be installed.

scaffolding works

Needle beam scaffold:-

1- Wood needle beams shall be in accordance to safety requirements, and shall be not less than 4 by 6 inches in size, with the greater dimension placed in a vertical direction, metal beams or the equivalent.

2- Ropes or hangers shall be provided for supports, the span between supports on the needle beam shall not exceed 10 feet for 4- by 6-inch timbers, and rope supports shall be equivalent in strength to 1-inch diameter first-grade manila rope.

3- The ropes shall be attached to the needle beams by a scaffold hitch or a properly made eye splice, the loose end of the rope shall be tied by a bowline knot or by a round turn and one-half hitch.

4- The platform span between the needle beams shall not exceed 8 feet when using 2-inch scaffold plank, for spans greater than 8 feet, platforms shall be designed based on design requirements for the special span, the overhang of each end of the platform planks shall be not less than 1 foot and not more than 18 inches.

5- When one needle beam is higher than the other or when the platform is not level the platform shall be secured against slipping.

6- All unattached tools, bolts, and nuts used on needle beam scaffolds shall be kept in suitable containers.

7- One end of a needle beam scaffold may be supported by a permanent structural member.

8- Each man working on a needle beam scaffold 20 feet or more above the ground or floor and working with both hands, shall be protected by a safety life belt attached to a lifeline, the lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the workman in case of a fall.

Ladder-jack scaffolds:-

1- All ladder-jack scaffolds shall be limited to light duty and shall not exceed a height of 20 feet above the floor or ground.
2- All ladders used in connection with ladder-jack scaffolds shall be heavy-duty ladders.
3- The ladder jack shall be so designed and constructed that it will bear on the side rails in addition to the ladder rungs, or if bearing on rungs only, the bearing area shall be at least 10 inches on each rung.
4- Ladders used in conjunction with ladder jacks shall be so placed, fastened, held, or equipped with devices so as to prevent slipping.
5- The wood platform planks shall be not less than 2 inches nominal in thickness, Both metal and wood platform planks shall overlap the bearing surface not less than 12 inches, the span between supports for wood shall not exceed 8 feet, Platform width shall be not less than 18 inches.

6- Not more than two persons shall occupy any given 8 feet of any ladder-jack scaffold at any one time.
7- Safety requirements for the construction, operation, maintenance, and use of scaffolds used in the maintenance of buildings and structures.

scaffolding works

What should you know about proper use of scaffolding :-

1- Erected, moved, dismantle or altered only under supervision of competent person.
2- No work on platforms covered with snow, ice except when removing the ice & or snow.
3-Work on scaffolds is not permitted during storm or high winds.
4-Keep scaffolding clean and free of debris.

Inspected by Competent Person :-

1- Before each work shift and
2- After any occurrence which could Affect the scaffold's structural integrity.
3- Report any damage or weaken scaffolding to the competent person.

Scaffold Inspection :-

Do not use any components with damage; including, heavy rust, dents… etc

Sequence install of the scaffolding as follows: -

1- Safety planning before the work.
2- Defined the places, kinds and height of the scaffolding required.
3- Design the scaffolding required.
4- Prepare sufficient labors and tools required.
5- Start installs scaffolding according to program schedule.
6 - Installing according Security and safety instructions.
7 - Inspection and testing and follow-up continued through the implementation of industrial security officials.
8 - Cleaning the area around the scaffold after the scaffold finish.
9 - Delivery of the scaffold to the customer.
10 - Start the work on the scaffold, top of Form.

For the serious of the scaffolding ,taking these procedures into account the work of the scaffolding :-

1 - update the verticals , the pillars and means of connectivity and installation .
2 – Use congenial required of preparing sufficient and appropriate length.
3 - The work of protective barriers and the protection of pipes and side pipes.
4 - The development of wood-based panels and installed a well.
5 - Is taken not to load in excess of the scaffolding.
6 - Is taken not to work on scaffolding without safety belt.

scaffolding works

Types of scaffolding :-

1 - scaffolding structure (with box), the installation and it shall be the earth's surface, which will be installed by the level required.

2 - scaffolding pipes used in the difficult works, which is used in industrial works .

3 - Scaffolding used in the mobile works and industrial electrical installations and have the means to secure their installation and to prevent movement during the work.

The design of the scaffolding :-

1 - must be designed to withstand at least four times the required load.
2 - Protective barriers must be the work of high standard and at least 1 meter, as well as horizontal barrier
3 - take into account the presence of stairs during the transfer window is anchored to the scaffolding.
4 - In case of scaffolding should be held pending nails linking the entire carrier scaffold.
5 - Proven by taking into account the ground.
6 - Claibsat connecting pipes to each must be of good.

Scaffolding materials :-

1 - Standard pipes.
2 - Standard wood panels.
3 - Steel stairs.
4 - Standard tools install scaffolding.
5 - Tools of scaffolding (keys - safety belts - porter bag - Claibsat).