COMPETITION
POOL

COMPETITION POOL SOLUTIONS

INDEX

01 INTRODUCTION

This report sums up the most suitable selection of resources and solutions available to design, size, calculate and equip an Olympic pool, ready to host the most demanding international swimming disciplines and competitions.

This has been made possible by the expertise of **Fluidra**, a company with more than 50 years of experience in this sector, pioneers in Olympic pool water treatment and the first to assemble new systems for world swimming championships in large stadiums.

Its purpose is to put forward the most functional, inexpensive, cost-effective and sustainable construction model as is possible that is also of high quality, so that it may serve as a model and guideline for developers, architects, engineers, clubs and federations that need facilities for similar uses.

Therefore, a full building has been designed with all of the spaces required for staging Olympic competitions, world championships, national and regional championships, all in line with the EU and FINA's current regulations.

The solutions proposed for the facilities are the most efficient and cost-effective that exist in the market. They are able to save energy and water, as well as being environmentally friendly (equipment that does not discharge water treatment products, by-products, chlorine, etc.).

02 ABOUT FLUIDRA

Fluidra is a leading multinational group dedicated to developing applications for the conservation, handling and enjoyment of water, with more than 50 years of experience in the sector.

Respect for water and its rational use is the core philosophy of our group.

_MISSION STATEMENT & VALUES

"Our mission is to create the perfect Pool and Wellness experience responsibly."

_INTEGRATED BUSINESS MODEL

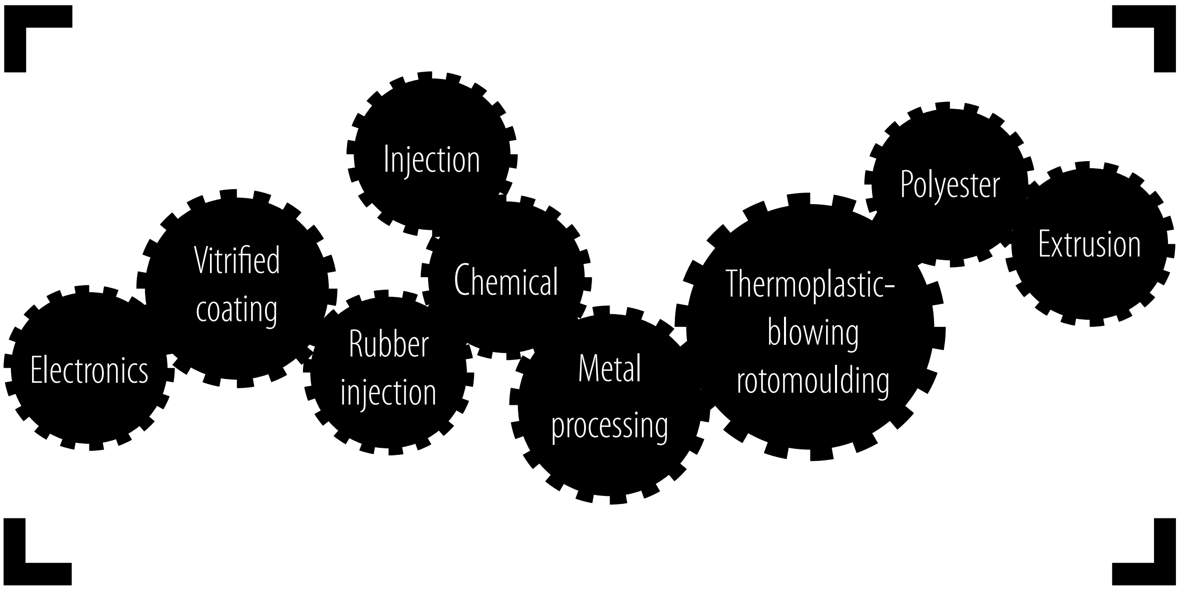
The **Fluidra** Group works with an integrated business model

We have a multidisciplinary R&D&I centre that focuses on sustainable solutions. Our commitment to sustainability has led us to create a specific line of sustainable products. Fluidra has the ability to create exclusive solutions up to quality certificate standards, homologated for different countries.

I+D				
R+D+I Multidisciplinary R&D&I centre that focuses on sustainable solutions	**PRODUCTION** +35 Flexible multitechnology plants in key countries	**LOGISTICS** Logistics operators to ensure fast and reliable deliveries	**DISTRIBUTION** +135 points of sale, giving support and training to the professional clients in +45 countries	**ENGINEERING** Design and enfineering of water projects

_FLUIDRA PRODUCTION TECHNOLOGIES

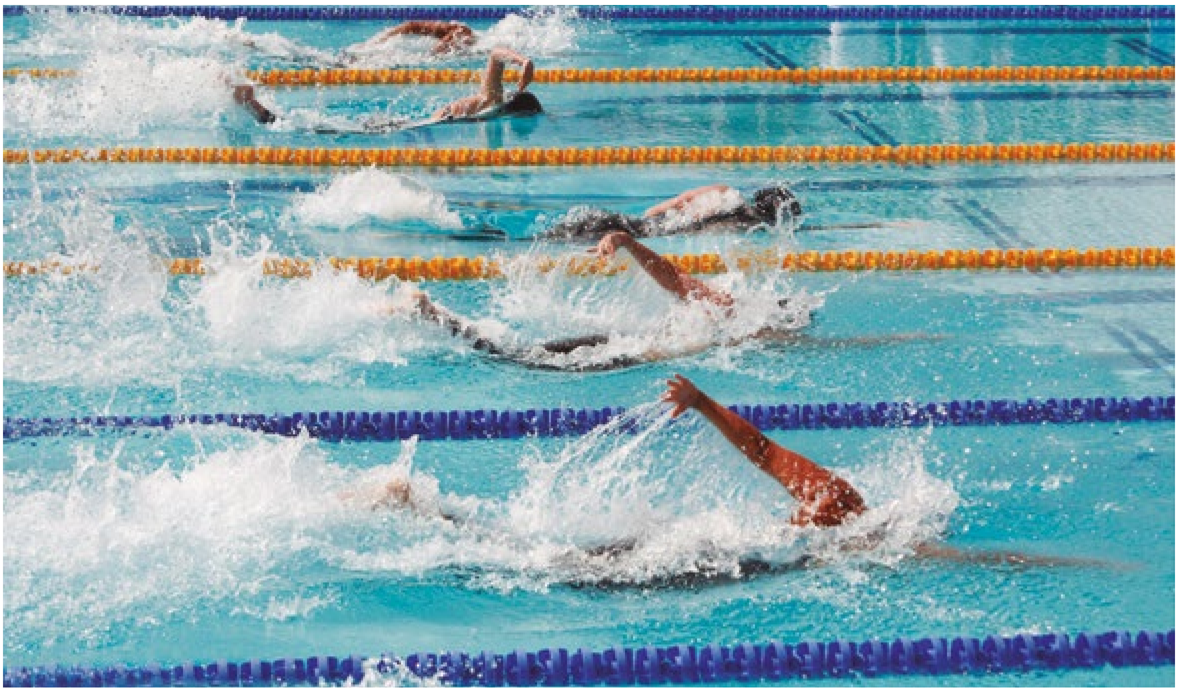
- We are manufacturers; we have the most advanced manufacturing equipment.
- We have +35 production plants. Flexible multi-technology plants in key countries.
- We have an automated logistics operator on a 55,000 m^2 facility with a capacity to dispatch +150,000 pallets per year and to pick and pack +20,000 cases daily.
- We have a direct presence in +45 countries through approximately +135 commercial delegations.



Army Training Olympic Pool. *Sharm El-Sheikh. Egypt.* 2016

_MAIN BRANDS

Our portfolio includes some of the most trusted brands in the sector and offers our customers a wide range of products in the residential and commercial pool and wellness market.



03 ABOUT FLUIDRA PROJECTS

Fluidra Projects is a multi-faceted engineering company with extensive experience in designing, developing and implementing pool facilities all around the world. It provides integral solutions for performing all phases of a project and to manage the finished facility's entire lifecycle.

WATER

Respect for the environment, saving & sustainability

CONSERVATION **HANDLING** **USE** **ENJOYMENT** **TREATMENT**

Fluidra Projects has a highly qualified and experienced team of engineers, architects, designers, BIM technicians and project managers.

Our extensive knowledge, expertise and successful olympic pool projects ensure that our execution fulfils all requirements, as well as their technical and economic feasibility.

Fluidra Projects is the right interlocutor for every single aspect of a hydraulic installation, as it solves doubts and organises every step with reliability and precision.

Fluidra Projects is the **Fluidra** Group's area for hydraulic sports projects, and the guarantee for quality and sustainable solutions.

04 FLUIDRA PROJECTS SERVICES

_PRELIMINARY CONSULTANCY

From our very first meeting, we listen to what you have to say so that we can meet your needs.

- Feasibility study & conceptual design
- Alternatives studies
- Cost estimates (installation and maintenance)
- Advice on administrative procedures
- Zoning and user circulation

_PROJECT ENGINEERING

We take in charge all the tasks that make it possible to turn your project into reality.

- Design development and construction documentation:
  - Preliminary design
  - Basic project
  - Executive project
- Innovative technical solutions
- Equipment calculation and sizing
- Space optimisation
- Energy consumption control and environmental compliance

_MANUFACTURING AND DISTRIBUTION

Respect for water and its rational use is the core philosophy of our group. Our commitment to sustainability has led us to create a specific line of sustainable products.

+35 own production plants

Most advanced manufacturing equipment

Quality certifications

Homologation for different countries

Environmentally responsible

Direct presence in +45 countries through more than +135 commercial delegations

Automated logistic own operator in a 55,000 m^2 facility. Dispatch +150,000 of pallets per year

_PROJECT MANAGEMENT AND EXECUTION

We have the human resources and tools for both onsite and remote project control. Quality assurance is always our highest priority.

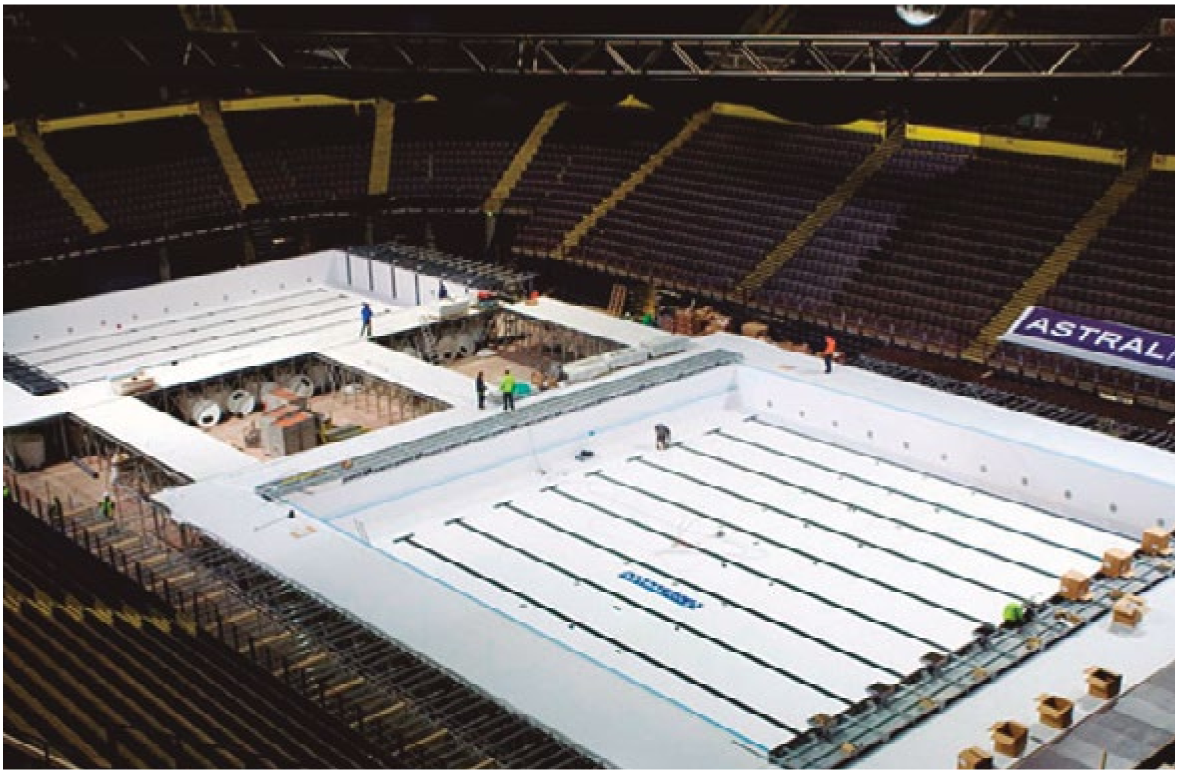
Project management

High quality standard procedures

Project scheduling and coordination

After sales support

All-in-one warranty with a single point of contact

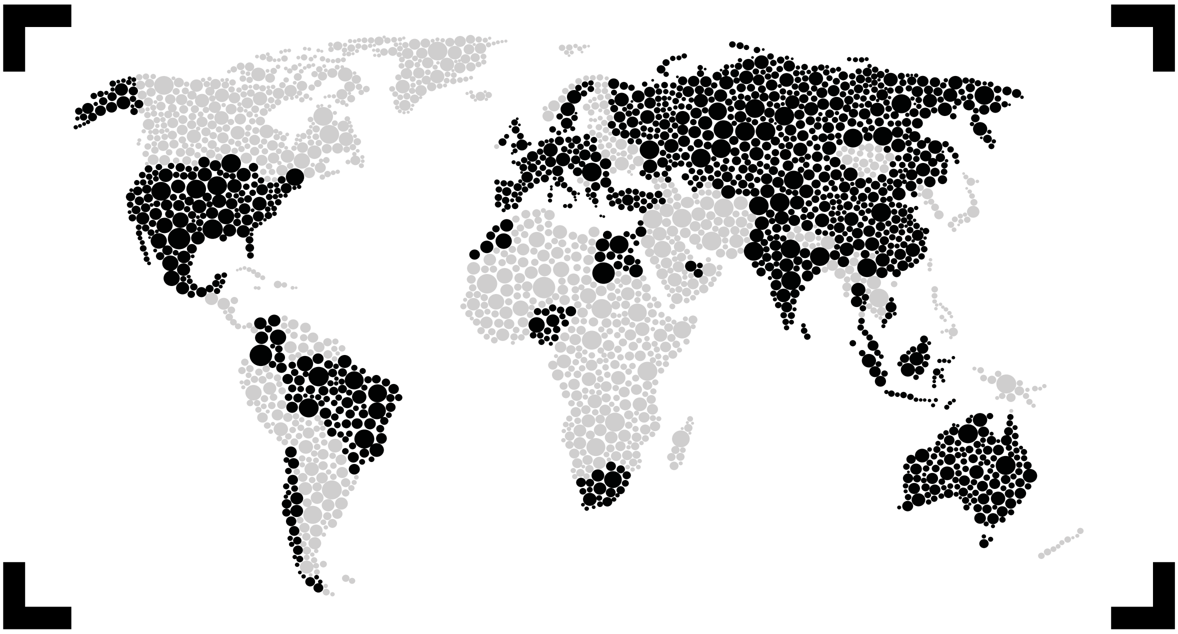


FINA World Swimming Championships. *Manchester. UK.* 2008

05 WHY CHOOSE FLUIDRA PROJECTS

_EXTENSIVE EXPERIENCE

Fluidra Projects remarkable experience is the result of many years working on different projects. Today, **Fluidra** has a consolidated leading position in aquatic centres all over the world.



_BROAD SCOPE OF SOLUTIONS

Fluidra is a vertically integrated group that can offer a matchless scope of turnkey solutions, completely adaptable to our clients' needs. Our services include preliminary consultancy, engineering and design, manufacture, supply, project execution and after sales support. All of this guarantees the perfect integration of components in a project in order to achieve the best quality.

Design

Manufacturing

International footprint

Flexibility and adaptability

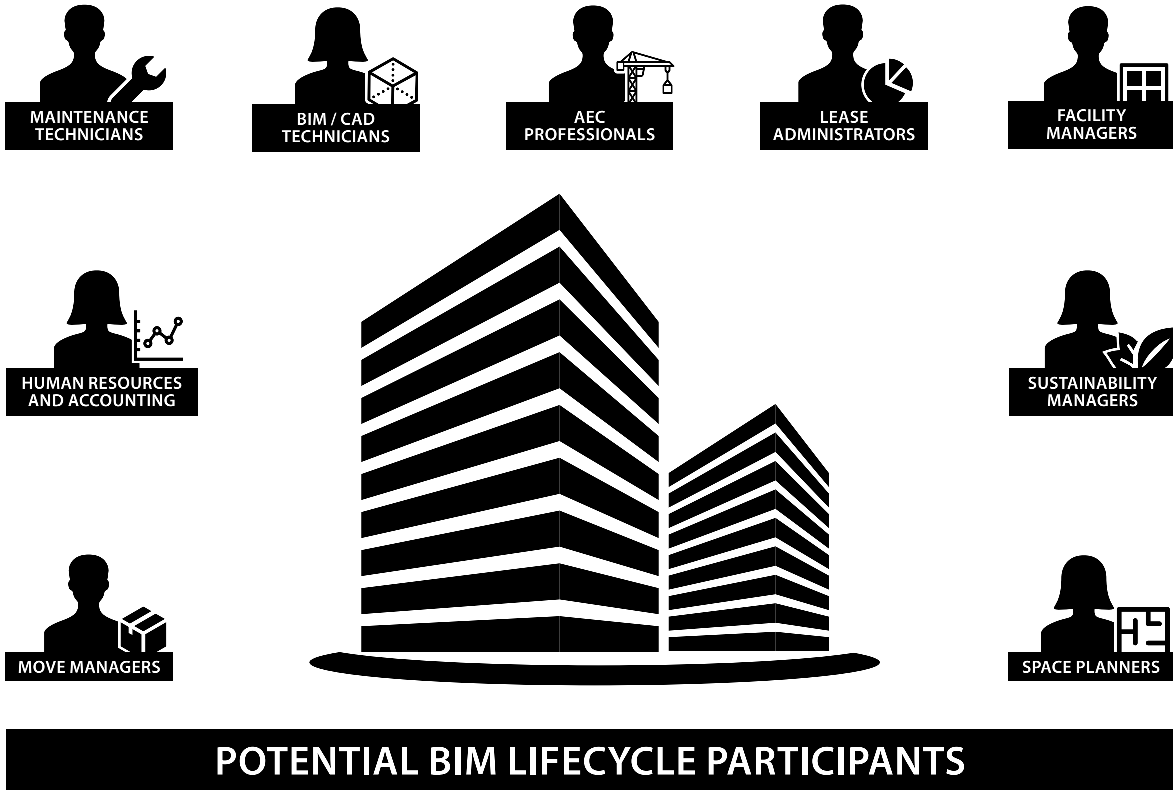
Know-how

_TRANSPARENCY

As a multinational group publicly listed in the Spanish stock market, **Fluidra**'s accounts are public and accessible. This gives proof of transparency, financial solvency and accountability, which translates as more confidence

_WORKING METHODOLOGY: BUILDING INFORMATION MODELLING

Fluidra's engineering team has designers, engineers, architects and BIM technicians who, with the latest technology available, are responsible for the conception of a project, and the creation and subsequent supervision of the 3D model of the pool and its surroundings, which are the result of the combination of the three main pillars in the construction of a facility in one single file: architecture, structure and MEP.



