



- *Alternative Methods of Pool Construction*
- *New ISPE Technicians*
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NOTICE TO ALL READERS

Articles and advice in the ISPE Magazine are for guidance only. Further professional advice should always be sought before acting upon, or refraining from acting upon, a course of action. Health & Safety is of paramount importance and the correct PPE (personal protective equipment) should always be utilised before undertaking any job.
If in doubt, ASK!

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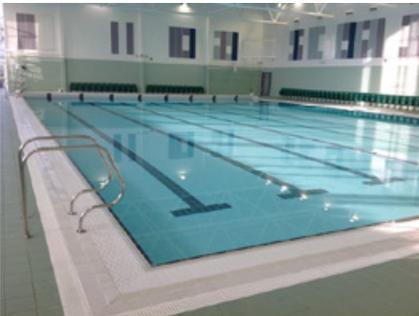
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Front Cover Picture

Buckingham Swimming Pools were awarded the contract to design, construct and install the swimming pools at Perdiswell Leisure Centre by the main contractor, Speller Metcalfe. The complex included a 25m x 17m competition pool and a 18m x 10m learner pool with a moving floor. The consultant was Silcock Dawson.

The pool shell design was complex to deal with the loads being placed through it and to work correctly on poor ground that had to be piled throughout to reduce the risk of floatation due to a high water table in the area. The pools were built using sprayed concrete to a BS8007 design and both passed the static water test. Each pool has a balance tank built as part of the shell structure. There is a large shared backwash holding tank alongside the main pool.

The 25m pool was designed to have a raised end for starting blocks and was built with an underwater camera system from Poolview.



The plant room was designed and installed to meet the Silcock Dawson performance specification and included a pair of Ø2.5m Certikin SLX filters on the main pool and a pair of Ø2.35m Certikin SLX filters. Both pools were running a duty/duty/standby combination of 15hp Certikin BP circulating pumps. All of the filters were a nozzle plate design with a separate air scour system for each filtration system.



The dosing was via a bulk storage chlorine tank for Sodium Hypochlorite which fed into a 230-litre day tank and Hydrochloric Acid for pH correction feeding into a day tank via a mains water venture system. The LMI dosing pumps were controlled via Evoqua Ezetrol Plus chemical controllers which had weblinks on each unit to allow the centre manager to have access to real-time information on the dosing systems in their office.

Each filtration system also had ATG medium pressure UV units installed which, when

combined with chlorine, gives a greater kill rate than using just chlorine. A benefit of this setup is that the chlorine set-point can be set lower which gives a more pleasant swimming environment for the users as well as meaning that the centre uses less chemicals in the dosing of its pools. PAC dosing was also installed for each filtration system.



The learner pool moving floor system was supplied and installed by VarioPool and the competition equipment was supplied by Swiss Timing as part of their competition timing equipment package.

The contract length was 50 weeks and the centre was opened by Worcester City Council on its planned date of 7th January 2017.

We are most grateful to Richard Troman, MISPE, of Buckingham Swimming Pools for this contribution.

**Buckingham Swimming Pools
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Kenilworth,
CV8 2EB
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www.buckinghampools.com**

As I write this, the wind has picked up to around 40mph and we've had over an inch (2.54cm) of rain in the last 24 hours. Welcome to Summer!

Following an excellent ISPE Seminar back in March, which included two RIBA-approved CPD presentations (one of which is summarised in this issue on page 28 - thanks to Shaun Howarth from Ardex UK), we are pleased to report that we have around sixty people who have registered on the new ISPE CPD scheme.

Inevitably, opportunities for training will reduce, in and around the pool and spa trade during this time of year, but we hope to be able to report more and more industry-supported free CPD seminars in the Autumn. Keep an eye on the ISPE website (www.ispe.co.uk) and the next issue of the ISPE Magazine, out in early October. Bear in mind, there are many other ways in which individuals may keep their CPD (Continuous Professional Development) up-to-date, and this includes reading technical articles such as those in the ISPE Magazine! For a free CPD folder and CPD Activity log sheet please contact ross@ispe.co.uk (these are available to ISPE members and non-members).

Don't forget to let us have your news stories, company news, product profiles or anything interesting. In the meantime, keep busy! **Ross Alcock June 2017.**

SPATEX hits refresh with a whole new Show for 2018

Following in the wake of 2017's blockbuster and with the rebooking of exhibition stand space 36 per cent up on the same time last year, the early indications are that SPATEX 2018 looks like being another un-missable Industry spectacular.

SPATEX Organiser, Michele Bridle says: "The team is delighted! Such strong sales reflect the quality of this year's Show and the confidence the Industry has in us repeating that performance next year. We never forget that SPATEX is only as strong as the sum of its parts so we thank everyone for their continued support and faith in us. SPATEX has never been more on top of its game!"

Lots to look forward to

"Each year we like to set the bar that little bit higher so we are currently engaged in ways of

making the 2018 Show even more vibrant and relevant across all aspects," says Michele. "Lots of hard work is already going into the new ISPE Workshop programme which is such a cornerstone of the Exhibition. We know that our visitors really value the knowledge that the workshops impart and in 2018 we are looking to introduce many more esteemed speakers and some hands-on practical demonstrations – Mega-Demos as we are billing them!" Watch this space.

Just landed – a bright new website

A new show calls for a brand new website. We know a very high percentage of you regularly use the website to keep abreast of plans for the forthcoming Show plus, from the latest news section, the day-to-day happenings within the Industry.

For the 2018 website, we've used the same creative design



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team (ASP Design) who each year manage to come up with something unique and fresh. Featuring lovely new graphics (many of which are taken from this year's stupendous collection of BISHTA & SPATA award winning pools), the website is simple to navigate, informative and interactive. We'd love to hear what you think.

Facebook, Twitter and now Instagram!

As many of you know, the SPATEX team already has an impressive presence on Facebook and we regularly tweet on your and the Show's behalf but we've now added Instagram to our social media mix. Instagram is said to be the fastest growing social media platform and with its emphasis on the visual, it gives us a great opportunity to showcase all the beautiful pools, spas and wet leisure installations that you guys are involved in.



Book now!

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SPATEX 2018 -

Tuesday 30th January to

Thursday 1st February

The Ericsson Exhibition Hall,

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ISPE Seminar Dates for your Diary

The ISPE One-Day Seminars for Autumn/Winter 2017:

116th One-Day Seminar-

Including: Chemicals, Water Treatment and Water problems, plus more...

Thursday 12th October

The Watermill Hotel, Bourne End, Near Hemel Hempstead, Herts.

