TECHNICAL PAPER – DOMESTIC SWIMMING POOL TANK INSTALLATION.

There has to be an international understanding of certain words when producing any paper such as this.

The word “REGULATION” means that there is a national law and is associated with the word “MUST”.

The word “RECOMMENDED” means that there is no legal requirement but this is the EUSA suggested best way of working and is associated with the word “SHOULD”.

DOMESTIC SWIMMING POOL TANK INSTALLATION

DESIGN BRIEF

1. Before any pool is designed it is essential that the end users requirements are established to ensure the finished pool will meet those requirements.

2. These requirements will include:-

    a. Usage – leisure, swimming, competition or specialist

    b. Shape and size – length and width

    c. Profile – gradients of pool floor

    d. Circulation system – freeboard or level deck

    e. Bathing loads – maximum users

    f. Temperature requirements

    g. Water Treatment – suitability according to mains water analysis

    h. Drainage availability – capacities etc

    i. Equipment – situation and area

    j. Excavation – Water Table, rocks, disposal of spoil etc

    k. Budget restrictions

3. It is also essential, before construction begins to establish beyond doubt the exact position of the pool and the datum point from which the top of the pool walls are to be set.

DOMESTIC SWIMMING POOL TANK INSTALLATION

CONSTRUCTION METHODS

4. The following are methods of construction in general use:

    a. Steel Reinforced concrete blocks or reinforced patent blockwork construction.

    b. Cavity block wall containing reinforced concrete.

    c. Traditional reinforced poured concrete using formwork or concrete blockwork as built in shuttering.

    d. Pneumatically placed (sprayed) concrete.

    e. Solid block wall for liner pools.

    f. Reinforced liner pools (freestanding and in ground) to include timber/steel/aluminium/ glass reinforced plastic, prefabricated and on site constructed systems.

    g. Hand packed concrete onto reinforced steelwork mesh.

    h. Prefabricated fibreglass, stainless steel and PVC sheet fabricated pool shells. These are generally made in the factory and installed in one piece.

5. New methods of construction should meet the recommendations laid down in these Standards.

6. Swimming Pools are water retaining structures however constructed or fabricated. They should be water tight however a small water loss may be difficult to detect.

7. The maximum drop in water level over a period of seven days excluding evaporation, backwash and splash losses shall not exceed 12mm. This tolerance is the minimum standard accepted by EUSA, but where other tolerances are laid down they shall be clearly stated in the specifications. The structure may be acceptable for water tightness providing losses do not exceed this rate. Every effort must be

made by the Installer to detect the loss. Where the outside of the pool shell can be viewed, for example in a cellar, water seepage must be stemmed.

8. This test can be applied to confirm whether or not the tank is leaking. Fill a container with pool water and float on the pool water. Mark both the pool wall and the bowl to indicate the level of water. At the end of 24 hours examine the water loss. If evaporation is the cause then the pool and bowl will have lost the same amount of water.

POOL DEPTHS AND DIMENSIONS

9. Specifiers must make it clear whether they are specifying the water depth or the wall depth. EUSA favours specifying both so that the freeboard, if any, is obvious.

10. For Domestic pools no recommendations are made as to shape or size. Most swimming strokes require a water depth of approximately 1100mm and this should be taken into account during design.

PROFILES AND GRADIENTS

11. The design of the pool floor must take into account the usage of the pool.

12. Children and non swimmers will require being able to stand at all times and a water depth of between 800mm and 1000mm should be provided for them.

13. Swimmers can swim satisfactorily in a depth of no more than 1200mm but if turning, jumping in or side dives are indicated, this depth should be increased.

14. Shallow diving should not be permitted into a water depth of less than 1500mm with an available forward length of 7600mm. Board diving should not be permitted except in accordance with the requirements shown in elsewhere.

15. In all design, the transition between shallow and deep water should be maintained at a maximum of 1:15 to a depth of 1500mm. Where in short lengths it may be needed to increase this gradient, markings, signage or protection by means of buoys and lines should be provided.