The quality of a BIM model depends on the level of graphic detail and the level of information, and **Fluidra**'s models score high in both. The graphic detail of the families included are close to production requirements, and the information consists of material properties, water flow, costs, energy consumption, manufacturers and more.

Our technicians and engineers can add and pin all the new elements and modifications that they make in any of the above mentioned parts to the file, hereafter called DOC, and quickly detect if there is any interference or error in any modification added to the model.

Moreover, **Fluidra** has gone one level further in the implementation of collaborative work in order to enhance communications with our own project managers supervising the execution of work onsite and with our clients.

Project managers work with tools that enable them to see the current status of the BIM model generated in the technical office, so that they can take measurements, cut sections and detect incoherencies with the construction work that is being carried out. Due to this, any problems that may arise on the work site can be perceived faster and solved in coordination with the technical office from a distance.

Finally, clients can be provided with a link from which they can visualise and navigate through a 3D version of the model and follow the latest updates in the model, so that we can make sure that the project fully adapts to what our clients need.

If needed, **Fluidra**'s technical office is also capable of coordinating the modelling with other architecture and engineering offices that are using the same methodology in order to be synchronised throughout all project phases.

Advantages over conventional design and construction methodology:

- Building information models (BIM) support investment decisions by comparing the functionality, scope and cost of the solutions.

- They make it possible to run comparative analyses of energy and environmental requirements in order to choose design solutions and set objectives for monitoring the operation of the building and its services.

- Design display and construction feasibility studies.

- Improved quality assurance and data exchange to make the design process more effective and efficient.

- Use of the building project data during construction, operation and maintenance.

The general objectives of building modelling information include the following:

- Supporting project decision-making.

- Enabling the parties to commit to the project objectives using the building information model. Designing display solutions.

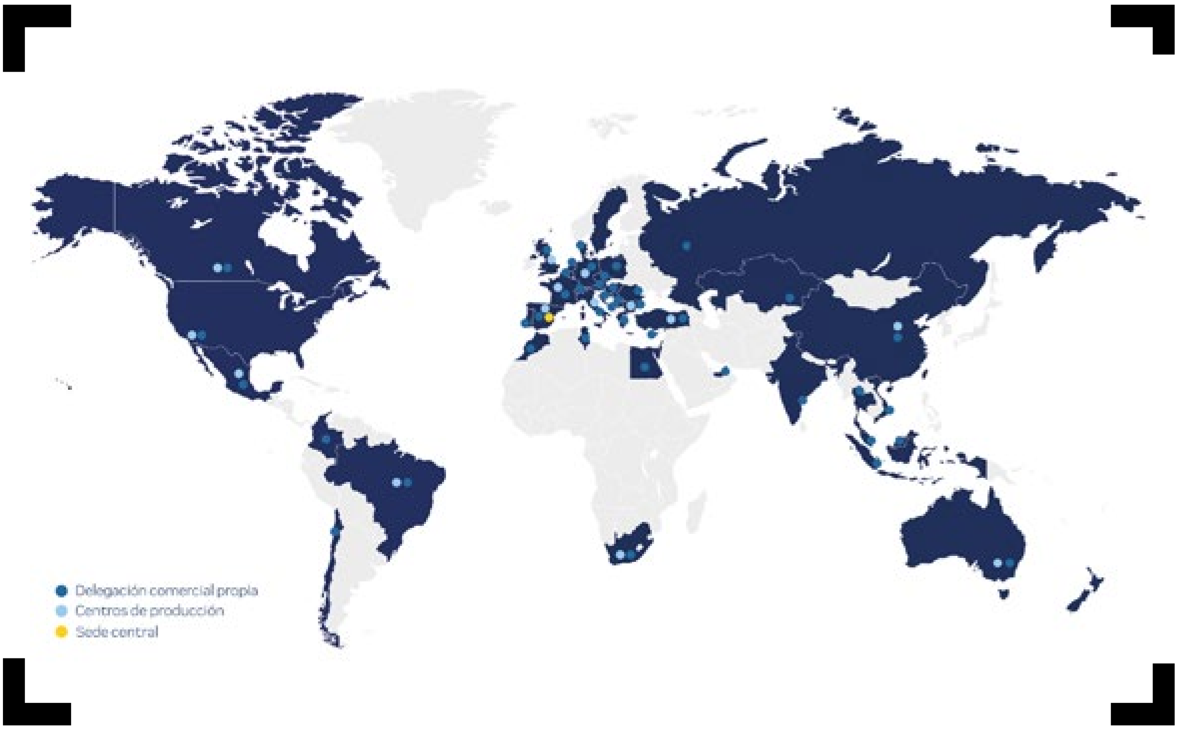
- Assisting during the design phase and coordinating different designs.

- Increasing and ensuring the quality of the construction process and the final product. Making processes more effective during the construction phase.

- Improving safety during the construction and operation phases. Facilitating project management and data transparency during operations.

_OWN MANUFACTURING COMPANIES

Fluidra's forefront position is based on working together with its own manufacturing companies. We manufacture almost all the products included in the solution, which means that we have first-hand know-how, and through which we can offer a complete guarantee for the whole solution. We are capable of offering tailor-made pool solutions for the most demanding clients.

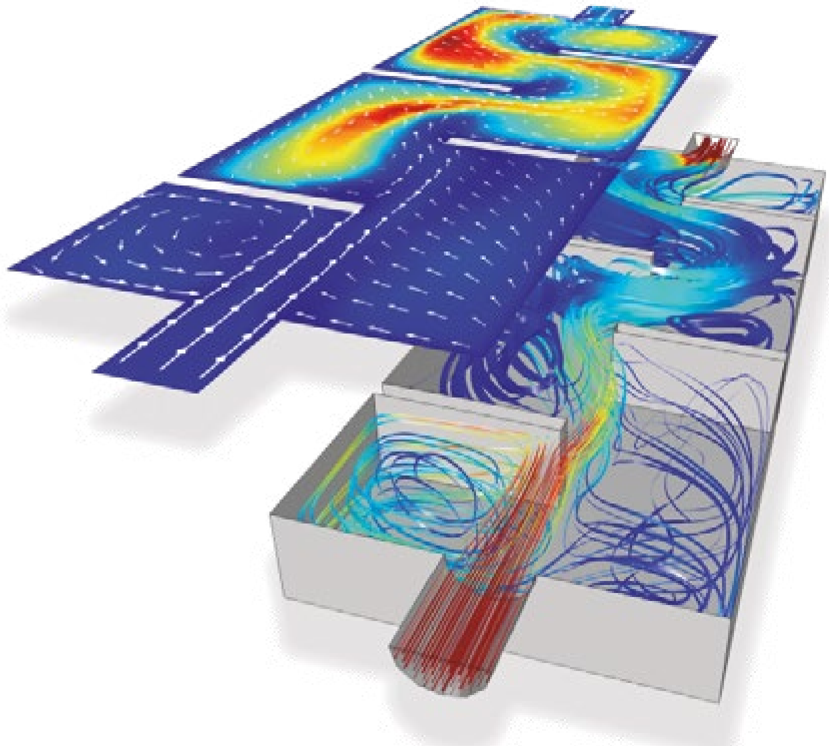


_BEST TECHNOLOGY: BIM AND CFD

The implementation of the most effective working methodology in combination with the best existing software in project design, engineering and management lead to a great deal of possibilities and a significant improvement of the services offered by **Fluidra**.

Fluidra is currently using BIM technology for designing, engineering and managing the execution of projects, and CFD technology for testing the appropriate fluid dynamics in our models.

Computational fluid dynamics (CFD) is a methodology based on numerical computational models that simulate fluids' behaviour. It makes it possible to foresee the evolution of water's physico-chemical characteristics over time by monitoring factors such as speed, temperature, turbulence and other variables.



CFD water dynamics simulation in swimming pools permits optimal distribution of disinfection products, thus avoiding areas of stagnant water.

It also allows the study of the behaviour of a water recirculation system in time and check its efficiency before its installation.

Fluidra, through its R&D department and **Fluidra Projects**, has extensive experience in simulating the behaviour of water by CFD, having simulated a variety of facilities and equipment.

_SINGLE INTERLOCUTOR

Due to **Fluidra**'s broad portfolio of products and services, working with us is easy because there is no need to coordinate with multiple third parties. At **Fluidra** we believe in the advantages of being able to coordinate tasks with a single interlocutor.

_PRODUCT QUALITY

Fluidra's products are manufactured in accordance to the strictest quality certificates. Our work methodology enables us to achieve effective outcomes of a high quality.

06 OLYMPIC POOL SOLUTION DESCRIPTION

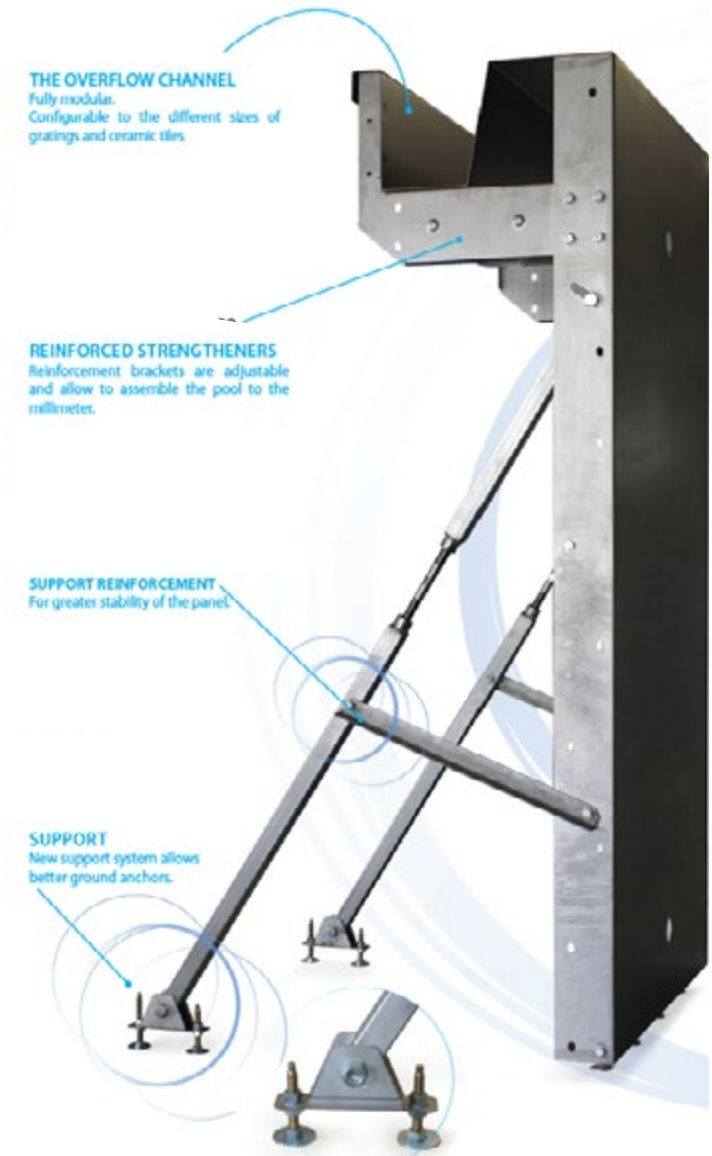
Building an Olympic pool has clear rules; rules for the basin size (50 x 25 x 2 m), determined by FINA, and for the water quality that improves athletes' performance.

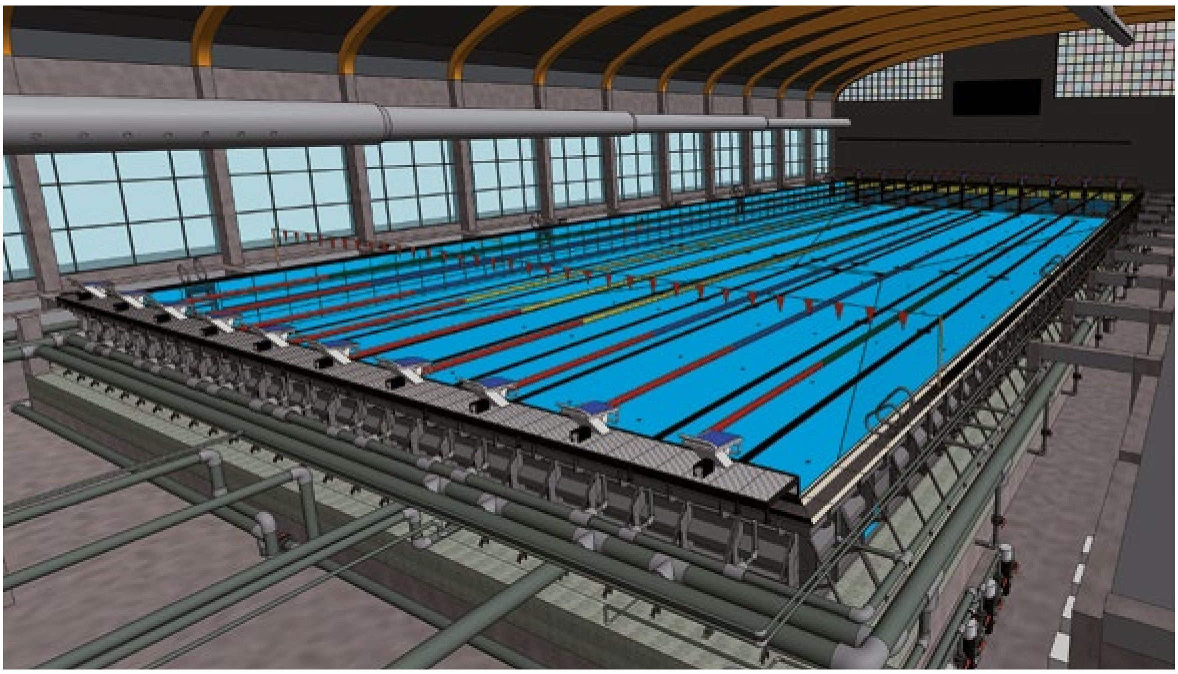
The accessories such as the lane ropes are very important too, so Fluidra takes care of every detail of each single aspect.

_POOL BASIN

The pool basin is all of the construction elements that contain the pool's water volume; it must ensure user safety, perfect waterproofing and geometric precision.

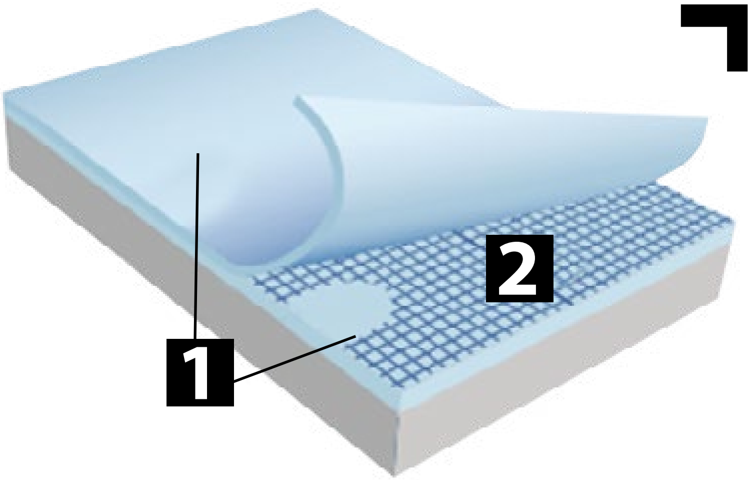
Fluidra's patented pool basin solution is called the **SkyPool system**. It consists of sections of prefabricated steel panels screwed together and fixed on a concrete slab, covered with a PVC-P membrane called a liner and finished with ceramic tiling. The hot-dip zinc bath gives the galvanised steel panels excellent protection against the corrosion. The use of fully prefabricated components and an easy system of assembly drastically reduce the assembly





Fluidra's OP Solution / Render view

The **SkyPool system** makes it possible to take on swimming pool projects adaptable to existing infrastructures (fixed or temporary), such as aquatic centres, sports stadiums and other venues. Built in short time, an in-ground or above-ground pool is a reality.



1 HIGH RESISTANCE PVC

2 GLASS FIBRE REINFORCEMENT THE POLYESTER

OLYMPIC POOL SOLUION DESCRIPTION

_FILTRATION & DISINFECTION SYSTEM

Fluidra manufactures the ideal filtration system for olympic pools.

In the recommended solution presented, bobbin-wound filters designed to cover all filtration needs in public pools are recommended. Their impressive high-tech specifications make PRAGA filters an essential cornerstone in pool filtration.

A structurally resistant filter thanks to the manufacturing process. The filters are composed of two layers: an internal polyester and fibreglass liner with equal projection, and a second one wound with a fibreglass and polyester resin layer. The liner's job is to maintain the filter's water integrity, while the second layer provides the structural resistance necessary to support the filter's internal pressure. This is achieved thanks to the layers in continuous threads of which the winding is made.

Either silex or active clear glass can be chosen as the filtration medium. Both give adequate results.

The pump also plays an important role in filtration. For this specific solution, we recommend the most efficient plastic filter pump in the market with a built-in prefilter: KIVU.

The KIVU® range has been designed to deliver top efficiency while it is working and to run almost silently.