~

117th One-Day Seminar

Thursday 23rd November

Venue and subjects to be announced.

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Alternative Methods of Concrete Pool Construction

At the 115th ISPE One-Day Seminar in March, ISPE Past-President Ian Betts, FISPE, looked at some alternative methods of construction of concrete pools. This article is an adaptation of Ian's presentation on the day.

The following are methods of construction in general use:

- Steel reinforced concrete blocks or reinforced patent blockwork construction.
- Cavity block wall, containing reinforced concrete.
- Traditional reinforced poured concrete using formwork, or concrete blockwork as built in shuttering.
- Pneumatically placed concrete; Gunite, Shotcrete etc.

It is important to note that in accordance with the Water Regulations, swimming pools should be watertight and not leak.

Concrete

The following standards, codes and recommendations are useful reference, but should not be considered an exhaustive list:

BS EN 1992-1-3:2006, (Eurocode 2) — Design of concrete structures, especially Part 3: Liquid retaining and containment structures. This is now the only current BS EN relating to water retaining structures, consequently, it is recommended that you should advise its use in the construction of commercial pools within their specifications. For information, BS 8007 has been superseded by the above Eurocode

and so if your company (or structural engineer) wishes to reference it, they should also mention the Eurocode.

Codes of Civil Engineering and Building Practice.

Major Considerations

- The importance of restraining cracking to avoid leakages.
- Adequate reinforcement in sections where tension may occur i.e. at the bottom of the stem and at the corners. Tensile stresses due to direct tensile forces and those due to bending must be designed for.
- The reinforcement must extend well beyond where it is required to resist the tensile stresses, particularly the face in contact with the water.
- The design should consider the cases where the structure is full of liquid and when it is empty. Since the passive resistance of the earth is never certain, it should be ignored when designing the structure when it is full of liquid.
- When filling for the first time, it should be done slowly, as slow filling permits stress re-distributions to occur which will greatly reduce the extent of cracking. The relevant British Standard recommends a maximum fill rate of 750mm per 24 hours, with emptying being done at the same rate.
- Where reinforced concrete pool shells are required to be built in accordance with EuroCodes, this requirement is usually limited to commercial pools or those where absolute water tightness is of paramount importance (e.g. where

the pool is installed above, or immediately adjacent to, other habitable accommodation).

- Whilst this standard of construction may be desirable in certain installations, compliance can be very costly and unnecessary in the case of the majority of smaller (domestic) outdoor pools.

- However on proposed domestic indoor pools where Building Regulations approval is required it may be necessary to comply with the EuroCodes.

A reinforced concrete pool shell will be deemed to comply with the relevant standards provided that:

- It can be shown by calculation to be stable in both the full and empty condition.
- It is capable of withstanding the normal stresses arising from seasonal changes, soil movement or

the superimposed loads created by enclosing or adjacent structures.

- Suitable precautions have been taken to prevent damage or flotation due to hydrostatic pressure.

- The shell is lined with a suitable material such as PVC, GRP, or waterproof cement rendering finished in terrazzo, tile or mosaic, to ensure that the water loss from the pool does not exceed the permissible limits indicated in Section 2.

Sprayed Concrete

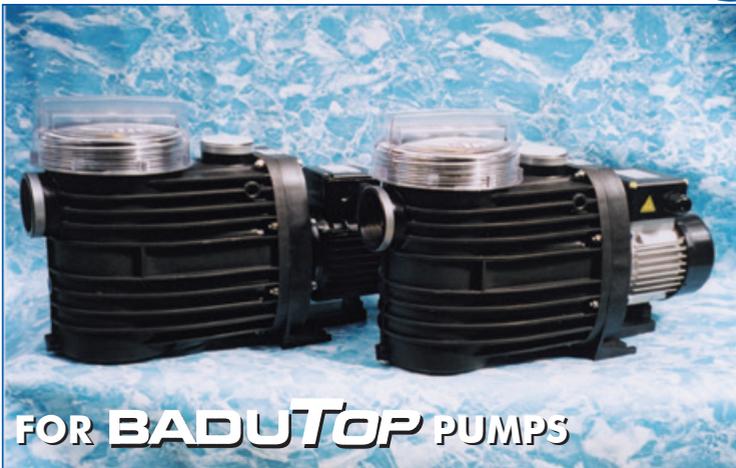
(Gunite/Shotcrete)

Wet Mix

Wet process sprayed concrete consists of a mixture of cement and aggregate, weight or volume batched and mixed with water prior to being pumped through a hose or pipe to a discharge nozzle. High velocity air is used to propel the mixture into position and this supply of high

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pressure air is introduced at the nozzle and the resultant velocity propels the concrete into position where it is compacted by its own momentum.

With the wet process the water/cement should be accurately controlled and with water reducing plasticisers, water/cement ratios as low as 0.4 can be reasonably achieved.

Concrete strength requirements can be specified in a similar manner to traditional concrete, although in the wet process high strengths are usually achieved due to the cement rich characteristic. The range of aggregate cement ratio mixes that can be sprayed is limited and the range used is typically 3.5:1 to 4.0:1 by weight. Because the rebound is mainly aggregate, the placed mix will be richer in cement than the batched premix.

The performance characteristics of sprayed concrete are good density, high strength (typically 40 to 60N/mm²) and a very good bond to a suitable substrate.

Due to the high bond characteristics of sprayed concrete traditional construction joints are not necessary and in most cases a water bar is not required for day joints. All penetrations should be carried out in accordance with the recommendations of the Sprayed Concrete Association.

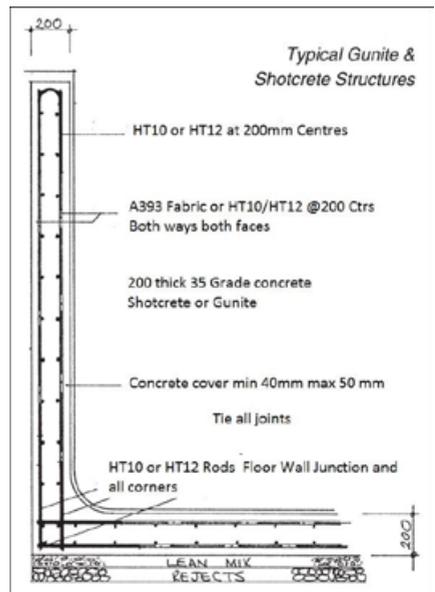
Wet sprayed concrete is a structural material, not a decorative finish. Sharp returns and fine details are not advisable but where they are specifically required they should be clearly defined by the engineer in the specification.