DOMESTIC SWIMMING POOL TANK INSTALLATION

BASIC REQUIREMENTS OF A POOL TANK

16. All pools shall conform to the following:

    a. In ground pool shells shall be designed and constructed to meet the internal and external water pressures, as well as withstand soil forces from additional structures or separate foundations which may be imposed upon them. Necessary provision shall be made for hydrostatic forces (sub soil water pressure) whether by under floor and general drainage, hydrostatic relief valve, mass concrete, pool side sump well or a combination of all or some of these methods.

    b. Design provision shall help protect an outdoor pool shell, fixtures and fittings against frost. It must be appreciated that correct winterising procedure is necessary to prevent frost damage. The contractor should instruct the client as to the method of winterisation he recommends for his type of pool.

    c. Freestanding pools shall be designed and constructed to withstand internal forces placed upon the structure.

TOLERANCES TO POOL DIMENSIONS

17. Except where dimensions are laid down by international or national competitive swimming authority, the following shall be the maximum construction

18. Deviation for

a.	1500mm of length or width	+/- 25mm
b.	750mm water depth	+/- 25mm
c.	1500mm water depth	+/- 40mm
d.	3000mm water depth	+/- 50mm
e.	1500 measure across levels	+/- 10mm

DOMESTIC SWIMMING POOL TANK INSTALLATION

BALANCE TANKS AND LEVEL DECK SYSTEMS

19. Because of the nature of water, correct operation of a level deck system depends on accuracy. The surge channel at the perimeter must be constructed level. +/- 2mm is the maximum tolerance on a 25000mm length pool. Any greater will be inviting problems during pool use with water surge beyond the capacity of the surge channel at lower points.

20. The channel itself should be designed and sized to accept the top circulation ratio together with calculated surge and an additional safety percentage. The outlets from this channel must also be of sufficient size and number to ensure that water can pass through to the balance tank at these rates.

21. A safety measure of incorporating additional outlets above the balance tank can be incorporated.

22. The balance tank itself should be constructed to the same strengths as the pool and finished with a water resistant floor plastering with sand or water proof lining with consideration to future maintenance and cleaning. If heavy duty liner material is use to line the tank it must be fixed to the walls of the tank to prevent the suction of the pump pulling it off them. In high ground water areas this method may not be practical.

23. It is advisable that the tank is the same depth as the deepest end of the pool as a shallow tank can, when at low level, cause entry of air to the circulation system.

SPECIFICATIONS

24. Members of EUSA shall conform to the following Standards for concrete pools when submitting quotations:

    a. The specification shall be drawn in accordance with recognised Codes of Civil Engineering and Building Practice.

    b. Design calculations and structural drawings prepared by a qualified structural engineer shall be available to the client on his request at a commercial charge.

c. All works shall be supervised and carried out by the contractor in accordance with recognised good civil engineering and building practice.

d. Recommendations as far as design, workmanship and materials of the appropriate National Standards Institution's Code of Practice shall be observed at all times.

e. All pool shells shall conform to basic requirements as stated above.

f. All pool shells shall have an adequate under pool drainage system constructed, dependent on soil conditions likely to occur.

g. Pool shells must not be sited where damage to the foundations of existing buildings could occur; nor must they be located near to any trees where roots might disturb the structure.

h. Excavations shall be carried out to a high degree of accuracy with hand trimming as necessary.

i. All pool fittings (skimmers, inlets, outlets, underwater lights etc) shall be installed in accordance with manufacturers' instructions. All pipework must be installed and secured against possible movement so that settlement cannot take place.

j. Areas of overdig shall be brought back to correct levels using dry lean concrete to avoid possible subsidence.

k. Backfilling must be carried out with 25mm down rejects, or fine pea gravel or similar, to provide free draining backfill with no possibility of settlement. Spoil should not be used.

l. Where a diving board is to be fitted, the floor profile shall conform to the Cage of Safety minimum diving depths.

m. All works shall be undertaken in accordance with the provisions of national health and safety requirements.

n. The shell is lined with a suitable material such as PVC, GRP, or waterproof cement wall plastering with sand finished in terrazzo, tile or mosaic, to ensure that the water loss from the pool does not exceed the permissible limits indicated above.