Disinfection is an essential part of the water treatment. **Fluidra** presents a water treatment solution that has been developed to offer perfect quality in pool water and the environment, thus benefiting the health and comfort of users of a facility. It is the **FreePool system**.

freepool

UAB

CLÍNIC BARCELONA

This new treatment system, designed to eliminate the dependence on adding chemicals to the water (low-salinity saline electrolysis units, UV disinfection and controlled high-performance CO_2 injection), has made it possible to lower environmental pollutants by 400% and increase users' comfort level by more than 30%, thereby improving the health-related conditions in these installations.

A revolutionary solution for treating and disinfecting water in public pools.

A system for the treatment and disinfection of water designed by **Fluidra** together with Universitat Autònoma de Barcelona, Ctrl4 Enviro and Hospital Clínic de Barcelona to provide perfect water quality in pools, but also in the natural environment, thus ensuring the health and comfort of a facility's users.

The FreePool system disinfects the water in the pool with the most natural and sustainable technology on the market, Neolysis. It corrects the pH levels by injecting high efficiency CO_2 , whilst reducing water consumption.

HOW DOES freepool WORK?

Freepool disinfects the water thanks to the **neolysis** system and corrects the pH levels by injecting CO_2.

Freepool provides a perfect water quality and environment thanks to the technology used. Its main **characteristics** and **advantages** are:

75% **reduction**

in the concentration of **oxidants** in the environment, improving the quality of the environment and reducing the smell of chlorine.

100% **reduction**

in the addition of diluted **acids** and **chlorinated** products; it completely avoids the need to add chlorinated products (hypochlorite, chlorine tablets, etc.) and acids.

20% **reduction**

of **combined chloramines** in the water, improving the health of users and preventing skin irritations and respiratory difficulties.

66% **reduction**

in the consumption of new supplies of water, with savings in **water** and energy wherever it is installed.

TECHNOLOGY

freepool neolysis

A solution for the treatment and disinfection of swimming pool water that combines electrolysis with ultraviolet disinfection in a single reactor. This system combines the key features and benefits of these techniques and corrects its faults, drawbacks or limitations.

Besides carrying out the disinfection of the water without using chlorine, it dramatically reduces the concentration of chloramines, which are created when chlorine comes into contact with different organic nitrogen compounds (cosmetics, sweat, etc.) that bathers bring into the water.

Ultraviolet radiation is combined with the production of chlorine from salt water. This type of chlorine disinfects the water efficiently without causing strong smells or irritation to the eyes and skin.


ASTRALPOOL

_ MCS MANAGEMENT SOFTWARE

MCS Management Software is the most efficient solution for the automated management of an aquatic facility.

MSC manages pools by means of mathematical algorithms developed by **Fluidra** together with the Universidad Autónoma de Barcelona, that are able to **predict** an installation's requirements by monitoring the real number of users, set points, water quality settings, temperature, etc.

Thanks to the MSC system, a pool's settings automatically adapt to the needs of the facility at any given time: for example, if the system detects that a group of swimmers has gone into the changing rooms the disinfection process starts so that the water is properly disinfected and automatically reduces when the group leaves the pool.

The MCS system also enables the pool's manager to be fully aware of all of the facility's variables and consumption rates, as well as to see displays of forecasts of its running times.

All of the above results in greater potential savings in managing a facility, as well as making it possible to run it automatically.

Programs had been designed for the automated control of a facility that were able to start processes such as backwashing filters, or that displayed the values of a pool's physical and chemical settings. This type of application was intended for pool maintenance engineers.

Using MCS, the management of a pool will be down to the system itself, thus serving as a work tool for the facility's manager.

_ ACCESSORIES

Fluidra has a wide range of high quality competition products and equipment compliant with FINA regulations, as well as being fully compatible with SkyPool technology.

_STARTING BLOCKS

Made of polished stainless steel, the starting block designed by **Fluidra** has a detachable platform that makes it easy to put the electronic stopwatch in place. This starting block reflects **Fluidra**'s innovative spirit as it was the first one that enabled swimmers to manually change the angle of its platform.

_SYDNEY LANE ROPE

This lane rope model floats in compliance with the rules of the International Swimming Federation (FINA), and the regulations to which FR3 swimming pools for the Olympic Games or World Championships are subject.

_TIMING SYSTEM

Fluidra's has all the technical equipment required for holding swimming competitions. The rugged design and the best materials guarantee a long-lasting timing system without problems.

A fully automatic timing system is a system with which the swimmer of each lane stops the time by touching the touchpad. In addition, it is possible to connect each lane up to three manual push buttons and a relay judging sensor. There are speakers at the start position. They are used by the starter to give commands and the starting signal. This system can be extended so that even the largest event can be carried out without any problems.

_FLUIDRA'S MOVABLE BULKHEAD MAKES DIFFERENT USES FOR THE OLYMPIC POOL POSSIBLE

Fluidra has dedeloped stat-of-the-art technology for installing movable walls in pools so they they can be divided into more than one area and used for different purposes. Thus, the most can be made of the space in a pool and a variety of uses made of it at very little cost. This system can be adapted for use in existing and new-build pools. It is recommended for Olympic pools.

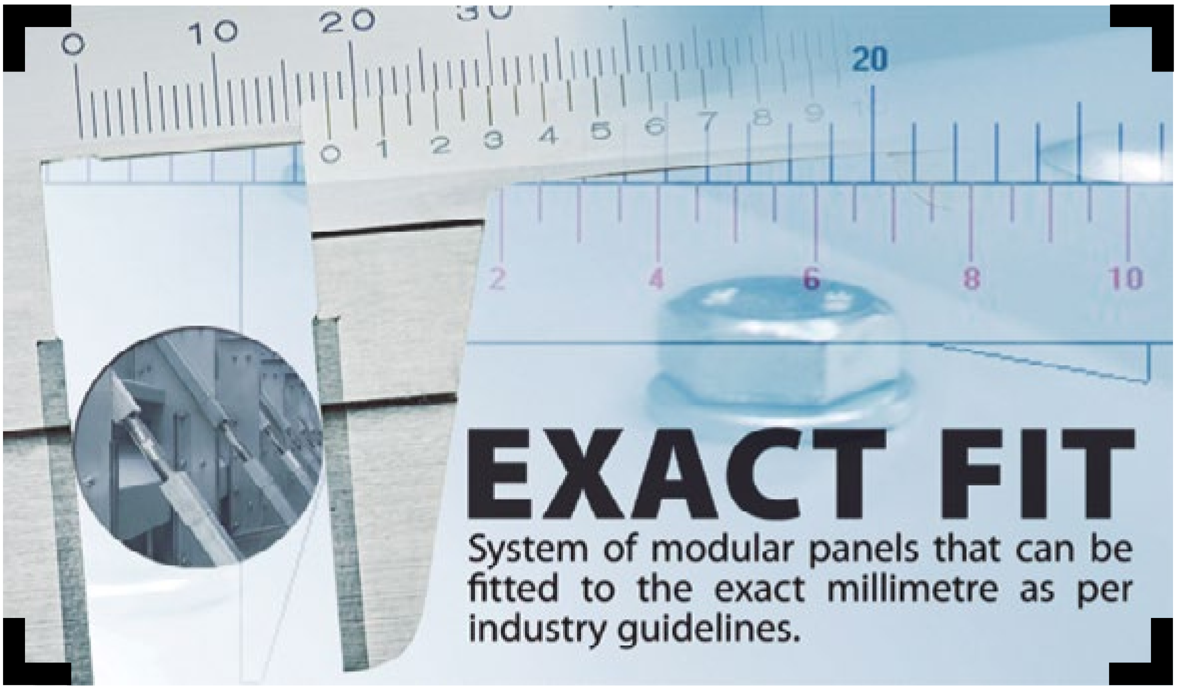
This patented movable wall system is based on the concept of modules that have a significant advantage: versatility. The partial removal of modules makes it possible to use the full length of a pool if necessary. It is made of AISI-304 stainless steel and lined with non-slip white plastic slabs.

Sports Center Rio Esgueva. *Valladolid. Spain.* 2010

Taipei

_ POOL BASIN

1_ Fluidra's Olympic SkyPool solution offers maximum precision.



2_ Fluidra's SkyPool solution makes Olympic pools readily available. All piping and panels comply with regulations.

3. Fluidra's Olympic SkyPool solution offers maximum flexibility: it can adapt to any size or pool's shape.

4. Fluidra's Olympic SkyPool solution is based on a lightweight structure that is easy and quick to install.

- It does not require heavy machinery during construction.
- It requires less construction time than concrete swimming pools: more than 2 months can be saved on each pool.

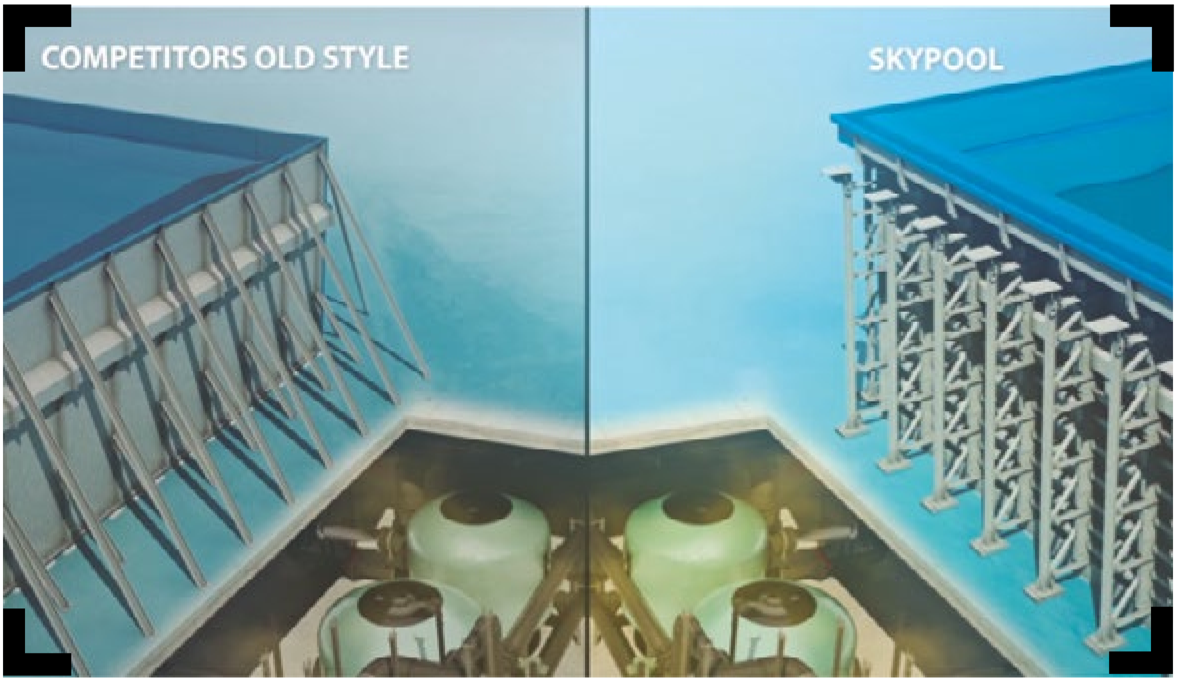
5. The SkyPool system has excellent anti-seismic behaviour.

A system of maximum stability, thanks to [. . .] reinforced prefabricated concrete slabs.

6. Fluidra's SkyPool solution does not require the use of sealants between panels and the water-proofing comes from PVC liner's continuity.

7. Fluidra's SkyPool solution is the most efficient panel system for pool maintenance: it does not require joint repairs during the pool's life cycle.

8. Fluidras SkyPool solution has a separate structural and waterproofing system. This avoids leaks when structural movements occur (seismicity).



ADVANTAGES OF FLUIDRA'S SOLUTION

_ FILTRATION & DISINFECTION SYSTEM

Designed to provide perfect water quality whilst also taking care of the health of users, **FreePool** provides the following benefits:

SAVINGS

The environment

- Savings in water consumption.
- Savings in energy consumption.
- Reduction of periodic water renewals by 66%.
- Disappearance of chloramines.
- Increased durability of the components and filters in pools.

SAFETY

- Thanks to **FreePool**'s automated control, handling errors are avoided and the safety of facilities is increased.

HEALTH

- Improves the comfort and wellbeing of users
- Avoids skin irritation.
- Diminishes ocular, nasal and respiratory (asthma) problems.
- Decreases inflammatory responses in the airways.
- Provides a clean environment without a strong smell of chlorine.

Fluidra's filtration solution's technology also:

- Has low installation costs.
- Is proven to be the most effective system in the market.
- Has the most reliable disinfection system.
- Is energy efficiency thanks to KIVU pumps.

Virgin Active Pool. *Indonesia*

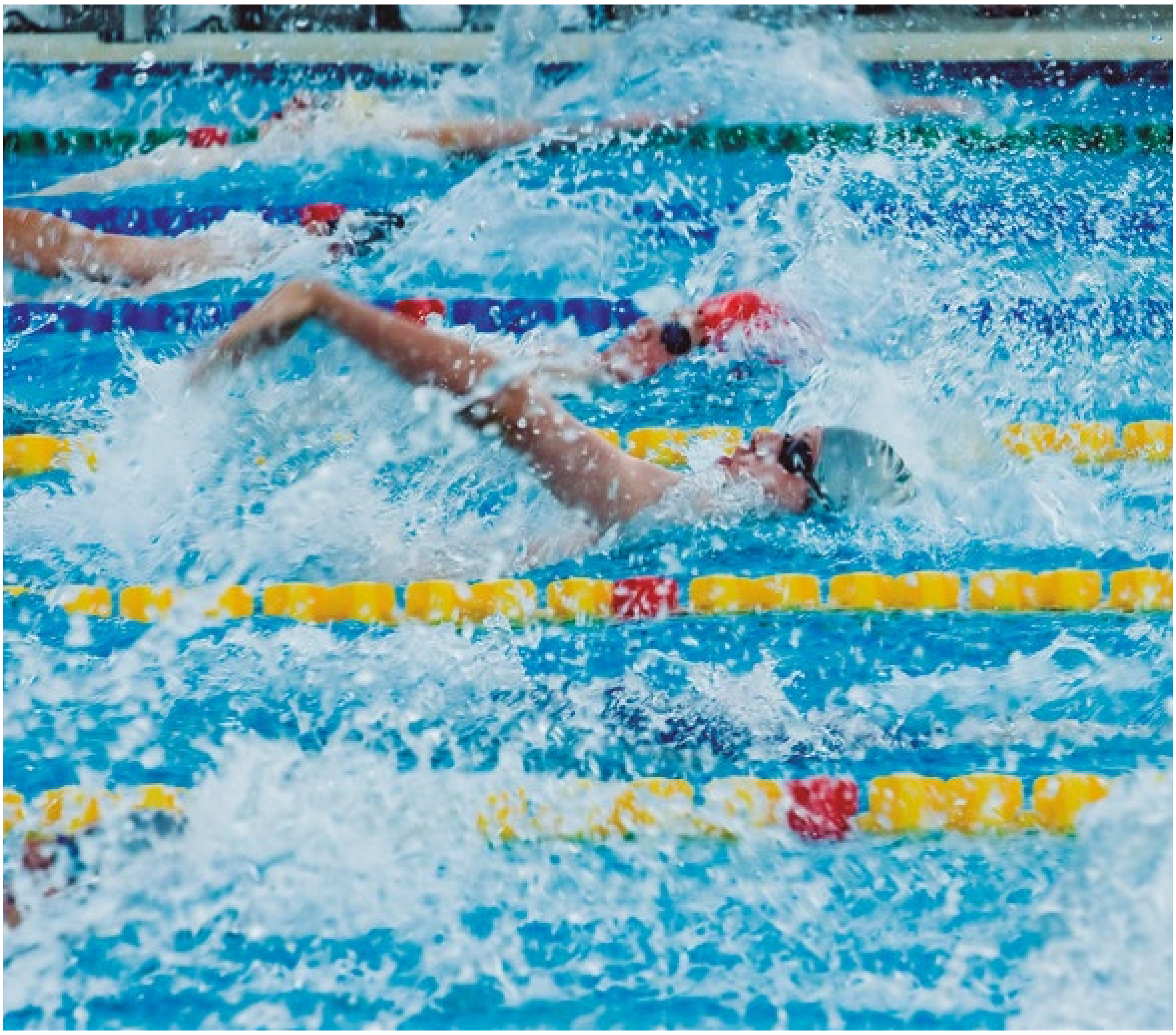
_ ACCESSORIES

All **Fluidra**'s Olympic pool accessories meet FINA rules.

Fluidra's Olympic pool accessories are own products.

All Olympic pool accessories are high-tech and comply with the most demanding quality standards.