Whereas tolerances of +/- 10 millimetres over a 3 metre length are readily attainable on plain flat

surfaces, special provisions will be required in respect of more complicated shapes or difficult locations.

Where an alignment similar to traditional concrete is required, it is usual for the concrete to be placed slightly proud of the required alignment and carefully 'sawed' back with a timber straight edge. After the concrete has reached its initial set, a further layer is applied, aligned with a timber straight edge and is then rubbed up with a wooden trowel. A finish similar to a normal rendered surface will be achieved.

On thin coatings, trowelling is undesirable as it can disturb the impaction bond.



Dry Mix

In dry process sprayed concrete, a pre-determined ratio of cement and aggregate is batched and mixed without added water.

The mixture is placed in a purpose-designed machine wherein

it is pressurised; an even flow of the mixed material is introduced into a high velocity air stream and conveyed through flexible hoses to a discharge nozzle. At this nozzle, a finely atomised spray of water is added to the stream of materials in sufficient quantity to hydrate the mix and to provide the right consistency so that the uninterrupted stream of materials can be projected at high velocity into place where the impact compacts the material. Because water or admixtures are not required to give workability during transporting or to achieve compaction, dry process sprayed concrete with suitable aggregates and aggregate/cement ratios can be placed at low water/cement ratios, with low slump characteristics.

Admixtures can be introduced in powder form into the dry premix, in liquid form with the added water at

the discharge nozzle or as a separate injection at that nozzle. Steel and other fibres can be incorporated in the pre-mix.

The technique is very flexible, capable of wide variation in throughput, able to handle virtually all types of cement and a wide variety of conventional and lightweight aggregates. Aggregate sizes up to 10mm and sometimes 20mm maximum size can be used but there is normally no advantage in using material over 10mm. The range of aggregate/cement ratio mixes that can be sprayed is limited and the range used is typically 3.5:1 to 4.0:1 by weight.

Because the rebound is mainly aggregate, the placed mix will be richer in cement than the batched premix. The performance characteristics of dry process sprayed concrete are good density, high strength (typically 40 to 60N/mm²) and a very good bond to a suitable substrate. The intrinsic properties tend to be more variable than conventional concrete or wet process sprayed concrete.

Note: For the application of all sprayed concrete, it is critical that the spray nozzle operative and the concrete pump operative are trained in accordance with the recommendations of the Sprayed Concrete Association (SCA).

Overall Design

Because the designer can achieve almost any shape, adequate plans with detailed dimensions should be provided to ensure that the contractor can accurately assess the specifier's requirements.

The strength of sprayed concrete should be specified as follows: -

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Grade	Characteristic 28 day strength
C30	30N/mm
C40	40N/mm
C50	50N/mm

The contractor should achieve the specified characteristic strength, and ensure that the gradation of fine and coarse aggregates is such that the mix can be pumped without the occurrence of 'bleeding' within the pumping lines.

Cement

Except where otherwise specified the cement should be Ordinary Portland Cement complying with the requirements of BS EN 197-1.

All cement should be fresh and after delivery should be stored in a dry area or in a purpose-made bulk silo.

Aggregate

This should consist of sharp washed sand graded in accordance with BS EN 12620. Medium Grade is preferable. Where Medium Grade is not readily available, other fine aggregates may be employed if the contractor can demonstrate that the specification can be achieved.

Coarse aggregate should comply with BS EN 12620 and in general should not exceed 16mm. Some aggregates, such as proprietary lightweight aggregates that can only be pumped in a high slump condition, should not be specified without reference to the specialist contractor.

Water

All water should be clean and free from harmful matter. Where tests are required, they should be in accordance with the requirements of BS 3148.

Admixtures

Plasticisers, water reducing agents and admixtures, such as accelerators, (complying with BS EN 480-1) may be used with the approval of the engineer but the method of introduction and concentration should be left to the specialist contractor's discretion.

Pumping and delivery equipment

Equipment should be specifically designed for sprayed concrete work and should be capable of delivering a continuous even flow of material to the nozzle. The equipment shall be inspected and cleaned at least twice a day, when in use.

Pumping and delivery equipment continued:-

The nozzleman should be competent and experienced in such work and have a working knowledge of concrete practice.

Sprayed concrete should not be placed onto a frozen substrate. It should not be placed when air temperature falls below 3°C. It should be maintained at not less than this temperature until the final set is achieved.

A proportion of sprayed concrete will rebound and measures shall be taken to prevent it from being incorporated in the finished work. The amount of rebound will vary according to the parent surface and the type of reinforcing.

In general the sprayed concrete should be cured in accordance with the recommendation set out in the relevant BS EN Standards. Where the ambient temperature exceeds 25°C or in

exposed conditions where air movement may cause a rapid drying of the concrete surface, as the spraying proceeds the work shall be immediately protected by wet hessian or a fog spray system. In these conditions no surface shall be exposed for longer than one hour.

Testing

As the material has been premixed prior to entering the system, day-to-day quality control shall be by test cubes taken in accordance with BS 1881, (-124 & -128) Part 108. If warranted by the size and nature of the contract, subject to notice at tender stage, sample test panels shall be constructed incorporating typical reinforcement to demonstrate nozzle techniques and reinforcement bond.

Similar panels should be used for routine quality control. Such a test panel should be 750mm x 750mm x 100mm thick and should be sprayed in the same location and same plane as the main work.

The test panels should be marked, cured, cored and tested in compression in accordance with BS 1881, (-124,) Part 4.

Alternatively the properties of the sprayed concrete may be established in situ by the use of generally approved testing methods, such as coring.

Steel Reinforcement

Steel calculations should be undertaken by a Qualified Structural Engineer with design to accord with relevant BS EN Standards.

Main bars (vertical) and distribution bars (horizontal) should generally be constructed in high yield deformed steel bar at centres of 200mm (maximum), according to

design, and care should be taken to avoid rusty or dirty components. (Steel reinforcement to comply with relevant BS-EN Standards.)

Work should be undertaken by experienced steel workers, working with awareness of the Health and Safety risks involved.

Steel mesh can be used in the base of the pool subject to design (to BS 4483).

Wall ties (preferably stainless steel) and starter bars will be required in all cases.