VINYL LINER POOLS (In ground)

25. These should conform to the following construction standards and also to all Pool shell recommendations.

26. All liner pool wall structures shall be capable of withstanding internal pressures. Should ground conditions be such that they may jeopardise the pool structure when the pool is emptied, the client should be advised of such danger and care must be taken to check that ground water is removed and cannot quickly return to the pool area.

27. All liner pools shall have adequate ring beam, and under pool drainage; extra care must be taken to install adequate under pool drainage in high water table areas.

28. All liner material must be suitable for the source water for filling the pool. The material must not put PVC into the water.

29. The interior dimensions, depths, and floor profile to be very precise to ensure a well fitting wrinkle free liner without undue stress in any area.

30. The final floor plastering with sand of approximately 50 mm shall be sand and cement mix, non waterproof, well compacted, and trowelled to a perfect flat, smooth finish. In wet muddy conditions the excavation shall be increased as necessary to allow a suitable base for the floor plastering with sand.

31. All walls and floor to have a perfect finish without pits or protrusions and to be smooth; all to be thoroughly swept and vacuumed before the liner is fitted.

32. Some manufacturers advise a cushioning material between liner and structure; care must be taken that this is expertly fitted with no jointing gaps or wrinkles, and that only cushioning materials

recommended by liner manufacturers are used. It is particularly important to ensure such material is securely fixed so that there can be no movement due to ground water.

VINYL LINER POOLS (Partially or completely out of ground)

33. Where an in ground liner structure is constructed above ground, or partially above ground, extra stresses on the structure will be exerted when the pool is full, without the compensating benefit of backfill. In these circumstances, the manufacturer or a structural engineer must give written recommendations to ensure the future safety of the pool.

LINER POOLS (Above ground manufactured)

34. Above ground manufactured pools should be erected strictly in accordance with the manufacturers' instructions.

35. The site must be perfectly flat and level, and care must be taken that the pool is not erected on made up ground.

36. Above ground pools are not considered suitable for full or partial in ground installation except where the manufacturer gives guidance.

PREFABRICATED AND FIBREGLASS POOLS

37. Fibreglass pools fall into 2 categories:-
    a. Prefabricated modular shells
    b. Reinforced surface membranes

38. The former is a one piece shell moulding which is prefabricated in a workshop, possibly including the flow control fittings, and then transported to site. The latter is a one piece lining, which is site applied onto an existing pool shell.

39. In principle the fibreglass formulation will be, basically, the same for each but will be amended according to the use and application of the finished article. Chemically resistant marine epoxy or

polyester resins are used with a glass filament of between 300 – 450 g/m^2. Gel coats for finishing should be thixatropic to prevent sagging on vertical surfaces and to assist hand application.

40. Temperature plays a big part in these processes both during application and use. Epoxy resins are particularly susceptible to temperature fluctuation. Humidity and condensation should also be avoided during manufacture. Ideally working temperature for application should be between 15^{o}C – 20^{o}C and swimming pool water should not exceed 31^{o}C– 32^{o}C. In both cases failure to adhere to these temperatures will result in spots of cobalt, present in the resins, appearing on the surface in the form of a black spot.

41. In both cases the internal finish must have a uniformity of colour, be free from sharp pointed resin spikes and where necessary have a slip resistant surface worked into the gel/top coat.

42. Dark colours are to be avoided as thermal shock on hot days can cause a colour variation to become visible. Where tiles are fitted they should be applied and grouted with silicone based adhesives and grout to minimise the problems of differential expansion.

43. Multiple sections joined on site are rarely successful except where the final process of fibreglassing is carried out there. Consequently one piece shells are to be recommended.