Fluidra's OP Solution / Render view

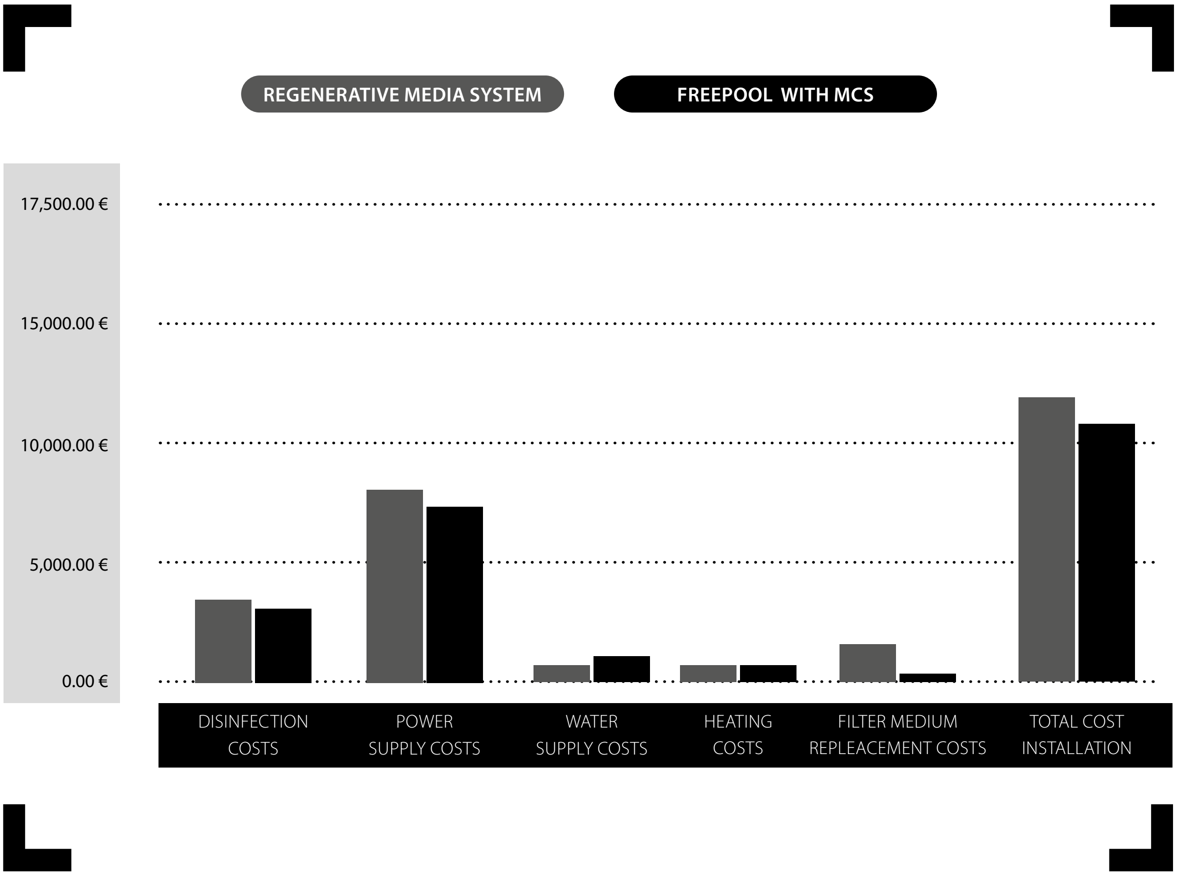


08 ENERGY EFFICIENCY

Fluidra takes care of the environment and each product developed is designed and produced subject to sustainable criteria.

FreePool technology combined with our MSC software is the healthiest way to treat water (see the UAB and Hospital Clínic studies) and also the most energy saving solution available.

The graph below illustrates FreePool operating costs compared to a regenerative medium filtration system. The FreePool solution combined with MCS is 19% more efficient in terms of energy cost than a regenerative medium filtration system. (Semi-Olympic pool).



Fluidra's OP Solution / Render view

COMPETITION POOL

09 MAJOR SPORTS EVENTS

FLUIDRA at major sports events

Fluidra is a significant player in the world of Major Sports Events. It has been involved in the design, planning and execution of several International Swimming Championship facilities that have hosted past FINA events, such as Barcelona 2003, Shanghai 2006, Melbourne 2007 and Manchester 2008. Currently, **Fluidra** sponsors numerous swimming competitions and teams internationally.

The swimming disciplines are closely linked to the FINA name (Fédération Internationale de Natation) and all na¬tional Swimming Federations, who, with others, are responsible for organising swimming championships, and whose duty it is to guarantee proper functioning of their events by giving advice and ensuring compliance with a framework of basic rules.

In this regard, the FINA facility rules document is a framework that sets forth the requirements concerning swimming competition venues.

Therefore, **Fluidra** has extensive experience in designing and executing certified olympic pools according to the FINA Facility Rules.

What are FINA facility rules?

FINA Facility Rules are a series of guidelines regarding pool requirements for installations that are intended to provide the best possible environment for competitive use and training.

FINA Facility Rules describe the standards that must be achieved – mainly in terms of pool and equipment measurements and colours– for Olympic swimming pools, as well as all other aquatic sports: water polo, diving and synchronised swimming.

FINA Facility Rules do not stipulate which materials an Olympic pool must be made of, nor the products or manufacturers that must be involved in the installation.

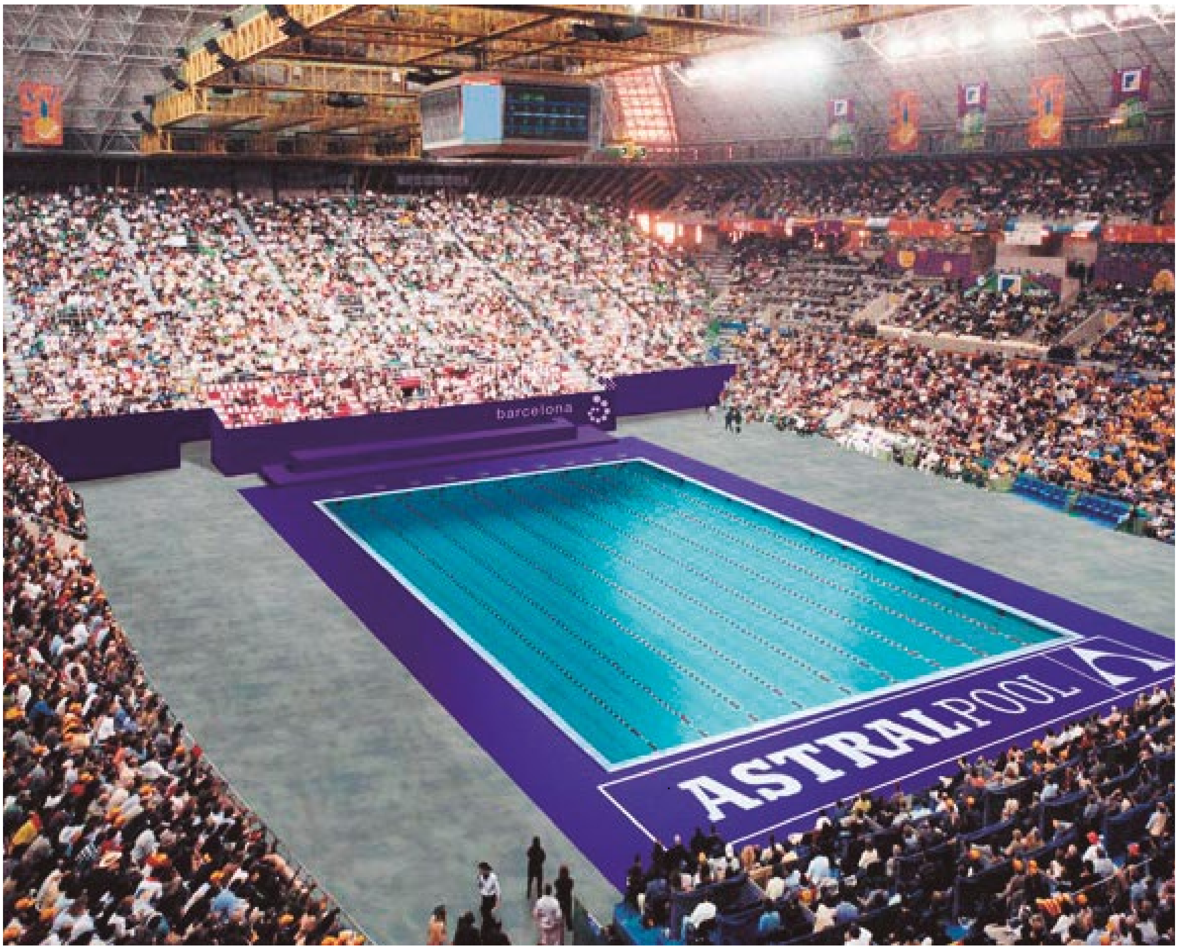
Olympic pool FINA RULES certification makes a pool suitable for staging Olympic competitions as well as World Swimming Championships.

Olympic pools certification procedure according to FINA rules

Once the design and construction process of an Olympic pool has been completed, the certification process starts. This process entails a qualified land surveyor certifying that the pool is the required size, following which a technician from the Federation in the corresponding country will visit the facilities and check the quality and functionality -following FINA facility rules- before issuing a certificate.

This certificate is submitted to the FINA facilities committee -whose power and duty it is to advise on aquatic venue (swimming pools) designs in accordance with the FINA facilities fules-, which then endorses it.

FINA WORLD SWIMMING CHAMPIONSHIPS, BARCELONA-SPAIN, 2003

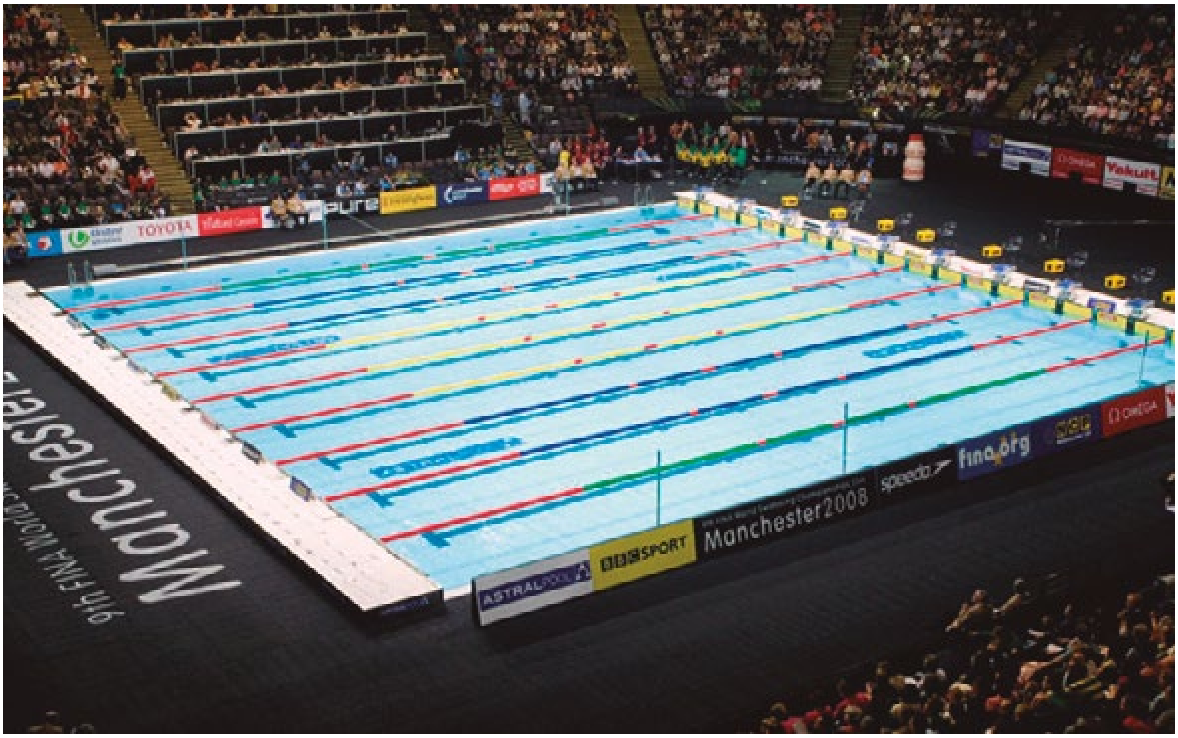


FINA WORLD SWIMMING CHAMPIONSHIPS, SHANGHAI-CHINA, 2006

MAJOR SPORTS EVENTS

FINA WORLD SWIMMING CHAMPIONSHIPS, MELBOURNE-AUSTRALIA, 2007

FINA WORLD SWIMMING CHAMPIONSHIPS, MANCHESTER-UNITED KINGDOM, 2008



10 DESCRIPTION OF EQUIPMENT

10.A_ FILTRATION EQUIPMENT

6 UNITS. BOBBIN WOUND PRAGA FILTERS

Ø 2000 M, OUTLET 140 MM. CODE: 00706

The Praga filter made of with fibreglass and polyester resin. It is totally anticorrosive. Lid of Ø 400 mm.

Fitted with collector arms and diffuser made of un plasticised PVC and polupropylene. Resistant to salted water.

It contains larger and more resistant ABS collector arms. Filter bed height 1m. Maximum temperature: 50ºC. Maximum working pressure of either 2.5 or 4 kg/cm^2.

6 UNITS. MANUAL MANIFOLDS - 5 VALVES

Ø140 MM [3 LEFT. 3 RIGHT]. CODE: 00789

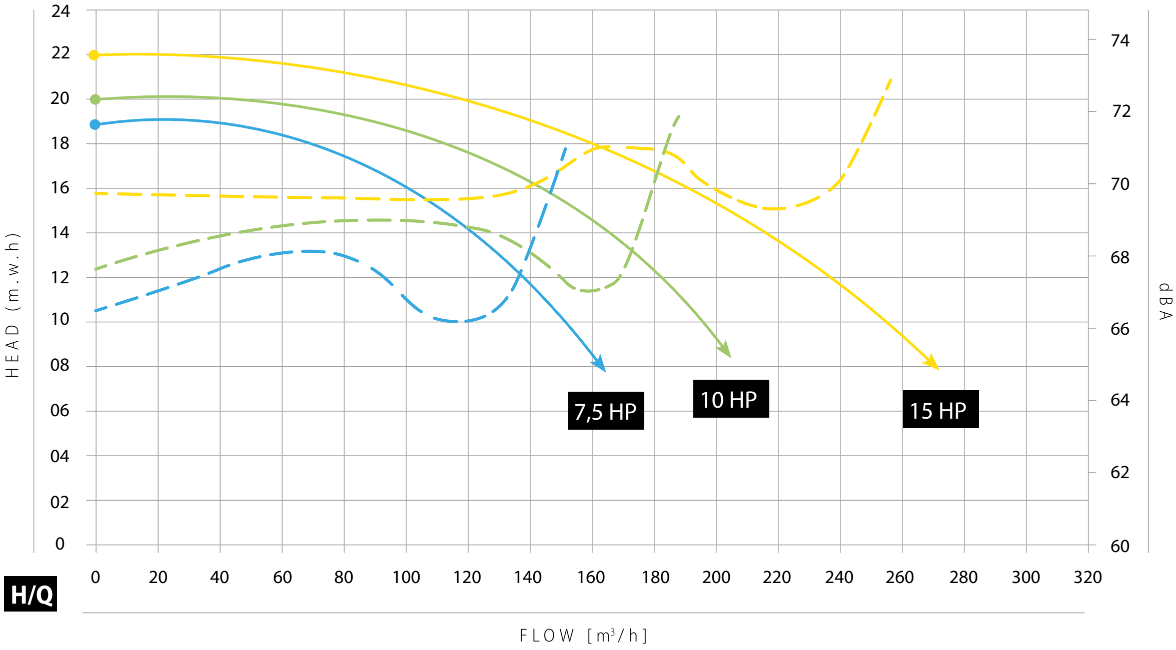
Manual valve manifolds made of PVC (PN 10) with flanges for connection to filters as per DIN-2501standard. Butterfly valves or ball valves in PVC. The type of filter and diameter must be indicated, with the required code of the valve manifold.

5 UNITS. CENTRIFUGAL "KIVU" PUMPS WITH PREFILTER

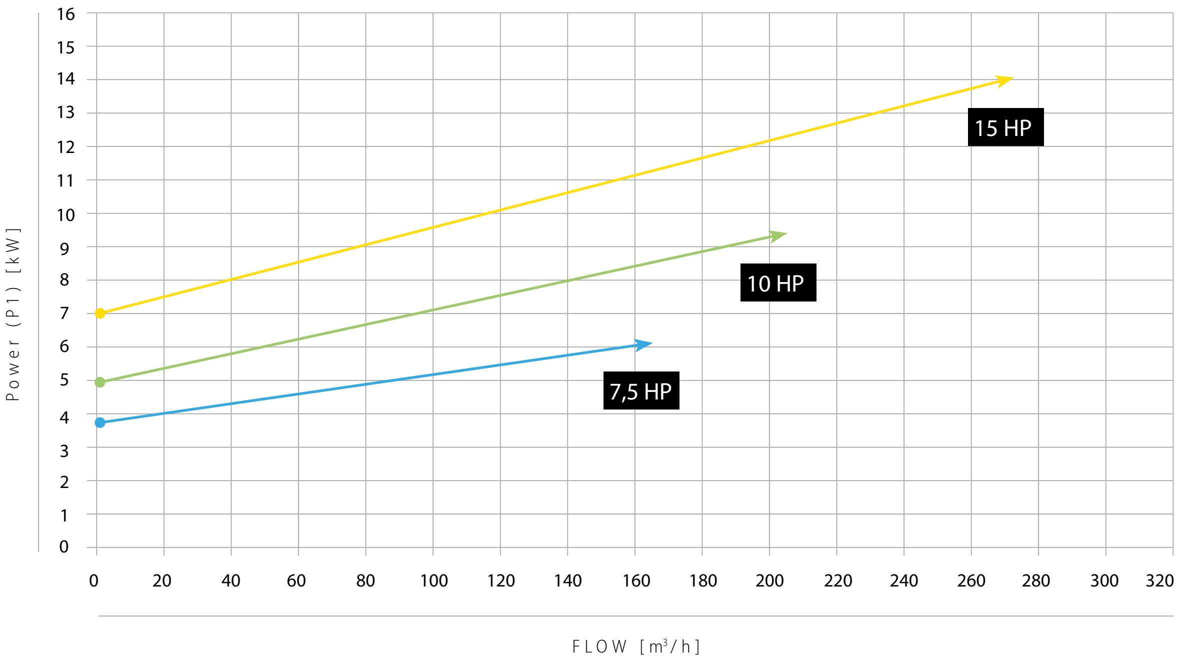
THREE 7.5 KW AND TWO 5.5 KW. CODE: 56674

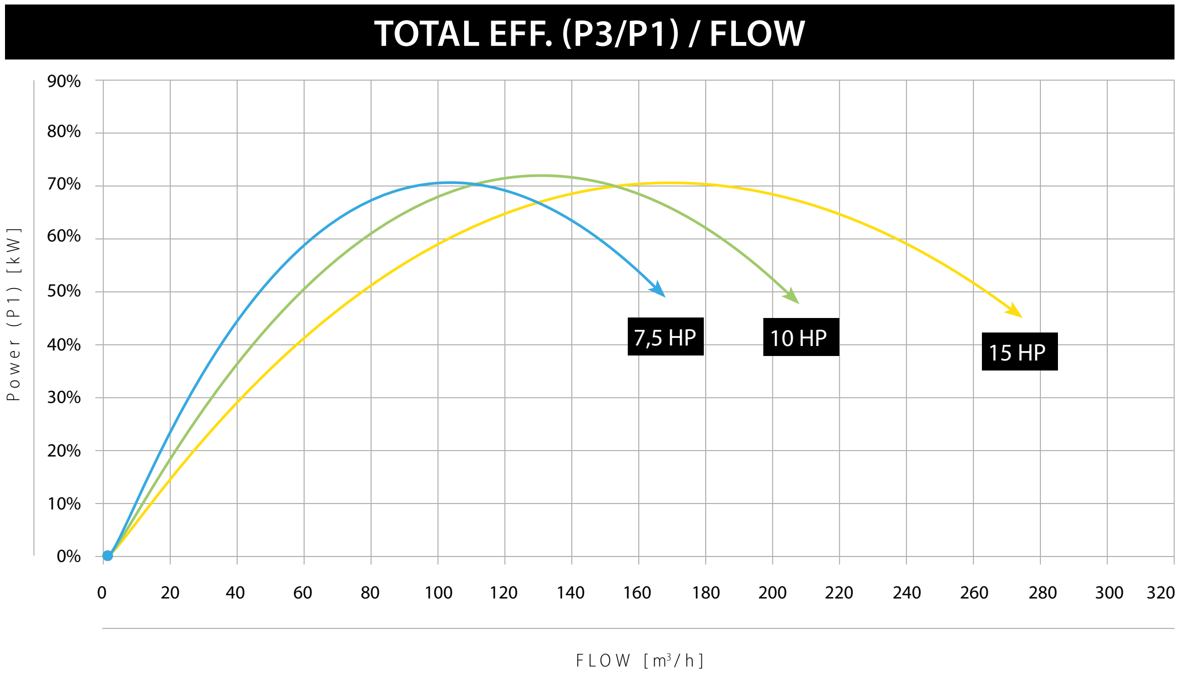
The KIVU plastic pump for large flows (up to 280 m3/h) has been designed to achieve maximum working efficiency with the lowest level of noise. High hydraulic efficiency (up to 85%). Low noise (up to 66 dBa). High efficiency motors: IE2 and NEMA premium efficiency.