Curing

To achieve full design strength, correct curing is imperative. In accordance with British Standards a curing period no less than 6 weeks is recommended from completion of a concrete shell during which time the surface should be allowed to dry out slowly or follow the BS criteria if the shell is built to relevant BS-EN Standards. If water testing is not undertaken, the shell should be wetted thoroughly for a minimum of 7 days, this wetting procedure reducing throughout the next 3 days until no wetting is required after 10 days. The shell can then be left to dry slowly, unless very hot weather occurs when wetting should be continued at a reduced rate. Curing periods for commercial pools should be allowed at intervals during construction as follows: -

- 1. Between completion of shell and render/screed – 6 weeks**
 - 2. Between completion of render/screed to tile fixing – 3 weeks**
 - 3. Between completion of tile fixing and grouting – 3 days**
 - 4. Between completion of grouting and filling – 3 weeks**
- ### **Water Tightness Testing**

Before curing, (provided water supplies are available), a water tightness test can be undertaken by filling the pool to maximum capacity at a rate not exceeding 750mm per 24 hours. Ideally the pool should be left full for 7 days before slowly draining. Not only does this test the water tightness but the procedure assists in correct curing and can be accepted as part of the required curing time.

Safety

Reasonable measures must be adopted in accordance with the requirements of the Health and Safety at Work Act or other relevant legislation. In particular, lighting, ventilation and protective clothing must be adequate for the safe and proper execution of the work.

Internal Finishing

Rendering to Pool Walls

Waterproof rendering 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 PVA (poly vinyl acetate) in accordance with BS 5385-2 is recommended and a curing period of 3 weeks should be allowed before tiling or finishing works commence.

Render mix should consist of sharp washed sand, cement and an approved 'water-proofing' additive.

In order to prevent delamination of render from the concrete all surface laitance should be removed from concrete (shuttered) prior to the first splash coat and all render and screed should be bonded to the substrate.

Retarder can be used on formwork which exposes aggregate,

or a light acid wash (done in a safe manner and washed off afterwards) is an alternative.

Screeding to Pool Floors

It is recommended that immediately prior to screeding the pool floor, an appropriate bonding agent should be applied. It is further recommended that screeding to the pool floor should be applied (to a minimum thickness of 25mm and a maximum thickness of 40mm) at all points. All plastering and rendering should be in accordance with BS 8000 / BS 5385 and BS 8204.

For rendering and screeding, particular attention must be applied to manufacturer's recommendations for the particular 'water-proofing' additive used.

Please note: The information in this article is for general guidance only and should not be relied upon in specific situations. If in doubt, please ask!

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Wilson's Wanderings

So, I'm on a flight, can't say where, as the issue is still sub judice. Basically, as far as I'm concerned, a little jaunt to sunnier climes plus the immeasurable joy of travelling business class.

With six hours flying to look forward to, I order tea. Not in a cardboard, non-recyclable container but with a little china pot, milk jug and dainty cup not unlike the ones my Mum used to get out from her securely locked china cupboard, whenever the priest came to visit us.

A scan through the films available provides an opportunity to see classics that I may have missed over the years. Up pops 'The Revenant' great film, seen it!

'The Hateful Eight', from Quentin Tarantino, yes I'll have some of that and sit back concentrating, to follow the complex but enjoyable plot.

I remember Tarantino's best movie ever, 'Pulp Fiction' and what a great sound track that had, although I must admit I had to watch it four times to fully understand the complex plot.

Following that up on the screen flashed 'Kill Bill' with Uma Thurman. Now I would watch a party political speech if she was in it and so I put it on. What a load of rubbish, Tarantino hang your head in shame! Uma is the anti-hero and in one scene she kills off about fifty martial arts fighters. But I'm racing ahead, at the start of the film, she



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recovers from a coma and although lacking movement below the waist, kills a couple of baddies and drags herself into the back seat of a stolen Ute, where she repeatedly commands her still and stubborn feet to start working. Now Una is a babe so I am unsure if it was really her feet being shown in the film or for some obscure reason, those of an ugly foot double. Just look at them. Are they not the ugliest feet we have ever seen? It quite put me off my beef bourguignon and Cabernet Sauvignon and just look at me, it takes a lot to put me off my scam.



Uma Thurman - at a cinema near you, maybe?



Uma's feet.... really?

So I then fall asleep until an announcement summons me to prepare for landing. It might be my age but now when I fall asleep and this is pretty damn often, I wake up with a patch of saliva the shape and size of Oldham down the front of my shirt. The other thing is, when I awake I somehow believe that I have miraculously recovered the power of being able to walk unaided JUST as Uma did in 'Kill Bill'. This stupid belief is quickly contradicted by my left leg collapsing under me and so I grab my walking stick and hobble off the plane. This hollow walking stick would be great to hide drugs in and the airport customs take a perverse pleasure in x-raying it and stripping it to the sum of its component parts before handing it back to me to re-assemble.



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In the arrivals lounge is a beaming figure, resplendent in a Stewie Griffin T-shirt and sawn-off denims, holding a handwritten sign misspelling my name. He solicitously takes my bags and escorts me to a vehicle, the type of which was used before cars were invented. I think it is the second time, Gambia was the first, that I travelled in a vehicle which had lino on the floors combined with the ubiquitous classic wooden beads car seat covers, incidentally still available on eBay for only £37.00.

As soon as I enter my hotel bedroom, I put down my case and, holding my breath turn on all the taps and shower (on its hottest setting) and leave the bathroom, closing the door behind me and exhale. After five minutes I go back in and shut off all of the water. Hopefully in that way, I have flushed away any bacteria waiting to attack me in the plumbing.

Auspiciously the inspection is on a spa pool and not a waterslide complex so fortunately no climbing involved. The allegation is that an elderly user contracted Legionnaires' disease whilst staying at the complex. Regrettably when you look at a spa it has the environment to generate the legionella bacteria at a temperature again ideal for this to take place. The aeration creates tiny water droplets, many of which carry a positive charge. Legionella bacteria is gram negative and is attracted to these minute bubbles. They rise from the water where the thickness of the bubble surface layer, and low surface tension being exceeded by the air pressure

inside the bubble cause it to burst, releasing the bacteria of a size less than three microns to become liberated, and this often takes place close to spa users' nasal orifices. The user inhales this bacteria and may become ill with a virulent pneumonia-type illness. Those at most risk are those with poor respiratory systems, smokers, the elderly and the obese.

In the Lens outbreak approximately 13 years ago that resulted in up to 18 fatalities (21% of the confirmed cases) some of those affected did not venture within 5km of the source, showing that the bacteria can travel over long distances.

I worked on a job on the Mediterranean where, although a hotel was blamed, the source was from a poorly maintained council fountain on a roundabout more than 100 metres from the innocent hotel.

The point I am trying to make is that the offending bacteria can travel and the elderly are most at risk, as they are with any outbreak.

I see elderly couples sat in parks and public spaces watching their grandchildren play in water features, often unsafely operated and spreading bacteria to the four winds. If you worry about this, just test with a No 1 DPD and take the appropriate action.