44. It must be clearly stated, by the manufacturer, whether the shell is free standing or requires support.

45. The shell design should avoid angular projections and sudden large changes of water depth.

46. During installation care must be taken to ensure that all cavities below the shell are filled and, as much as is required by the manufacturer, support the structure. Backfilling the side must also reflect this but in both cases the drainage around the pool must not be compromised and hydrostatic relief must be fitted.

DOMESTIC SWIMMING POOL TANK INSTALLATION

POOL FINISHES

Concrete Pool Finishes

Plastering to Pool Walls

47. Plastering should only be undertaken after the shell has been fully cured and the walls have been thoroughly dried and cleaned off. The use of a water resistant bonding agent (not poly vinyl acetate) and a curing period of 3 weeks should be allowed before tiling or finishing works commence.

Plastering to Pool Floors

48. It is recommended that immediately prior to plastering the pool floor a coat of a water resistant bonding agent is applied at a minimum thickness of 40mm at all points using a mix proportion suitable to ensure full compaction i.e. between 1:3 and 1:4.5 cement/sand. Water addition should be as low as possible although sufficient for correct workability. All plastering and wall plastering with sand should be in accordance National Standards.

49. Both wall plastering with sand and floor plastering with sand should be waterproofed with a proprietary water proofing agent.

50. The final surface finish can be achieved with:
    a. Tiling
    b. Mosaics
    c. Plaster (recognised finish with cement, colour additives and marble chips/dust mix for top coat finishing).
    d. Paint (applied to a properly prepared surface in accordance with manufacturers' instructions).
    e. Liner. Where a liner is to be fitted in a concrete structure the floor of the structure should be drilled to allow ground water to easily enter the shell and drain away. All inlets, outlets etc. should be of the liner type.

51. Outdoor tiling should be frost resistant. Plaster should only be used when correct water balance can be assured to prevent pitting or staining.

DOMESTIC SWIMMING POOL TANK INSTALLATION

Adhesives

52. All adhesives should be water resistant and cementacious. Sand and cement is only suitable if a semi-dry mix is used in conjunction with a slurry bonding layer to the base. All adhesive should be suitable for continuous immersion.

Grout

53. A curing period of 3 days should be allowed following tiling and before grouting. Grout should be selected to meet the standards required. Water resistant grout specifically recommended for continuous immersion can be suitable in many situations but where excessively soft water is to be used or the pool will be subjected to heavy water pressures, an Epoxy resin grout may be preferred. It should be noted (and client should be made aware) that pool water balance is imperative to the durability of grout. Cementacious grouts are particularly likely to be affected by poor pH control.

Tiling

54. All tiles and components should be fully vitrified ceramic specifically manufactured for use in swimming pools. Whenever outdoor tiling is specified tiles must be in accordance with National Standards and be reasonably free from crazing, of low porosity and guaranteed by the manufacturer as frostproof. Tiles must be solid bedded when fixed with adhesive.

Mosaics

55. Where full mosaic is not used a band of mosaic or frostproof tiles is recommended set around the top of the pool shell for easier removal of grease, dirt and scum at the water level. This tiled band, usually blue, increases the blueness of clear filtered pool water.

56. Either a scum band is inset at water level around the pool, or mosaics can be applied fully to pool walls and/or pool floor. Mosaics shall be properly bedded and tesserae set evenly to prevent sharp edges being exposed. Grouting shall comply with tiling requirements.

Plaster

57. A recognised finish with cement, colour additives and marble chips/dust mix for top coat finishing shall be not less than 6mm thick after sanding to finish.

58. It is essential that the mixing is carried out with dry ingredients and done on a clean, dry working surface. The mix must be blended thoroughly before adding clean water to obtain a workable consistency.

59. The Plaster is applied by stainless steel or plastic float (in a similar manner to normal wall plastering with sand), to the prepared wall plastering with sand surface of the pool shell. Joints in the Plaster (necessitated by day to day working) should not occur over joints in the wall plastering with sand.