HEAD PREASSURE / FLOW



P1/ FLOW





6 UNITS.
FLOCCULANT DOSING SYSTEM CODE: 54528

Automatic flocculant dosing equipment with adjustable water flow for swimming pools. Includes: adjustable pump from 151 cm^3/h to 1.5 l/h, injector valve, bottom filter, suction and return tube.

1 UNIT. POLYETHYLENE CYLINDRICAL TANK 1000 L CODE: 28831

For dispenser pumps.

8 UNITS. NEOLYSIS ZERO SALT X UV 120 G/H CODE: 57762

The combination of UV technology with salt chlorination in a single reactor has become a solution for the treatment and disinfection of the pool water (residential and commercial). Neolysis system is able to combine the characteristics and the most notable advantages of each technology, as well as correcting their failures, problems and limitations. Individually, both UV technology and salt chlorination are well known in the market; however, Neolysis obtains the incredible results of the combination of these technologies in a single reactor.

The main characteristics and advantages are:

- No need to add salt to the pool vessel
- Highly effective double disinfection (UVC + Chlorine / Anode Oxidation)
- Increased chloramine removal capacity (UVC + Cathodic Reduction)
- Increased chloramine sustainability thanks to water and energy savings.

No more filter backwashing for reducing chloramines (<0.6 ppms)

- Highly efficient synergic treatment thanks to oxidative ability with residual effect
- Completely avoids the use/addition of chlorinated products (hypochlorite, chlorine in tablets, etc.)

1 UNIT. DOSAGE TANK APQ 1500 L

- APQ dosage tank to hold chemicals (Cl- or PH) for dosing pumps
- Has closed retention system
- High density polyethylene liner (metallocene)
- Black
- Constructed by rotational molding
- Has a lilfetime of 10 yeras
- Its design standard is Schoeller Allibert B (IN-262) based on EN 13575-2002

2 UNITS. OPTIMA CONSTANT DOSING PUMP CODE: 57135

The analogue dosing pump in the Optima series requires a power supply. The flow rate can be set as percentage using the potentiometer under the front panel, which modifies the pump's operational frequency.

The dosing pumps are equipped with a level sensor input which indicates when the chemical product runs out and which can be easily accessed for quick connection and easy installation.

Double control scale: Optima analogue dosing pumps can divide the maximum dosing frequency by 5. This double scale allows the user to employ two pumps with a single model. The selector under the front panel provides easy changeover.

1 UNIT. GVG INJECTOR-CO_2

The GVG-injector is a CO_2 compact dosing system.

Equipped with an automatic self-management system and one consumption management program.

Connected to Ethernet , it has an alarm for controlling the whole system, is able to control CO_2 dosing, gives a monthly consumption report and has an automatic gas supply.

DESCRIPTION OF EQUIPMENT

90 UNITS. LINER FLOOR INLET BCN03
CODE: 43588

- Adjustable liner floor inlet. For glueing into PN6 and PN10 pipes
- In white ABS with self tapping screws
- Has screws or metal inserts according to the type of model
- With flange in plastic or stainless steel
- Maximum flow of 10 m^3/h

90 UNIT. WALL CONDUIT Ø90 MM
CODE: 43590

- Inlet / suction nozzle: 41519
- PVC plastic wall conduit.
- Cutting area of 120 mm to adjust it to the wall or to the floor of the pool
- Ø63 or Ø75 mm connection as preferences.
- Wall conduit for nozzles: Net, N'Clean: 43584, 43585 and BCN03: 43586, 43587, 43588, 43589

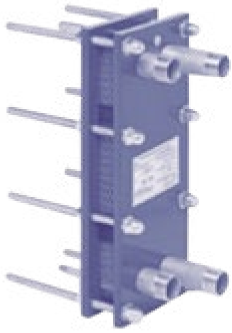
95 UNITS. SUCTION NOZZLE FOR OVERFLOW WITH LINER CODE: 41519

- Suction nozzle for overflow with liner
- PVC body, PA flange and Stainless Steel screw
- Suction flow rate 7m^3/h for a maximum water flow velocity of 0.5 m/s according
- to EN 13451-1 standard
- Ø75 or Ø90 pipe connection
- Double gasket

3 UNITS. MAIN DRAIN IN POLYESTER AND FIBREGLASS 515 X 515 MM. PLASTIC GRILLE
CODE: 20079

- Gel coat finish. With gaskets, flange, and screws
- Slots < 8 mm.
- With optional hydrostatic valve
- ABS UV protected grille

3 UNITS. ETNA PLATE EXCHANGER SERIES



Equipment available in three options: basic model, equipped model (with three-way valves and control) and model equipped with recirculating pump. Available power from 15000 to 580500 kcal/h. Corrugated plates in AISI 316 or titanium. In equipped exchangers, complete control with control of the purifying pump.

1 UNIT. SMART CONTROL CODE: 60361

Equipment control and regulation of chemical dosage to residential and public pools. Featuring a stylish and practical enclosure that houses the electronics and multiparameter sensor pocket camera.

Swing door for easy access to the probes for maintenance and inspection service.

Color touch screen with intuitive navigation menus.

Permits from regulatory control settings and professionals to very advanced version control conditions and more stringent state information.

1 UNIT. RECIRCULATION PUMP ALPHA2

Alpha2 uses proven technology from previous models and has been fine-tuned from the outside in to offer supreme reliability in a high-efficiency circulator pump.

Cataphoresis surface treatment of the pumps housing is standard with the new Alpha2. This provides the ultimate corrosion-resistance and makes Alpha2 fit for real cold water applications.

The ceramic shaft and bearings in the Alpha2 minimize friction and are guaranteed to increase the pump's service life.

4 UNITS. WOLTMAN TYPE TUBRINE METER (3-8” , 1-2.5”)

Woltman type axial turbine water meter, with numerical counter readout, and numbered drums. Dry dial with magnetic transmission. Easily removable gearwork and turbine. Pre-set for pulse emission. IP68 protection level. CYBLE type pulse emission.

10.B_ DISINFECTION EQUIPMENT

1 UNIT. VICTORIA PLUS PUMP CODE: 38780

Robust design with new generation easy to handle lid-locking nut. Low noise levels due to rubber paddings. IP-55 motor protection. Large capacity strainer basket. Flow rates given at 8 m head for 1/2 HP, and 10 head from 3/4 HP onwards. 3,000 rpm.

The Astral Victoria Plus has come up to the fusion of Astral Victoria and Sprint pump series. All their parts have been merged between the Sprint and Victoria series. New Prefilter cover: Victoria Plus has a new prefilter cover fully compatible with the Victorias and Sprints prefilter cover.

The new design of this prefilter cover unifies the image of the Columbia, the Sena and Victoria Plus series. Pump base: The pump base has been merged between the Sprint and Victoria series, focused on a motor size criterion: The pump base for frames 63 & 71, related to power rates till 1 HP, comes from the Sprint series. The pump base for frames 80 & 90, related to power rates till 3 HP,comes from the Victoria series. This merge has been introduced with the aim of providing better pump and motor support when it is required, just introducing a small base when dealing with small motor frames and a largest base for the biggest motor frames. . According the Energy Efficiency regulation class IE2.

1 UNIT. WATER LEVEL SENSORS CONTROL PANEL

3 water sensors control panel:

*SENSOR 3_*

Minimum safety level for pump operation:
The pump stops functioning if water level doesn't reach the minimum set level.

*SENSOR 2_*

Water make up level:
Gives the electro driven signal opening signal to maintain correct water level in the pool. Electro driven valve signal in 220 V II & 24 V II.

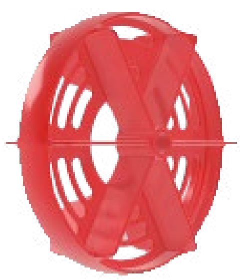
*SENSOR 1_*

Pump start level:
The pump starts operation when water level in balance tank reaches the overflow level (pipe burst or check valve failure).

10.C_POOL ACCESSORIES AND COMPETITION EQUIPMENT

4 UNITS. BLUE, 2 GREEN, 3 YELLOW: SYDNEY MODEL LANE ROPES CODE: 54479

- 50 meter lane rope (Ø 148 mm)
- Floats in accordance with the rules of the International Swimming Federation (FINA), and the FR 3 swimming pool regulations for Olympic Games or World Championships
- Lane ropes are supplied with floats, stainless steel cord of 6 mm and hook



10 U. UNDER DECK FLOAT LINE STORAGE SYSTEMS RCODE: 15842

Made of AISI-316, allows the storage of the float lines beneath the deck. The float line box is embedded in the pool surround and holds the retractable reel that the float line passes over.

10 UNITS. LANE ROPE STORAGE BASKET CODE: 28623

Trolley designed to transport and store the SYDNEY MODEL FLOAT LINE after use in the swimming pool.

The float line roller is manufactured using AISI-316 stainless steel and includes a PVC bag for collecting excess water from the float lines. Due to the bag's lower outlets, it is emptied in a controlled manner with no water spillage. The trolley has four rotating wheels for maximum mobility. Two of these have a brake. It can store a float line up to 50 m long (or 2 of 25 m) and can be used for all float line models.

1 UNIT. BACKSTROKE TURN INDICATORS CODES: 19953 / 19955L25

Comprises 4 posts in S.S. AISI-316. 1.8 m. Anchoring sockets not included. Two polyester Ø 7 mm cords. Bunting included.

4 UNITS. 2000MM, 16-2500 MM, 2-LEFT AND 2-RIGHT: PLATFORM FOR PODIUMS

REF: 34214 / 34215 / 34216

AstralPool has created a headwall that allows starting blocks to be attached to it. This addition extends our range of products for competitions. The item consists of an AISI-304 stainless steel structure and plastic grating. The platform can also be used as a turning panel and includes anchors for float lines.

4 UNITS. ANCHORING SOCKETS (LANE ROPE ANCHORS) REF: 19960

Anchoring sockets code 19960 and 19961 for Ø 48 mm pipe. These sockets are used in pool width up to 21.00 m. Made of AISI-316 stainless steel.

20 UNITS. STARTING BLOCKS REF: 53875

The starting block, developed and patented by AstralPool introduces two innovations:

- Allows the swimmer to adjust the angle of the platform by hand. They can choose the most suitable angle from those available (0º, 3º, 6º and 10º). *The regulations of the International Swimming Federation (FINA) (FR2.7) allow an angle of between 0 and 10º on the starting platform. So far, all the starting blocks on the market have consisted of a fixed unajustable platform.

- Adjustable side handles. The swimmer can change their position easily, leaving them up or down as they see fit. An ECO version is also available without adjustable side handles and fix platform to 6º.

The starting block is made of AISI-316 stainless steel. The standard starting platform can be dismantled to enable assembly of the Omega electronic timing system. It can also be adapted to other timing systems to order. The platform is 550 mm long x 500 mm wide, with a polished finish, and is 437 mm high. Ideal for installation in a swimming pool with side walls. Anchoring for installation in concrete is also included.

OVERFLOW GRATINGS

Made in PP (polypropylene) stabilised against UV rays. Standard white colour. The longitudinal design of the tiles ensures that any excess water from the pool is not allowed to overflow onto the pool surround to keep this area dry.

WATERPOLO POOL COMPETITION ACCESSORIES

2 UNITS. WATER POLO GOAL

A free-floating model with reliable frame construction made of aluminum profiles, powder-painted in white and with a floating white support. The width of the support ensures the goal post stay afloat.

The goal post can be used for competitions and training, are of high quality and are easy to handle.

Main features:

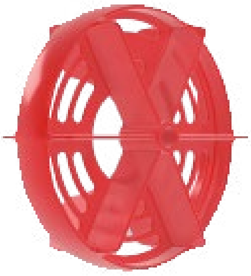
- It easy to assemble
- It is foldable for ease of storage and transport
- The water level position can be adjusted
- Comes with castors for ease of transport and handling
- Dimensions: Width 3 m / Height: 90 cm / Depth: 158,6 cm
- Measurements of frame: 75 x 40 mm. Nets included

1 UNIT. WATERPOLO BALL

FINA approved. Official Water Polo Ball for all FINA international competitions. A new colour combination yellow, blue and pink makes the ball more visible to the audience. The ball is made of materials tried and tested by polo players around the world for many years top quality rubber cover with professionally a buffed surface for a good grip. Nylon wound with double laminated butyl bladder.

LANE ROPES

3 UNITS. LANE ROPE SYDNEY



- Lane rope Ø 148 mm
- Floats in accordance with the rules of the International Swimming Federation (FINA), and the FR 3 swimming pool regulations for Olympic Games or World Championships regulations
- Lane ropes are supplied with floats, stainless steel cord of 6 mm and hook

1 BALL RELEASE SYSTEM

The ball release is used for the start of play of water polo matches. Retained on the half distance line, the ball is put into play when the ball release is submerged by pulling the rope from the side of the pool, allowing for fair and accurate starts every time. Manufactured from EVA foam, high density plastic and stainless steel, it is designed to hold both men and women's water polo balls. In order to use this release system, two eyebolts need to be installed at the bottom of the pool.

4 UNITS. HEADWALL FOR PODIUMS LANE 2000 MM WIDTH REF: 34213

This a headwall that allows starting blocks to be attached. This addition extends our range of products for competitions. The item consists of an AISI-304 stainless steel structure and plastic grating. The platform can also be used as a turning panel and includes anchors for float lines.

16 UNITS. HEADWALL FOR PODIUMS LANE 2500 MM WIDTH REF: 34214

2 UNITS. HEADWALL LEFT CORNER REF: 34215

2 UNITS. HEADWALL RIGHT CORNER REF: 34216

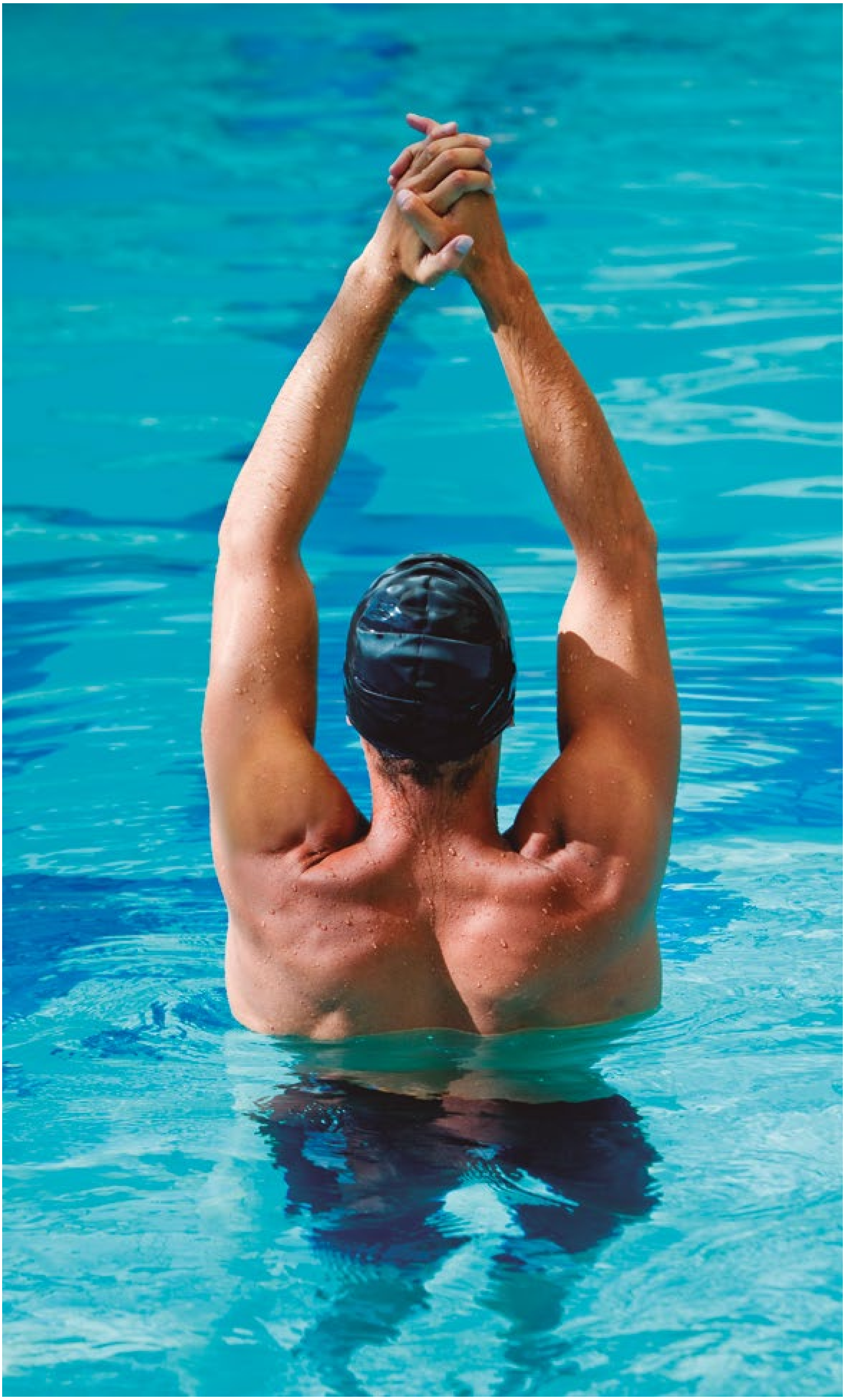
6 UNITS. UNDERDECK LANE ROPE STORAGE SYSTEM REF: 15842

4 UNITS. 2 DOUBLE LANE ROPES, 250 M LANE ROPES. LANE ROPE STORAGE BASKET

Trolley designed to transport and store the ***Sydney Model float line*** after use in the swimming pool.