Regards, Allen Wilson, FISPE Studies In Work.

Allen adds: Join the 85,000 recent visitors to my website at www.studiesinwork.co.uk

Ross adds: Also, see details of the latest ISPE-endorsed PPO courses on the news page of the ISPE website at www.ispe.co.uk

$\frac{3}{4}$ Million Miles (and counting...)

ISPE past-President Howard Gosling, FISPE, is well known to many ISPE members, but how many know about Howard's trio of PMX-plated vehicles which have now covered a staggering $\frac{3}{4}$ million miles between them?



$\frac{3}{4}$ million miles and going strong

The original PMX came along in 1980 (before the MG factory closed and following its conversion to V8) was first registered 1st August 1981, and has now covered over a quarter of a million miles, currently in a 4 litre V8 form, it is known as Quicksilver, which is the old name for Mercury, symbol Hg.

Quicksilver has been subject to constant repair, renewal and improvement over the decades.

When going to do either an expert report or a mediation it is a wonderful ice breaker because people either say they had one when they were young, their mother or their father had one, or something similar, and it gets people talking which helps solve a number of problems and creates goodwill.

J2 PMX was registered 3rd December 1991 and has since covered about 380,000 miles but

there is about 10,000 unrecorded due to a problem with the speedometer and no parts being available. 25 years of hard work has seen this car well laden, carrying initially some chemical samples, then a relatively easy life with children but sometimes laden with dinghy and bicycles for family holidays, and for the last 15 years predominantly used for carrying water test kits, computer, screen, laptop, and indeed water samples for training in water hygiene, especially spas and hot tubs. Periodically, as well, it's used in the training for 'Transport of Dangerous Goods' with all the heavy manuals and reference books for that.

The well-travelled Volvo is very comfortable, it had a new clutch at 197,000 and another one at about 357,000 but other than that it is all routine servicing at the Volvo main dealers, once every 10,000 miles and Volvo give 10,000 miles of Europeanwide breakdown cover with each service so it is remarkable value for money.

Rust is the only visible problem but the petrol engine is still as sweet as ever, as are the gearbox and back axle. For several years I have run on winter tyres all year round.

The Land Rover, A1 PMX, was my last company car and a 50th anniversary model of the Discovery, which I took with me when I left Certikin, and the 4 wheel drive is invaluable for towing and in fields and winter weather but this has only done a mere 176,000 miles.



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Balanced Water – for equilibrium and peace of mind

Balanced Water (or the Langelier Index) is an important factor in keeping your pool up-to-standard.

When water is in balance, it is said to be neither corrosive nor scale-forming. In other words, it will neither dissolve an existing layer of scale nor will it deposit a layer of calcium scale. Unbalanced water can aggressively eat away at the pool's infrastructure.

For most well-run pools, the water should be in balance if the pH value is kept within the recommended range. However, there are other factors that can have a significant effect on the condition of the water.

Monitoring the Alkalinity and maintaining its concentration helps to keep a constant level of pH within the pool water. High Alkalinity levels reduce the effectiveness of adding acid or alkali to the water, so pH levels are more difficult to change. Low Alkalinity levels increase the effectiveness of acid or alkali. This means tiny additions of chemical can radically change the pH, making it difficult to manage.

Maintaining Alkalinity within the recommended range keeps the pH stable and helps the effectiveness of disinfectant used in the pool, so it is important to monitor and maintain levels regularly.

Changes in Calcium hardness levels can affect fixtures and fittings within the pool. Low levels often result in the loss of grout around the tiles, as the water tries to satisfy its need for calcium. High levels are not necessarily a problem, as long as the water remains balanced. However uncontrolled build up of calcium in the water can lead to deposits in the pool structure and pipeworks. This can reduce the efficiency of the plant, filters, dosing systems and lead to increased maintenance, labour costs and time.

Ideally a slightly positive balanced water result should be aimed for. This will leave a thin layer of Calcium deposits on the pipework, which can act as protection against corrosion. High calcium levels can also affect other tests carried out including the DPD test. In areas of hard water it may be necessary to use a DPD High Calcium Tablet to reduce the interference during measurement.



The advertisement is divided into two main sections. On the left is a photograph of industrial pool equipment, including a large blue cylindrical tank and various pipes and valves. On the right is the company's branding and contact information. The logo features a stylized blue splash of water above the text 'LONDON SWIMMING POOL COMPANY'. To the right of the logo are two circular icons: one with a swimmer and the word 'SPACE', and another with '30 YEARS' and 'of experience'. Below the logo, the text reads: 'Specialising in below ground and moving floor pools. Services include consultancy and design, custom pool plant and water treatment.' At the bottom, the contact details are: '020 8605 1255 www.londonswimmingpools.com' and 'Unit 1, Shannon Commercial Centre, New Malden KT3 4PT'. A dark blue banner at the bottom left of the advertisement contains the text 'Engineering Excellence'.

Langelier Saturation Index (LSI)

The Langelier Saturation Index (sometimes also known as the Langelier Stability Index) was developed in the 1930's to determine a formula resulting in a single calculated number which is used to notify how much calcium is in the water. The golden result of just above "0" means the water is 'in balance'.

The Langelier Saturation Index is simple and reliable. It uses various parameters that can have an effect on the water balance and each is given a factor to give an Index value. Those parameters are: pH; Total Alkalinity; Calcium Hardness; Total Dissolved Solid; Temperature.

Each of these parameters has an effect on each other as proven by the formula below. However, generally speaking, low measurements result in negative balanced water, high measurements result in positive balanced water.

- Balance = Corrosive

Low pH
 Low Alkalinity
 Low Calcium Hardness
 Low TDS
 Low Temperature



+ Balance = Scale Forming

High pH
 High Alkalinity
 High Calcium Hardness
 High TDS
 Low Temperature

To calculate the Langelier Index more accurately, each reading is given a factor which is put into the following formula:

$$\text{pH} + \text{Temperature factor} + \text{Alkalinity factor} + \text{Calcium Hardness factor} - \text{TDS factor}$$

To calculate the respective **Factor** for each measurement, the following table may be consulted:

Temperature		Temperature Factor	Calcium Hardness mg/l	Calcium Factor	Total Alkalinity mg/l	Alkalinity Factor	Total Dissolved Solids mg/l	Dissolved Solids Factor
C°	F°		as CaCO ₃		as CaCO ₃			
0	32	0.0	5	0.3	5	0.7	0	12.0
3	37	0.1	25	1.0	25	1.4	-	-
8	46	0.2	50	1.3	50	1.7	1000	12.1
12	53	0.3	75	1.5	75	1.9	-	-
16	60	0.4	100	1.6	100	2.0	2000	12.2
19	66	0.5	150	1.8	125	2.1	-	-
24	76	0.6	200	1.9	150	2.2	3000	12.25
29	84	0.7	250	2.0	200	2.3	-	-
34	94	0.8	300	2.1	300	2.5	4000	12.3
41	105	0.9	400	2.2	400	2.6	-	-
53	128	1.0	600	2.35	800	2.9	5000	12.35
-	-	-	800	2.5	1000	3.0	-	-
-	-	-	1000	2.6	-	-	6000	12.4

Example calculation 1

pH 7.8	7.8*
+ Alkalinity 125	Factor 2.1
+ Calcium Hardness 100	Factor 1.6
+ Temperature 24	Factor 0.6
<hr/>	
= Sum	12.1
<hr/>	
- TDS 1000	Factor 12.1
<hr/>	
= Langelier Index	0.0

Example calculation 2

pH 7.2	7.2*
+ Alkalinity 100	Factor 2.0
+ Calcium Hardness 150	Factor 1.8
+ Temperature 29	Factor 0.7
<hr/>	
= Sum	11.7
<hr/>	
- TDS 4000	Factor 12.3
<hr/>	
= Langelier Index	-0.6

*taken from reading – no factor conversion required

-0.6 would represent quite an aggressively corrosive state of water, resulting in galvanic attack.

Try it for yourself!

Imagine you have taken the following readings from the sample of your pool water. By using the factor conversions and formula above, can you work out the Langelier Index of the pool and whether or not the Water is in Balance?

pH	7.35
Alkalinity	105
Calcium Hardness	400
Temperature	29.5
TDS	1440

(See solution on page 24)

We are grateful to Lovibond Tintometer for providing this article.

For more information contact:

The Tintometer Ltd.

Amesbury, SP4 7GR

Tel: +44 (0)1980 664 800

www.lovibondcolour.com

www.lovibondwater.com

Apprenticeships in the Pool and Spa Industry

There's been some discussion in and around the trade over the years about the possibility of some sort of Apprenticeship scheme for those seeking a career in the pool and spa trade. One of the problems in the past has been the fact that the pool trade includes various aspects of other established trades such as plumbing, construction, and numerous others, and it's difficult to find ways to pull all these trades under one scheme, to suit a typical pool engineer.

Quite by chance, I looked at the list of available apprenticeships on the Government website a few weeks back and was amazed to find one being advertised for a pool and spa engineer.

*It turned out that whilst some of the great and the good in our trade have been discussing the best way forward to this issue (and the discussions continue) Shropshire Pools and Spas sought their own solution to the problem by approaching their local Technical college and Tracy Roberts has kindly supplied the following report on their success.
Ross Alcock - June 2017.*

After initially enquiring about taking on an apprentice some four years ago we came up against the brick wall of there not being a specific college course available to suit our industry so decided not to pursue it any further.

Whilst browsing online we came across a course being run at our local college, Building Maintenance Operations, which covered the areas of plumbing, electrical, building, carpentry & tiling – all of which could be incorporated into the swimming pool industry.

I called the college to discuss our wish to take on an apprentice and explained the different skills required by our engineers and they agreed that the Building Maintenance Operations course fitted the bill exactly.

After that I simply had to fill in an online form from the college which they posted on the Government's Apprenticeship website and as a result we had 9 applicants in the first week!

Tony Roberts, MISPE, and I decided that in order to gain more swimming pool-based knowledge we would offer the right candidate the opportunity to take the ISPE exams which would sit alongside their day to day work and college experience perfectly.

I found this whole process very straightforward and along with the ongoing support from Shrewsbury College of Arts & Technology we welcomed our new apprentice to our industry.

Tracy Roberts,
Shropshire Pools and Spas Ltd.
www.spaslimited.co.uk

Newly Qualified ISPE Technicians

We offer our warmest congratulations to those newly qualified ISPE Certified Technicians, listed below, (purely in alphabetical order, not in order of merit) who recently passed their ISPE exams.

The presentation of Technician Certificates, and trophies, including the Gartside Cup for Student of the Year, will take place at the Institute's Awards during the 116th One-Day Seminar on Tuesday 12th October, 2017, at The Watermill Hotel, near Hemel Hempstead, Hertfordshire. We hope to see as many of the newly qualified Technicians as possible on that day.

Programmes with booking forms will be sent out during August and will be available to download from the 'Diary Dates' section of the Institute's website (www.ispe.co.uk) nearer the time.

Successful Technicians may place the letters 'TnISPE(Cert.)' after their names on any business or personal stationery for as long as they are paid-up members of the ISPE.

This year, for the first time, two certificates will be issued to each successful Technician: one (in the coming weeks) confirming their success and awarding CPD points (new for 2017) and the other, a Technician membership certificate, as part of the ISPE 2017 awards in October.

Alistair Allen	- Poolcare Services
Robin Baldey	- Home Counties Horsham
Atila Barna	- Polar Pools Ltd.
Jason Beirne	- London Swimming Pool Co.
Neil Bevan	- Tanby Leisure Products
Emma Brown	- Certikin International
Ryan Collins	- Certikin International
Rickie Comfort	- Comfort Leisure Services
Mark Daniels	- Home Counties Pools
Rob Davies	- Pollet Pool Group
Niall Gooding	- Golden Coast
Aaron Mander	- Panache Pools
Ian Mills	- Rio Pool Construction Co.
Jamie Perrin	- Blue Cube
Daniel Price	- No company advised.
Peter Schuster	- Trutec Pools & Leisure Ltd.
Damian Vittles	- I J Cannings & Son Ltd.
John Williams	- Pool Care & Services
Dane Wilson	- UK Poolstore

For details of the ISPE Home Study Course, ideal for those new to the pool industry, and information on the ISPE CPD scheme, suitable for anyone, whether an ISPE member or not, contact the ISPE office on 01603 499959 or email ross@ispe.co.uk

Solution to the Langelier Index Calculation

(from page 21)

pH 7.35	= 7.35
+ Alkalinity 105	= Factor 2.02
+ Calcium Hardness 400	= Factor 2.2
+ Temperature 29.5	= Factor 0.71
<hr/>	
Sum	= 12.28
<hr/>	
- TDS 145	= Factor 12.15
<hr/>	
Balanced Water	= 0.13

ISPE Annual Subscriptions

A huge 'thank you' to all ISPE members who pay their annual subscription invoices the moment they are received, which helps keep our costs down (there's no increase for 2017/18). Please take your invoice to your company if they pay this on your behalf.