60. Mechanical sanding takes place to remove any small high spots or trowel marks and provides a more even texture to the surface.

61. Sanding may take place as soon as the Plaster has hardened sufficiently to accept such treatment – usually a 24 hour period – but possibly slightly longer in low temperature conditions.

Pool Paints

62. Before application of a paint finish, the wall plastering with sand should be cured for 28 days.

63. Painting swimming pools and their surrounds presents special problems. To ensure satisfactory and trouble free coating, only materials specifically designed for pools shall be used. Manufacturers' instructions should be strictly followed.

64. There are three types of coatings normally used on concrete pools: chlorinated rubber, emulsion and two pack epoxy resin. Whichever type is used, a good quality coating and reputable manufacturer with specialised experience in pool paint is essential.

65. Cement type paints shall not be used as swimming pool coatings.

66. It is advisable to acid wash new wall plastering with sand before painting.

67. Painting is generally a short term application.

DOMESTIC SWIMMING POOL TANK INSTALLATION

LINER POOL FINISH

68. Installation of a PVC liner will provide necessary waterproofing, and also a decorative interior finish. Liners are supplied custom made in one piece or if heavy duty will be site applied. They are attached to the top of the pool into a linerlock tracking. Liners can be supplied in different colours and thicknesses.

69. Accuracy of measurements for liner manufacture is essential for a perfect fit. Once the installer cuts the liner he has accepted that it has been manufactured to the correct size.

70. EUSA members shall conform to the following standards and recommendations:

    a. The liner thickness shall be 20 thou minimum (or 0.5mm).
    b. The liner shall incorporate a fungicide to inhibit the growth of algae.
    c. The liner fabrication shall be by high frequency welding, with all welds being over-lapped by a minimum of 6mm. The depth of weld shall never exceed the thickness of the material used at any point.
    d. Liners are susceptible to excessive heat and manufacturers should be consulted regarding maximum permissible water temperature.
    e. Before fitting the liner, the installer shall check the material for any damage which may have occurred during transit.
    f. Always lift the liner in its delivery box and provide some form of protection upon which to unroll the liner (plastic sheeting is ideal).
    g. If the temperature is below 10^{o}C (50^{o}F) wait for warmer weather, or provide some additional heating to warm the liner.
    h. Handle the liner with care, especially when lifting it into position.
    i. Protect and cover sharp edges of the pool shell with masking tape.
    j. Before filling the pool with water, ensure the liner fits perfectly and is wrinkle free. Vacuum fitting can make this simpler.
    k. Any creases, particularly at the shallow end, must be smoothed out before the water reaches 100mm in depth.
    l. Under no circumstances may a liner be dragged along the ground or snagged by the pool wall system; there must be neither stones nor sharp material under the liner.

m. Inlet, skimmer or underwater light fittings must not be cut until covered with rising water.

n. All liners should be well fitting and wrinkle free.

ACCESS

71. Apart from in situ steps built into the pool shell, stainless steel ladders or recessed steps and grab rails may be provided according to the requirements of each pool type.

72. In other pools, the number of steps or ladders so provided shall depend on the pool's dimensions and type of use. For example, a long narrow pool would require egress from each end, and a diving section would require egress close by the boards, but outside of the diving area.

73. Treads on both recessed steps and ladders shall provide a non slip surface and shall be designed and installed so that they cannot trap or injure the swimmer.

74. Hand rails to assist bathers may be provided in accordance with the client's requirements. Pool side barriers and pool hand railing shall be located and fixed to prevent the possibility of bathers being trapped.

Pool Steps

75. Where integral access steps are formed either internally or externally to the pool shell, the treads should be of uniform height (not exceeding 300mm) and width (not less than 200mm) down to a depth of 800mm. Tread surfaces should be finished with a non slip finish and each tread should have a contrasting/defined edge with no sharp edges or protrusions.

76. Due care must be taken when designing pools where disabled persons may be using the pool. In this case risers may be decreased in height and treads increased. When applicable due notice of National Norms must be taken.