The float line roller is manufactured using AISI-316 stainless steel and includes a PVC bag for collecting excess water from the float lines. Due to the bag's lower outlets, it is emptied in a controlled manner with no water spillage.

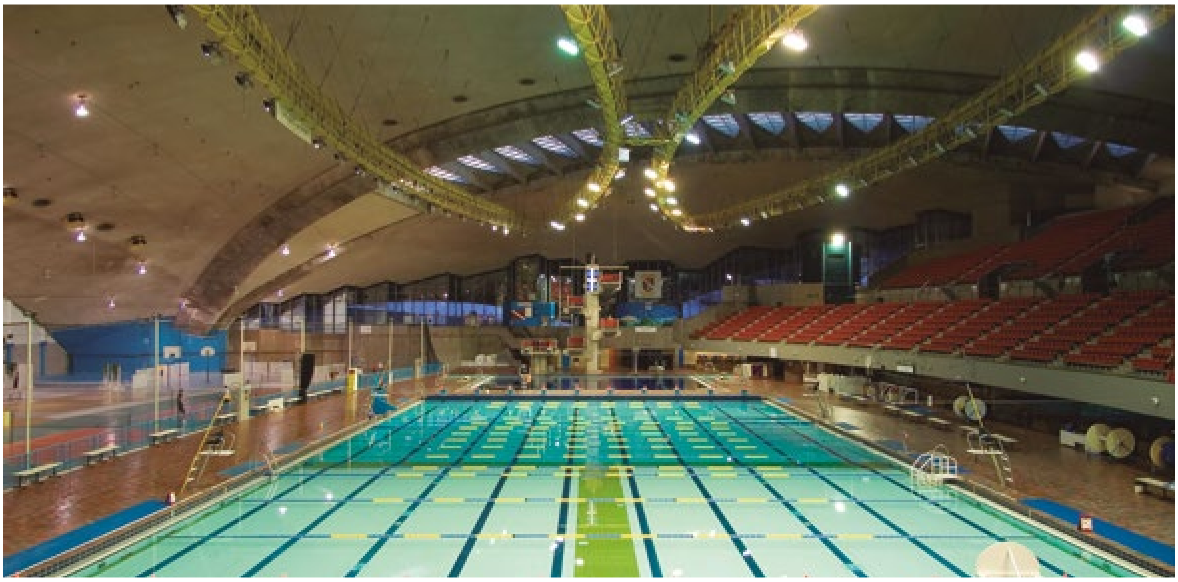
The trolley has four castor wheels for maximum mobility. Two of these have a brake. It can store a float line up to 50m long (or 2 of 25 m) and can be used for all float line models.



10.D_BILL OF QUANTITIES

BILL OF QUANTITIES OLYMPIC POOL 50x25x2 m			
Code	**Unit**	**Description**	**Quantity**
C.1		**OLYMPIC POOL 50 x 25 x 2**	
C.1.1		**POOL BUILT (Hot Galvanized)**	
	u	Hot Galvanized Skypool Panels 2 m Depth	1
	u	Liner & Geotextile	1
	u	Ceramic tiles	1
C.1.2		**FILTRATION SYSTEM**	
00706	u	Praga Filter Ø2000	6
00596	kg	Sand 0.4-0.8 mm	22.800
10697	kg	Gravel 1-2 mm	6.300
00789	u	Valve Manifold 140	6
56637	u	Kivu pump 10 cv. High efficiency	3
20436	u	Counter Woltman calibre 8"	3
20431	u	Counter Woltman calibre 2 1/2"	1
56116	u	Electrically driven plastic valve	1
12062	u	3 water level control panel	1
38780	u	Victoria Plus Pump 3 cv (Cleanning system)	1
	u	Piping and accessories	1
C.1.3	u	**DESINFECTION SYSTEM (Freepool)**	
60361	u	Control Equipment PR-207 pH/Cl2 PPM	1
56634	u	Kivu pump 5.5cv	2
57762	u	Neolysis 120 gr.	8
54528	u	Continous Flocculation System	6
57135	u	Dosing Pump OPTIMA	2
54528	u	Flocculation equipment	6
	u	GVG Injector	1
	u	GVG Injector Materials	1
	u	Management control system (Modul 1)	1
	u	Management control system (Modul 2)	1
	u	Recirculation Pump Alpha2 Grunfos	2
	u	Dosage Tank APQ 1500 CL	1
28831	u	Dosage tank Polyethylene 1000 L	1
	u	Piping and accesories	8
C.1.4	u	**FLOOR WATER CIRCULATION SYSTEM**	
43588	u	Adjustable BCN 03 nozzle for liner pools	90
43590	u	Wall conduit Ø 90mm	90
00332	u	Suction nozzle	4
41519	u	Overflow suction	100
20079	u	Main drains 515x515 Ø 140 mm	3
C.1.5		**ELECTRICAL COMPONENTS**	
	u	Electrical Box	1
	u	Electrical accessories, such as cable, etc	1

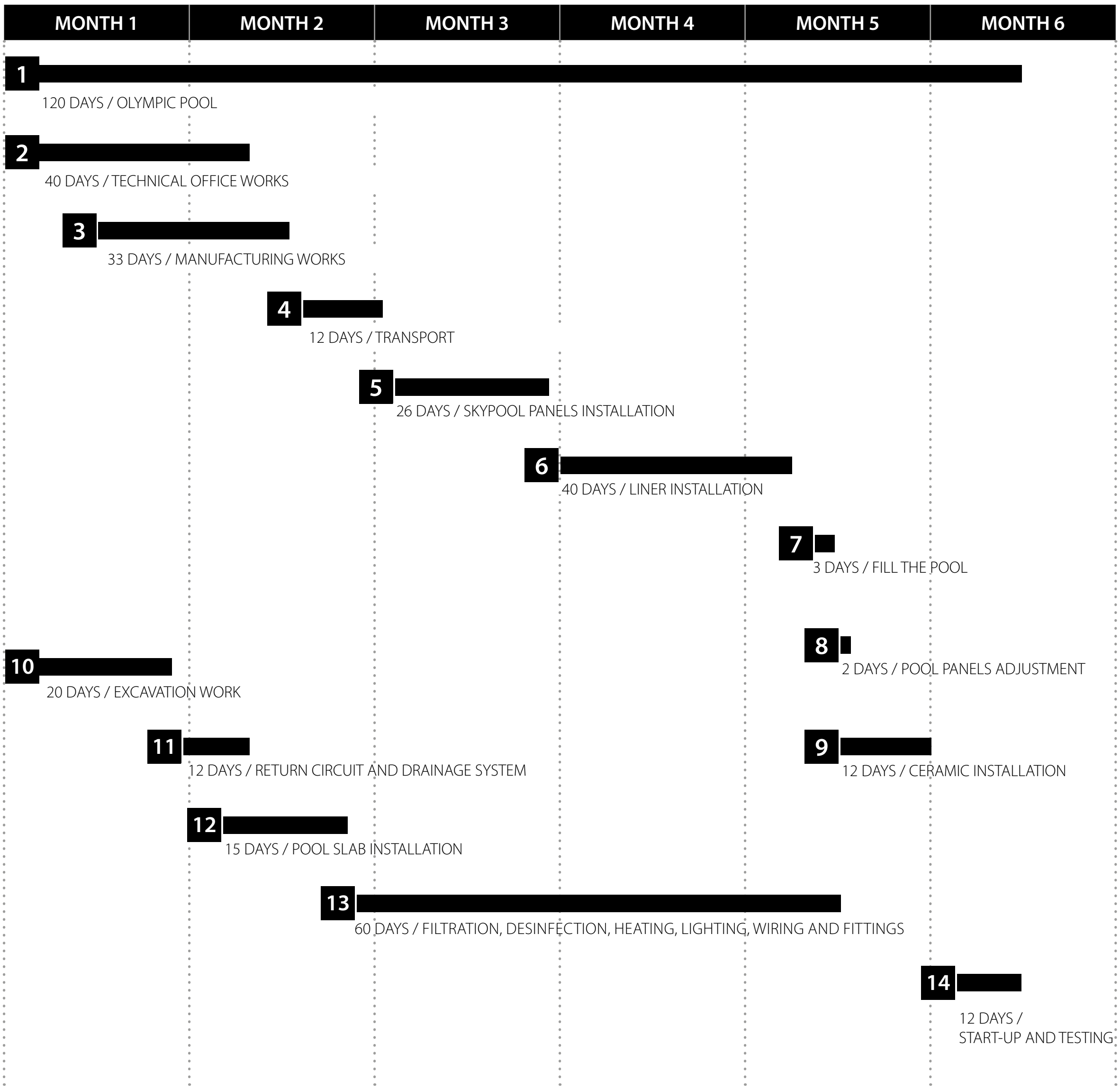
C.1.6		ACCESSORIES. COMPETITION EQUIPMENT	
54479	u	Lane rope Sydney(Blue & Red)	4
54481	u	Lane rope Sydney (Green & Blue)	2
54576	u	Lane rope Sydney (Yellow & Red)	3
15842	u	Under deck lane rope storage system	9
28623	u	Lane Rope Storage basket (Recommended)	9
19953	u	Backstroke turn indicators (Posts)	1
19955L25	u	Backstroke turn indicators (Bunding)	1
19960	u	Anchoring Sockets	4
34214	u	Headwall for podiums	20
34215	u	Headwall for podiums, Right corner	2
34216	u	Headwall for podiums, Left corner	2
53875	u	Starting Blocks	20
C.1.7		**TIMING SYSTEM**	
	u	Basic system for 10 lanes	1
	u	Touchpad FINA	22
	u	Transport Cart for Touchpads	2
	u	Backstroke Start Aid	22
	u	Meet management system	1
	u	Videowall in Olympic size	1
C.1.8		**DISABLED EQUIPMENT**	
49901	u	Portable Chair	1
C.1.9		**CLEANING EQUIPMENT**	
60164	u	Automatic sustion Cleaner (Ultramax Giro)	1
04648	u	Pool cleaner pump trolley	1
C.1.10		**OVERFLOW GRATINGS**	
05582	u	Parallel grating tile	750
22380	u	90º Corner	4
C.1.11		**LIFE SAVING ACCESSORIES**	
01369	u	Lifebuoy	4
01370	u	Lifebuoy holder	4



Fluidra's OP Solution / Render view

Midland Natatorium. *Midland. USA*. 2016

11 PROJECT SCHEDULE



12 SOLUTION TECHNICAL DESCRIPTION

12.A_ GENERAL DESCRIPTION OF THE PROJECT

DIMENSIONS OF THE POOL:

- Length = 50 m
- Width = 25 m
- Depth = 2 m

POOL DEVIATIONS:

- Length = + 30 mm – 0 mm
- Width = + 30 mm – 0 mm
- Depth = + 10 mm - 0 mm

VOLUME OF WATER INSIDE THE POOL:

- 2.500 m^3

RACE COURSES OF 50 M IN LENGTH:

- 10 (only 8 are used in competitions)

SURGE TANK'S INTERNAL DIMENSIONS:

- Length: 12.65 m
- Width: 6.50 m
- Depth: 2.40 m

VOLUME OF WATER IN SURGE TANK (NET VOLUME):

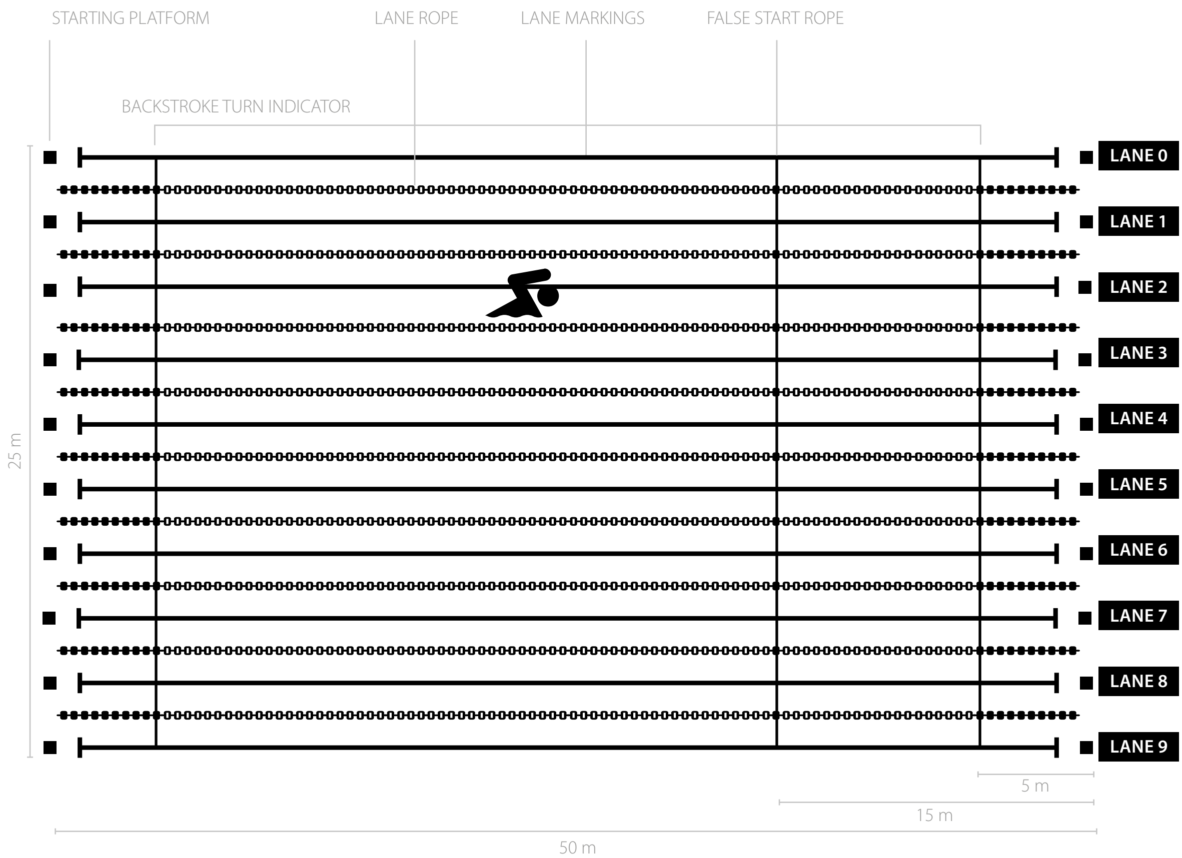
- 197.3 m^3

LANE WIDTH:

- 2.5 m

LINER:

- Made of reinforced PVC-P.
- This is the most effective material used for pool coating because of its high malleability, tearing resistance, easy welding, resistance to discolouring by UV rays and a wide colour range. It can be 100% recycled.
- Perfect assembly and placement of the liner guarantee waterproofing of the swimming pool. It provides the highest level of security, protection, strength and durability.
- The flexibility of the membrane's liner allows adaptation to structural movements during the filling and emptying of the the pool shell. Absorption of structural movements and settlement of the supporting base system.



12.B_ REGULATIONS

The facilities will be fully compliant with EU regulations, whilst the pool's competition features and the measurement of the pool shell will follow FINA and NIDE standards. This will ensure without any shadow of a doubt that the facilities will be up to standard in terms of quality and safety. The inherent quality of the facilities and the project, for which the most advanced materials and techniques in the world will be used, have been solely designed for professional use, as a result of which no modifications may be made to it whatsoever. **Fluidra** has more than 50 years of experience as a world leader in this sector, over which time it has been involved in the installation and assembly of different spaces for holding world championships, regional competitions, as well as municipal pools for swimming and playing water polo.

12.C_ARCHITECTURE

C.1_ SCOPE & BULDING DESCRIPTION

By way of example of local regulations that may apply, we have drawn up this report on the assumption that the facility is to be located in Barcelona. As described above, a sports building has been designed for swimming and water polo competitions, training and/or leisure. All the spaces must meet a minimum set of requirements to cater for these uses, as must the spaces used by athletes, judges, the press, users, etc.

The ultimate aim is for this project to serve as a model and guideline for any developers, architects, engineers or clubs that have to build a facility for similar uses.

All of the spaces and transit areas are coherently joined up so that they are functional and sustainable.

Due to its long-standing experience in the sector, **Fluidra** is able to give advice about new projects or the refurbishment of existing pools.