ISPE Seminar Subjects and Speakers

The ISPE Council spend many hours each year trying to come up with interesting ideas for ISPE Seminar presentations. Quite often one of them will suggest a subject only to be met with a response of "Good idea, how long would you like to speak for?". Would all ISPE members please give this some thought and let us know what you would be interested in seeing at an ISPE Seminar?

In addition, if you would like to give a presentation at an ISPE Seminar please let us know. Subjects should be broadly generic and not product-specific but sometimes, we can make arrangements for a company to give a sponsored, commercial presentation on a

particular product or system. Please email us at ross@ispe.co.uk with your ideas.

ISPE Seminars are an excellent investment for ISPE members and others to attend. In addition to the informative presentations, there is ample opportunity to ask questions or raise discussion on any pool or spa-related topic and a chance to meet some of the other 800+ ISPE members for a exchange of views, ideas and experiences. A comprehensive pack is provided for delegates containing copies of the day's presentations (& other goodies too, sometimes) and attendance certificates indicating 4 CPD points. Oh, and the lunch is usually pretty good too!

What about [SPATEX Workshops](#)? Again, do let us know if you would like to give a presentation at SPATEX. ISPE Workshops at SPATEX must be generic and speakers should, where possible, be linked to, or part of, an exhibiting company and, ideally, an ISPE member but this is not always the case.

HSG 282 Updates

We are grateful to ISPE Fellow Howard Gosling for the following: ISPE members should be made aware that an updated version of the HSE guidance document "**HSG 282 The control of legionella and other infectious agents in spa-pool systems**" has been posted on the HSE website. This may be downloaded free of charge at: <http://www.hse.gov.uk/pubns/priced/hsg282.pdf> This latest version corrects one or two technical

errors and makes some editorial amendments as notified on the ISPE website and elsewhere.

To differentiate from earlier versions, the latest version is dated 05/17, as per the footer on page 62 of the document.

Cobweb Corner

Did you know... That in May 1971, the very first injection plastic skimmer, the HD100, a British designed and manufactured product, was introduced to the European pool market by Bob Kent the then MD of Certikin? Up until then, all skimmers were either manufactured using GRP, bronze or aluminium die casting. The trade price of the HD100 was then £8.10 6d. This was followed by the world's first injection moulded pool light, PU9 in 1972. Bob Kent, FISPE. www.mineralsi.com www.zeoclere.com

Email Addresses

Of our 800+ members there are about 400 for whom we still do not have a personal email address. If you have not received a personal email from ross@ispe.co.uk in the last six months, please send an email to that address so we can keep our records up-to-date. We promise NEVER to pass email addresses to any third party (including other

members, without your permission) or to bombard you with weekly emails telling you things you've already seen elsewhere.

ISPE Logo Use

Let's keep this simple. **Please do not, ever, use the ISPE logo anywhere**, including advertising, vehicles, letterheads or websites. Please report infringements to ross@ispe.co.uk and one friendly request for removal will be issued. After that, we will have to take stronger action. If in any doubt, or you need any advice, please ask.

Hop in, the water's lovely...

One member reports a customer has removed some frog spawn from an outdoor pool with a free chlorine level of 3ppm. Will it survive? Please send your experiences in this area to ross@ispe.co.uk for publication in the next issue.

ISPE Filtration Workshop

We are taking names of those interested in attending the next Workshop in the Autumn, in East Sussex. Please email us at ross@ispe.co.uk for more details of this excellent 'hands-on' ISPE Workshop, ideal for those new to the trade and even more experienced fitters.

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Get the training right and the rest will follow!

There was no hot air, just a transfer of essential facts and knowledge when Certikin recently hosted a special Heating & Ventilation industry training day on the subject of air source heat pumps on behalf of SPATA.



Graham Kneale, FISPE

Specifically designed for pool retailers and installers, the course provided vital information on local authority planning requirements including the General Permitted Development Order (GPDO) for domestic swimming pools.

Held at Certikin's HQ in Witney, Oxfordshire, the course gave delegates a detailed understanding of what might be required by a local authority planner and rewarded their attendance with Continuous Professional Development points. Comprehensive in its breadth, the course covered the ins and outs of GPDO as well as giving a full insight into how heat pumps work; how to install them and troubleshooting.

Venturing out of the classroom, the afternoon session

had a more practical bias. Certikin's Field Sales Manager, Graham Kneale (FISPE), showed delegates the market leading Calorex ProPac heat pump, highlighting its USP's such as the ten-year anti-corrosion warranty on the casing; dual position for the stat; outlet fans and components such as the evaporator, condenser, expansion valve etc.

The day was well received by all delegates. Keith Tupman, MISPE, of Petersfield's Aquafayre said: "The course was extremely useful and very well presented, I only wish more of my staff could have attended. I learnt a great deal from Graham Kneale who explained the intricacies of GPDO and noise calculations in a simple and easy to understand manner. I would certainly recommend it to anyone involved in the heating and ventilation of swimming pools."

Inventive Training

James Dyson is setting up in 2017 a tuition-paid university at his Dyson Institute of Technology in Malmesbury, Wiltshire, to help tackle Britain's engineering skills shortage. Students will be paid up to £16,000 pa to work on new products, build up engineering experience and organise their own knowledge-base, across a 4-year course working in partnership with the University of Warwick.

Thanks to John Dawes, FISPE, for keeping us informed of this training opportunity.



ISPE Seminar Report

The Experts in Swimming Pool Tile Installations



Operating across more than 50 sites worldwide, ARDEX are a leading manufacturer of premium products for the preparation and installation of tiles in swimming pools and wet areas.

ARDEX UK recently gave their RIBA-approved CPD presentation on “Specifying Tiling in Swimming Pools and Leisure Areas” to members and delegates of The Institute of Swimming Pool Engineers (ISPE) at a one day seminar at the Watermill Hotel, Hemel Hempstead. ARDEX were represented by Shaun Howarth, one of seven ARDEX Business



Development Managers, who work closely with architects, specifiers and contractors to provide detailed recommendations, and through strategic alliances with complementary manufacturers, can ensure the

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most suitable specification for any project.

More specifically, ARDEX UK Ltd can assist the specifier with tile selection, and the correct waterproofing, adhesive and tile grout selection, while at the same time offering best practice installation advice.



ARDEX manufacture high performance, fast track products that can help to deliver projects on time, and products incorporating unique RAPIDRY Formula Technology, lock the mix water within the mortar, controlling drying and reducing shrinkage.