C.2_ AREAS

There are a number of areas (competition, athletes, press, TV, trainers, spectators, staff, installations...) that must meet the minimum standards for this kind of facility, which have been distributed based on the criteria described below:

GROUND FLOOR

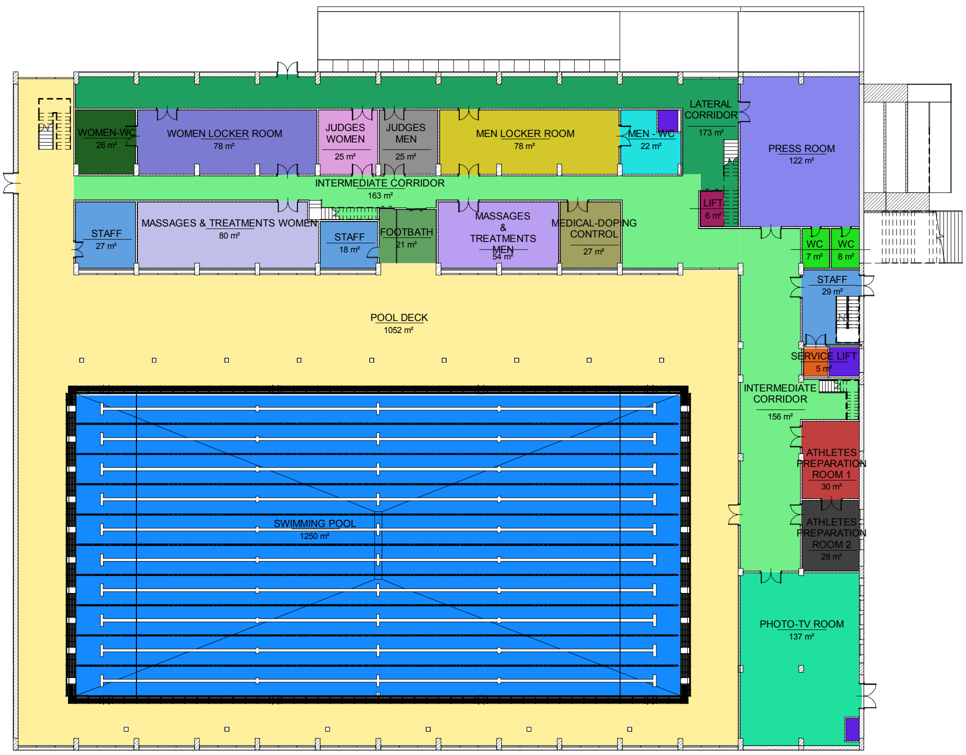
This can be considered the largest area with a surface area of 3,690,49 m^2 that is taken up by the competition space, changing rooms and side rooms for athletes.
The main spaces are shown below:
POOL 50m x 25m x 2m. Net surface area of 1,250 m^2. A volume of 2,5003 and a depth of 2 m for swimming and water polo competitions. It will be built using the SkyPool panel system. The prefabricated panels, which are made of hot-dipped galvanised steel that are highly resistant to corrosion, enable competition pools to be built to exact specifications. For further information, see the SkyPool construction report.

DECKS. Net surface area of 1,074 m^2. This multi-purpose area can be divided into spaces for athletes, judges and TV crews, depending of the use made of the pool. For competitions that require a bigger crowd capacity, the number of spectators can be doubled by fitting temporary grandstands.

CHANGING ROOMS. Net surface area of 298 m^2 .Divided into two areas, one for women and one for men of 120 m2, and another two of 29 m^2 for male and female judges. They will have their own toilets and showers. Massage area. Net surface area of 190 m^2. Press room. Net surface area of 120 m^2.

ATHLETES' PREPARATION ROOMS. Net surface area of 58 m^2

TV AREA. Net surface area of 133 m^2

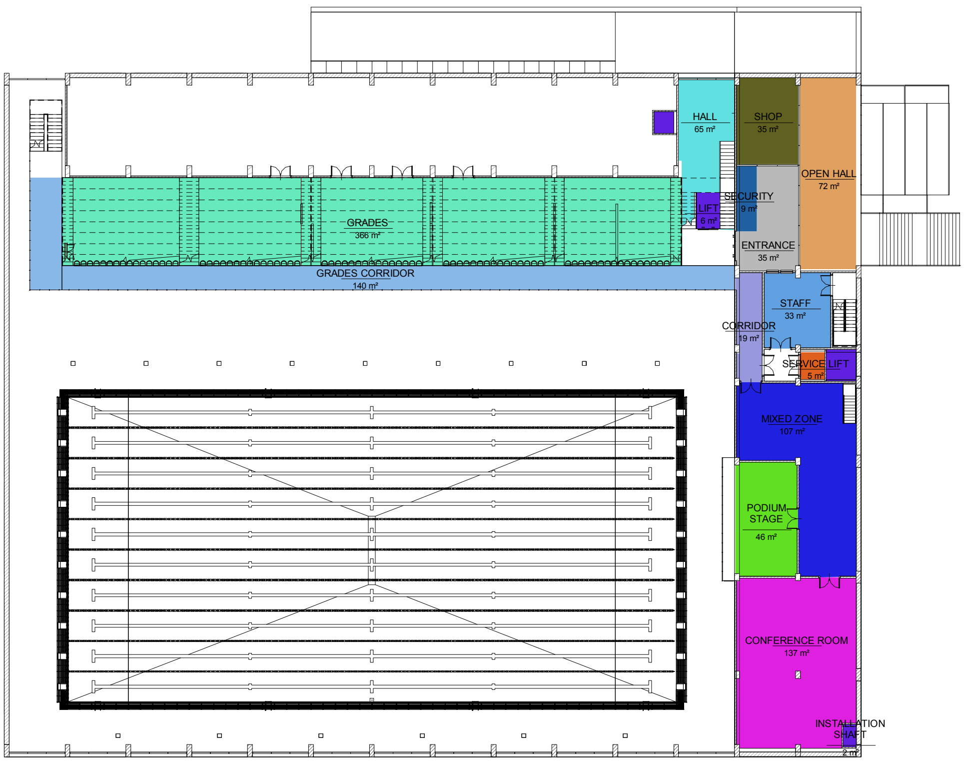


FIRST FLOOR

The main purpose of this floor is to serve as an entrance hall and distribution are. By going down one ends up on the athletes' floor, and by going up one ends up in the upper part of the grandstand and the cafeteria. The gyms and staff rooms are also on this floor but can only be accessed from the ground floor.

It has a net surface area of 1,702.7 m², distributed as follows:

Hall: Net surface area of 72 m²
Reception: Net surface area of 35 m²
Staff Rooms: Net surface area of 33 m²
Shop: Net surface area of 35 m²
Gyms: Net surface area of 316 m²
Podium Stage: Net surface area of 46 m²
Mixed Area: Net surface area of 107 m²
Conference Room: Net surface area of 137 m²



2nd FLOOR

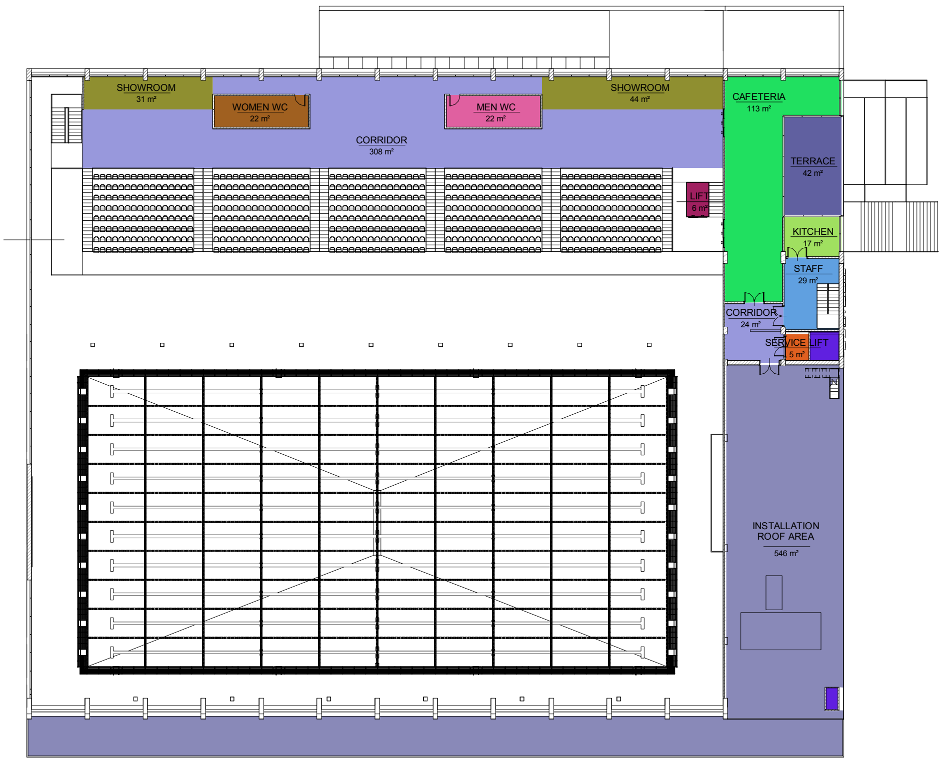
With a surface of 1,274.07 m^2, it is mainly devoted to catering facilities, a showroom and storage space. The main spaces are:

SHOWROOM. Net surface area of 75 m^2. Area that is readily accessible by the general public and the press for displaying sports equipment, technical components, etc. Extremely useful for sponsors.

CAFETERIA. Net surface area of 113 m^2. Area for having drinks and eating sandwiches. There is a 42 m2 terrace for leisure and entertainment.

STAFF ROOMS. Net surface area of 29 m^2. Storage and transit area for the building's staff. It should be highlighted that this space projects from top to bottom of the building and can be accessed completely separately on each floor, including the steps and service lift.

TERRACES. Net surface area of 42 m^2. Area for installing the building's general purpose equipment. Some of it will be placed on the same level as the 2nd floor and the rest of it above the cafeteria. It is accessed from the staff area and from the outside.



- 1st FLOOR

Area devoted mostly to machine rooms, with a net surface area of 1,507.48 m². It has an access ramp, and a loading and unloading dock. It is mainly divided into the following two areas:

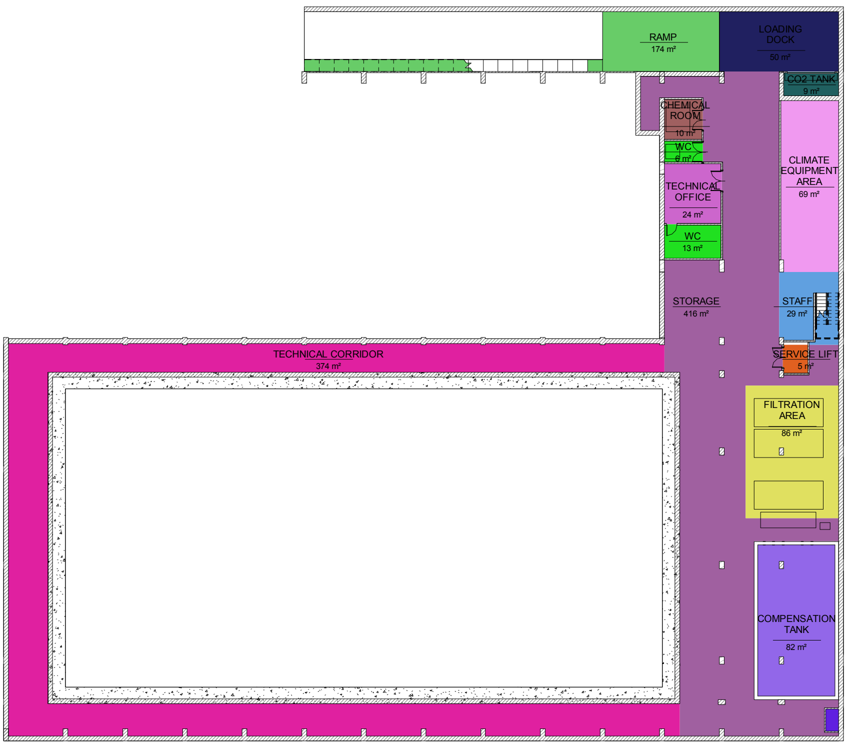
CHEMICAL STORAGE ROOMS. Net surface area of 10 m². Highly ventilated rooms in which the pool's chlorine and flocculant supply tanks will be kept. Easy access for taking supplies to. Divided into two totally separate rooms, one for chlorine and the other for flocculant. They will each have APQ-type tanks and all of the dosing pumps.

AIR CONDITIONING TECHNICAL ROOM. Net surface area of 69 m². Area intended for the installation of air conditioning units for the whole of the building, mainly comprising buffer tanks, hot water tanks and recirculation pumps.

STAFF ROOMS. Net surface area of 29 m². As described above, the staff rooms run right up and down the building.

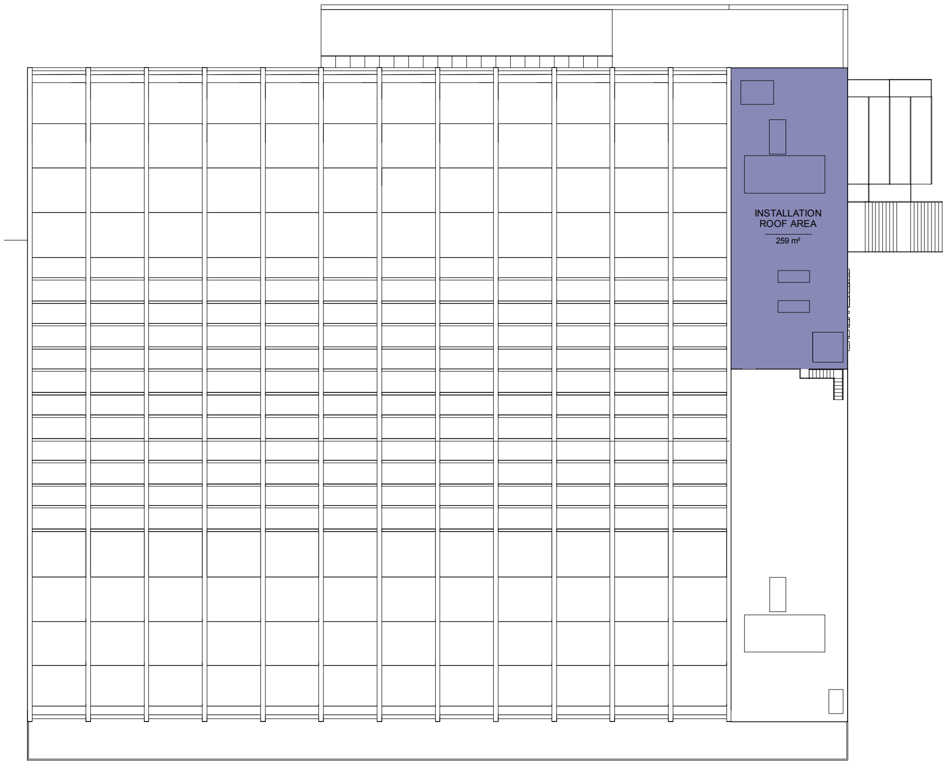
WATER TREATMENT TECHNICAL ROOM. Net surface area of 86 m². All of the pool water treatment units will be kept here, such as filters, pumps, CO_2 injection unit, etc.

COMPENSATION TANK. Net surface area of 82 m².
Tank that is essential for pools with overflow systems.



ROOFTOP

This will mainly be taken up by the building's roof and a terrace for technical equipment of 259 m^2.



C.3_ PATHS

One of the most important functionalities to consider in these types of buildings is the design of the routes to be used by the athletes, press, TV crews, spectators, executives and other personnel.

This design has to avoid different groups crossing each other and ensure speedy access, as timing is very important during competitions because of television broadcasts. Routes must be safe and made to the measurements needed for traffic densities.

In this report, the routes to be used in the following situations:

Athletes during competitions.
Prize-giving ceremony and lap of honour.
Press during competitions.
TV crews during competitions.
General public.
Athletes during training and leisure times.
Staff and executives.

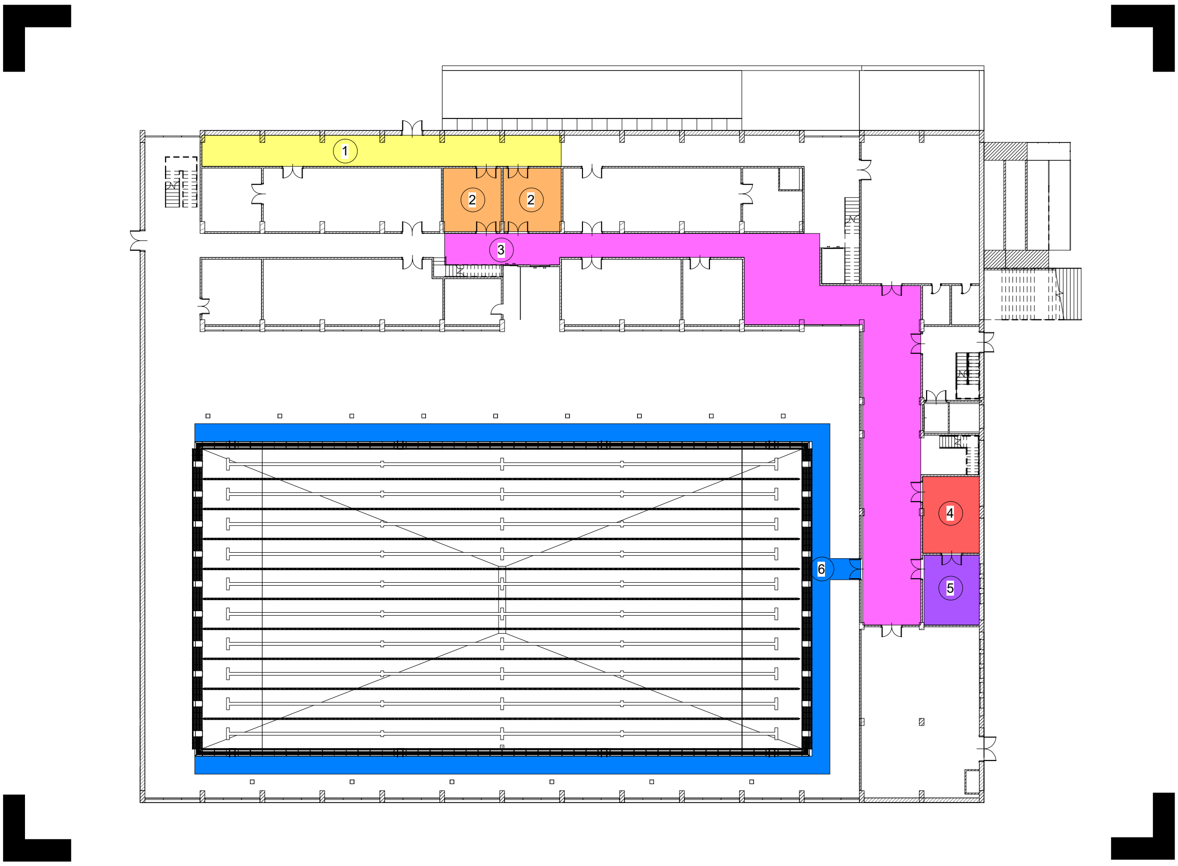
JUDGES' ROUTE IN COMPETITIONS

As seen in the attached plan, competition judges have independent access during competitions directly to the ground floor to enter the dressing rooms **[1]**.