Traditional renders and screeds can take up to four weeks to dry before tiling can commence, but ARDEX can dramatically reduce installation schedules by providing a range of high performance products that reduce drying times, irrespective of thickness, products like ARDEX A 38 Ultra Rapid Drying Screed Cement, which can be tiled in as little as four hours and ARDEX AM 100 Rapid Hardening One Coat Tiling Render which can be tiled in as little as 2 hours.

ARDEX UK are also at the forefront of training and development. Our purpose-built training facility in Haverhill, Suffolk, enables us to bring all parties involved in an ARDEX specification together, from the client through to the main or sub-contractors, ensuring total confidence in the specification and subsequent on-site application.

For further information on ARDEX products, or to take our RIBA-approved online CPD seminar - "Specifying Tiling in Swimming Pools and Leisure Areas" please visit the Ardex website: www.ardex.co.uk, and any ISPE members interested in training can contact Shaun Howarth on 07967 338364 for more details.

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How Did You Do?

by Chris Carr FISPE

Following the 2017 ISPE exams and after some discussion with Ross, I set myself the task of answering this year's part 'A' questions within the time frame suggested of 15 minutes for the section. As I'm a slow typist (and to match exam conditions) I initially hand wrote my answers and then later typed them up in order that they could be ready for printing.

After preparing these 'model' answers I then reviewed some of the students' papers which gave some answers that were less than ideal (see comments in italics after each answer below).

Section 'A' Answers:

Q1. The filtration of swimming pool water is usually achieved by passing the water through one or more 'media'. Give three examples of filter media including reference to size.

Grade 16/30 Silica Sand is the most commonly used filter media for domestic pool applications. Unlike ordinary sand you might find on the beach (sharp sand or builders sand) it is mined, then graded and is of a size around 0.5–1.0mm diameter. Washed pea gravel 3–6mm in diameter is often used as a base layer in larger (especially commercial) filters to assist with flow-through on backwash and filtering cycles. Activated carbon is sometimes used in commercial pool installations in conjunction with Silica sand and it will assist in the removal of colour and odour and may sometimes be used to remove chlorine from the water. **A number of papers made reference to various filter media (sometimes by brand name) which are not mentioned in the ISPE manual. Although these media may be available, higher marks will be**

obtained by referring to those listed in the manual.

Q2. Describe briefly the purpose of Backwashing.

Backwashing is used to remove dirt particles which have accumulated within the filter media. In a backwash the water flows through the filter in reverse (from the bottom to the top) expanding the media releasing the trapped debris which is then ejected to waste. A backwash is normally followed by a rinse and takes between 3–5 minutes in total. On most domestic systems a multi-port valve may be installed which simplifies the process. The rinse cycle helps to re-compress the media and dispels any trapped particles in the filter laterals from the backwash. Typically a backwash should be performed around once a week on a domestic pool filter and possibly 2–3 times per week on a commercial pool filter. It is always important to check the pool water level prior to and after a backwash. **Some answers to this question were fairly vague and extra points would have been given to those who stated backwash frequency, time to perform and detail such as checking water level.**

Q3. Describe briefly what you understand by the term "medium rate filter". Give an example of an application where a medium rate filter would be ideal.

A medium rate filter is normally used on a commercial pool and in this case the rate refers to the velocity through the filter which would normally be around 22–25m³/m²/hr. Note domestic filters usually have a higher velocity of around 40m³/m²/hr. **Many**

candidates stated that medium rate is used in domestic applications which is incorrect.

Q4. Using a domestic turnover period of 6 hours, what would be the required filtration rate (in m³/hr) for a pool with a length of 10 metres, a width of 5 metres and an average water depth of 1.5 metres?

Required filtration rate of a pool: 10 x 5 x 1.5 = 75m³ divided by a 6 hour turnover = 12m³/hr. **Most candidates got the end answer correct, but those who showed their working out (as above) would have obtained a slightly higher mark.**

Q5. Define the measurement of turbidity in water and state an acceptable turbidity level for pool water.

Turbidity in pool water is a reference to the clarity which is measured in NTU (Nephelometric Turbidity Units). An acceptable level for pool water would be 1.0 NTU as per ISPE manual or 0.5 NTU in accordance with PWTAG recommendations. **Many candidates seemed completely mixed up with this question and referred to other terms such as Hazen units or such like. One candidate referred to Turbidity as 'surface tension' of the water!**

My advice to those who will be taking the ISPE exam next year: Even if you regularly work on site you must read and learn the ISPE manual. The information in the manual will provide you with everything you need to pass the exam.

Innovative, professional pool dosing systems manufactured in the UK

The advertisement features a blue header with the text "Innovative, professional pool dosing systems manufactured in the UK". Below this, on the left, is a white Pellet+Pro Motive pool chlorinator system with a label that includes the product name, "POOL CHLORINATOR SYSTEM", and safety instructions. In the center is the Gaffey logo, a stylized blue and white 'G' inside a circle, with the text "GAFFEY technical services Ltd" below it. To the right of the logo are three website addresses: "hyprolyser.com", "desoclenz.co.uk", and "gaffey.co.uk". On the far right is a white Hyprolyser dosing system with its door open, revealing internal components and a label with the Hyprolyser logo.

New Members and Students

We extend a very warm welcome to those that have recently joined (or re-joined) the Institute of Swimming Pool Engineers.

Arnold, K.	-	Swan Pool & Spa Centre
Barber, M.	-	Premier Pool Services Ltd.
Harmer, S.	-	The Orange House Company
Hill, I.	-	Blue Planet Pools & Spas
Howard, R.	-	Portland College
Hubbard, A.	-	Surrey
Jackson, A.	-	Alzach
Jarvis, R.	-	ClearWater Marine Tech. Ltd.
McQuarrie, G.	-	Dryden Aqua Ltd.
Miller, J.	-	Fluidra WaterLinX (South Africa)
Penney, N.	-	Penney Technical Services Ltd.
Ransom, M.	-	Procopi Deitchland GmbH
Smith, G.	-	ClearWater Marine Tech. Ltd.
Stocken, C.	-	London Swimming Pool Co.
Warren, T.	-	DWS Services (South East) Ltd.
Wrenn, M.	-	Whitewaters Ltd.

Situations Vacant Summary

For full details of the positions summarised below and for the **latest vacancies** in the pool and spa industry, please see the Situations Vacant section of the ISPE website (www.ispe.co.uk), telephone the office (01603 499959) or email ross@ispe.co.uk and we will forward the full advert to you. *Please note, this is a free service to ISPE Members and their companies. Please let us know if a vacancy has been filled.*

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