There are separate dressing rooms for men and women **[2]**.

After changing, the judges step into the middle corridor [**3**] which leads to the corridor beside the press room, where they will be distributed to enter the preparation rooms **[4-5]** or to wait for the athletes to emerge for the championships. During the presentation at the start of a competition, the athletes emerge one by one via the centre of the poolside area and head to their assigned spot **[6]**.

When the competition has finished, they follow the same route back.



SOLUTION TECHNICAL DESCRIPTION

ATHLETES' ROUTE IN COMPETITIONS:

As with the judges, the athletes have independent access during competitions directly to the ground floor to enter the dressing rooms **[1]**.

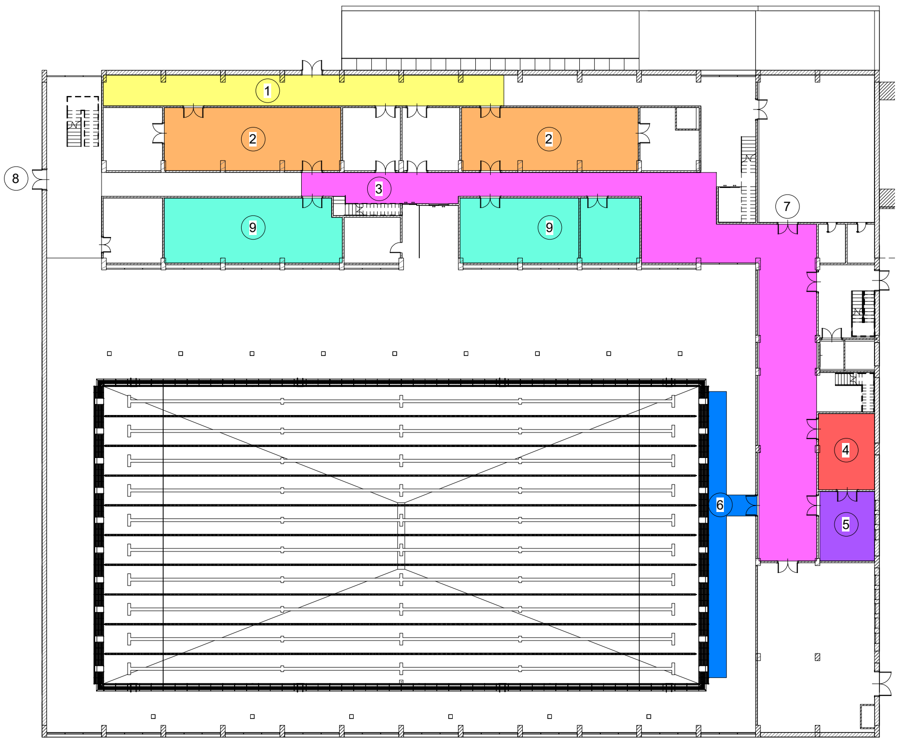
There are separate dressing rooms for men and women **[2]**.

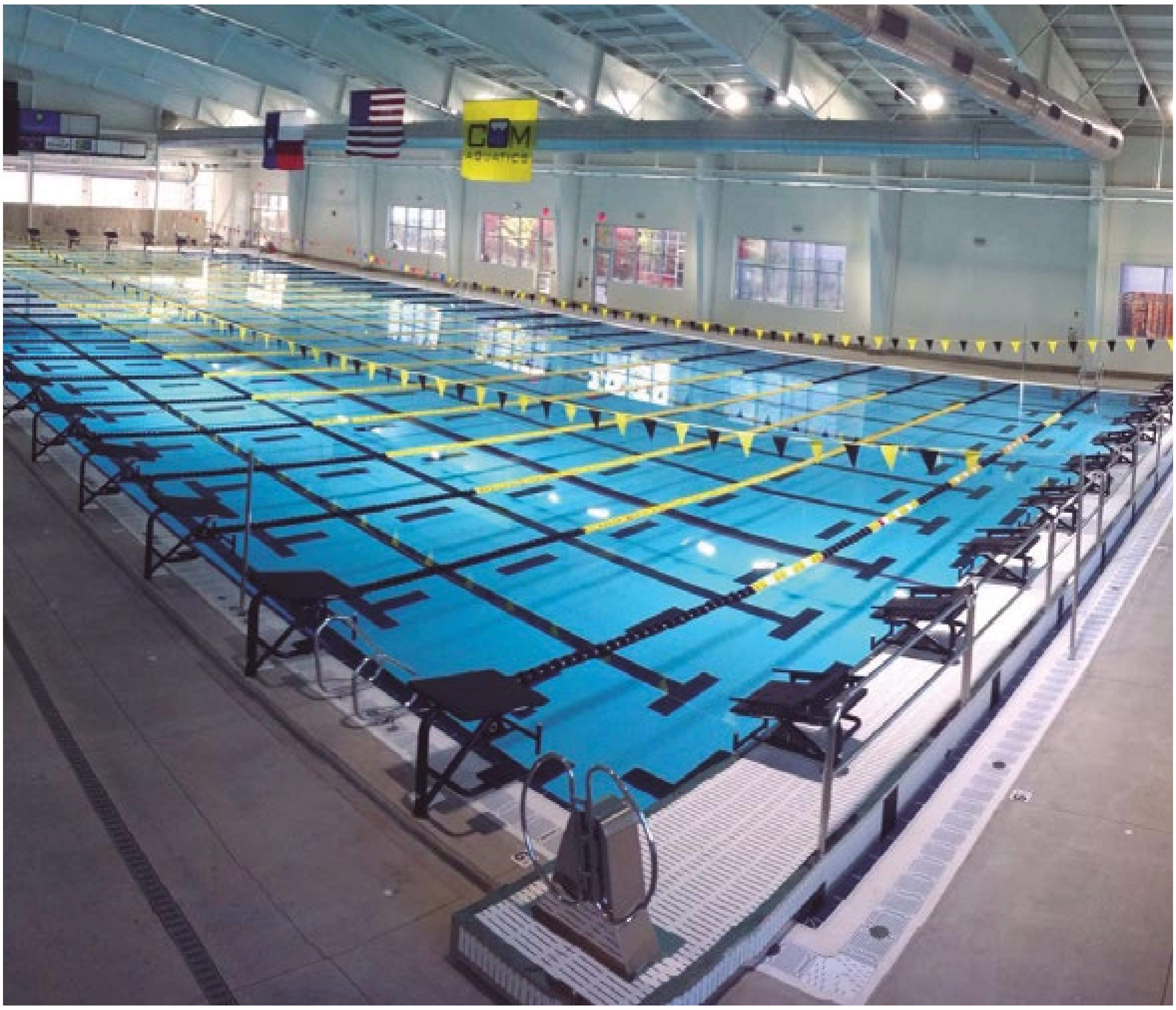
After changing, the athletes step into the middle corridor **[3]** which leads to the corridor beside the press room, where they wait to enter the first preparation room where the judges will check their clothing **[4]** and send them on to the second preparation room **[5]**, where they wait to enter the competition.

From this second preparation room, the athletes emerge one by one as their names are called, starting with the ones in the outside lanes and working towards the middle lines. They enter from the centre of the poolside area to avoid unwanted crossings in front of the television cameras **[6]**.
After the presentations, the athletes will be ready to start the competition.

When the competition ends, they leave by the same door mid-poolside (wide zone) and head towards the press area to be interviewed **[7]**. After this, they carry on along the middle corridor to the warm up pool **[8]** **which is not included in this project**.

After this, they can either return to the dressing rooms to shower and change (or head to the attached rooms **[9]** for a massage), or ascend the middle staircase to the upper floor with the gym **[10]**, where the rest of their team will be.



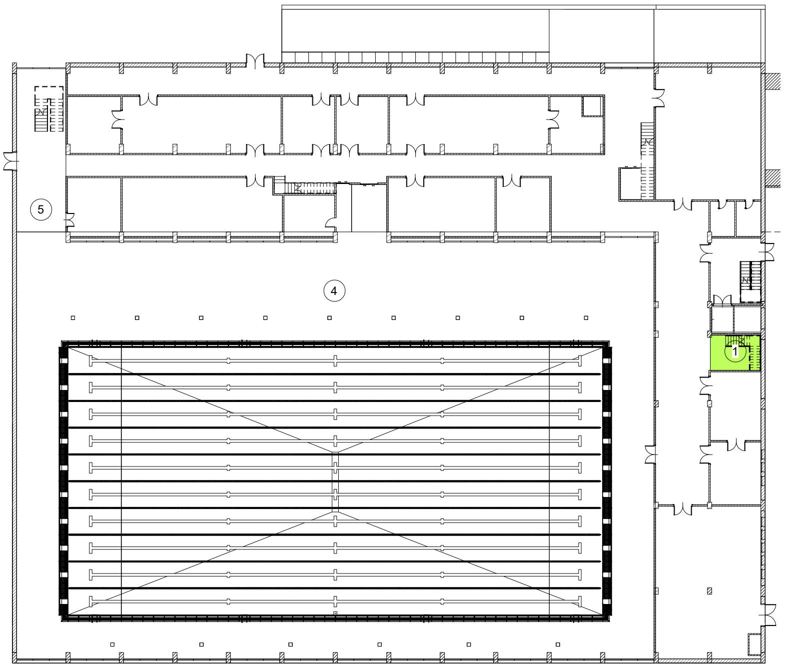


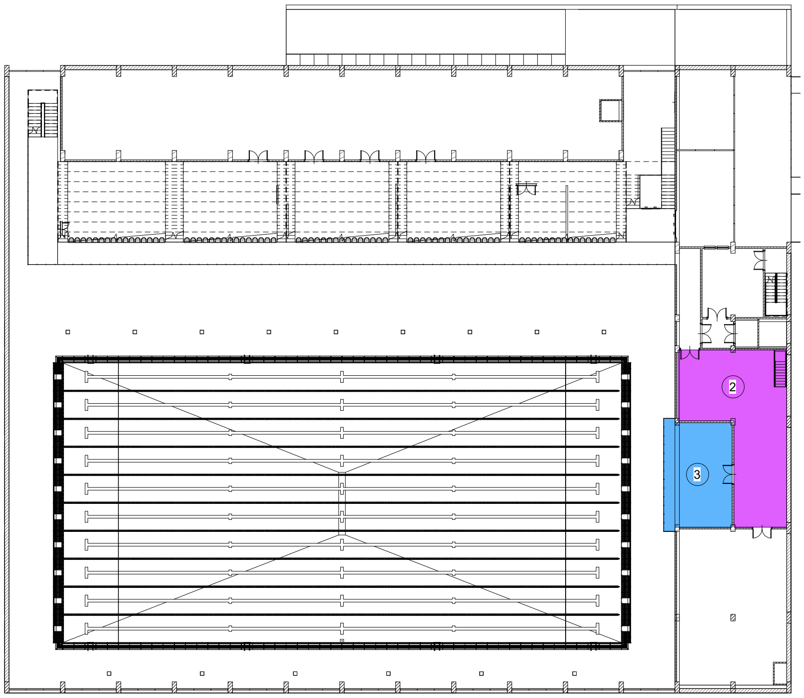
Midland Natatorium. *Midlatnd. USA*. 2016

PRIZE-GIVING CEREMONY AND LAP OF HONOUR

Winning athletes ascend to the first floor mixed zone via the staircase **[1]** beside the preparation rooms or directly via the corridor to directly access the mixed zone **[2]**. This is where the whole of the management team, press, trainers, etc., will be and where the athletes get ready to enter the prize-giving area **[3]** when their names are called.

When the prizes have been awarded, the swimmers can either quickly descend to the ground floor via the mixed area staircase or exit to do a lap of honour via the door mid-poolside (wide zone) **[4]**. Depending on the championship's organisers, the lap of honour can be a full lap or can end at the opposite side **[5]**, where there is direct access to the pools.



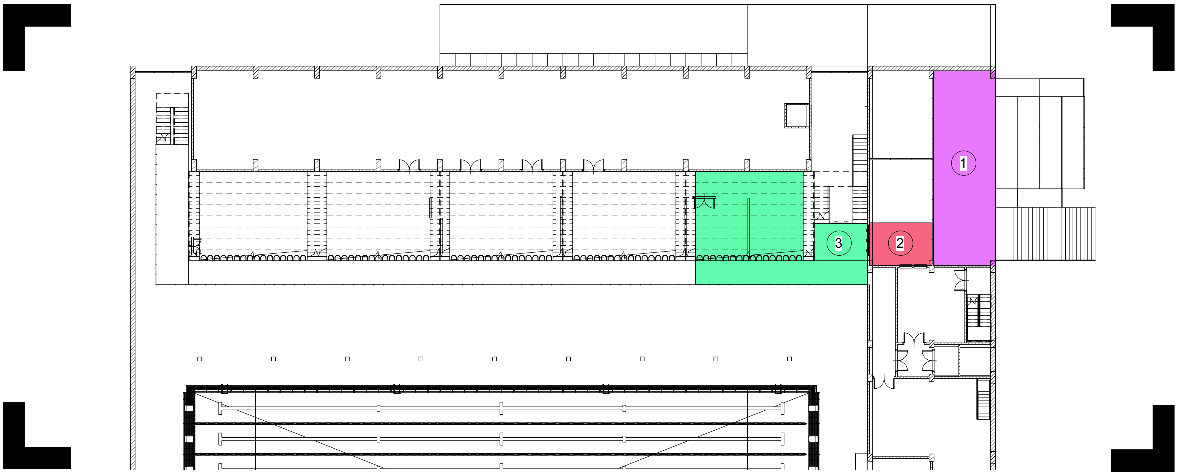


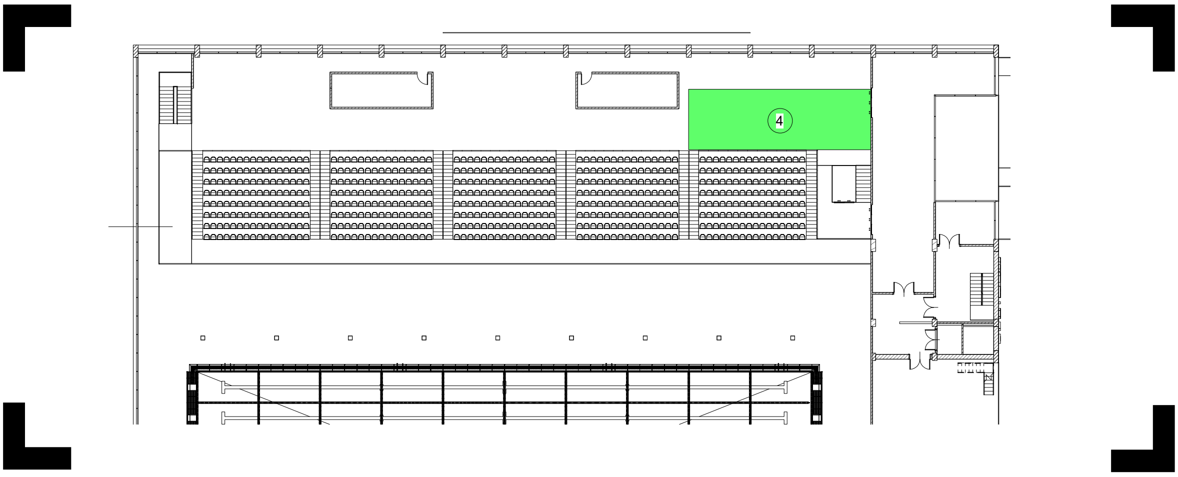
PRESS

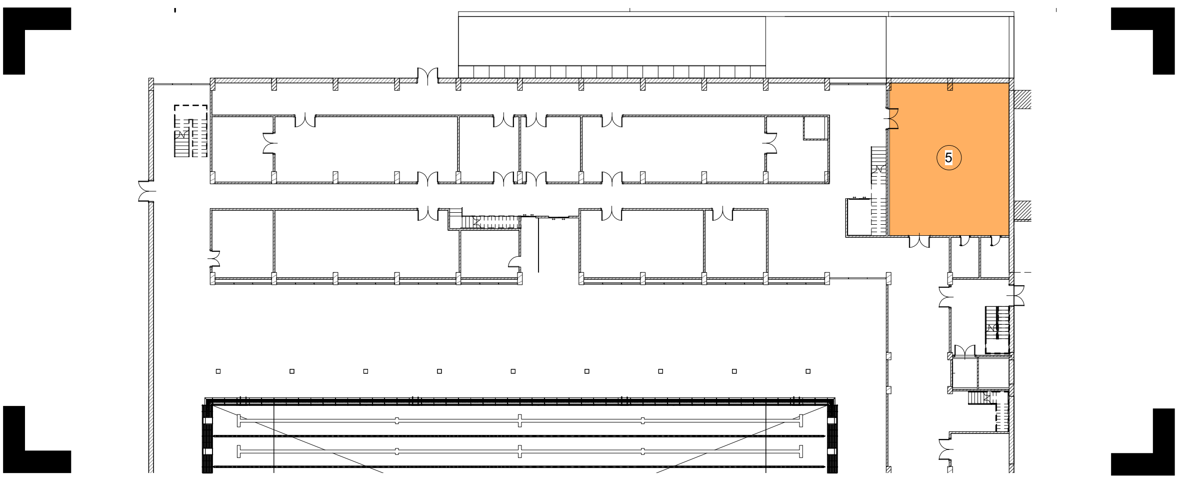
The press enter the building via the main door **[1]**with the hall **[2]**and the reception area, where their accreditations are checked.

Once inside, they can access the stands directly (the stands in line with the arrivals podium are reserved for members of the press) **[3]** or ascend to the second floor, with the cafeteria **[4]**. They can also descend to the ground floor to access the press area **[5]**.

As shown, members of the press are always at the forefront of the events and are very well communicated by the building's lifts and staircases, giving them full freedom of action to watch the competitions, take photos, conduct interviews at any point (before and after competitions), attend prize-giving ceremonies, etc.





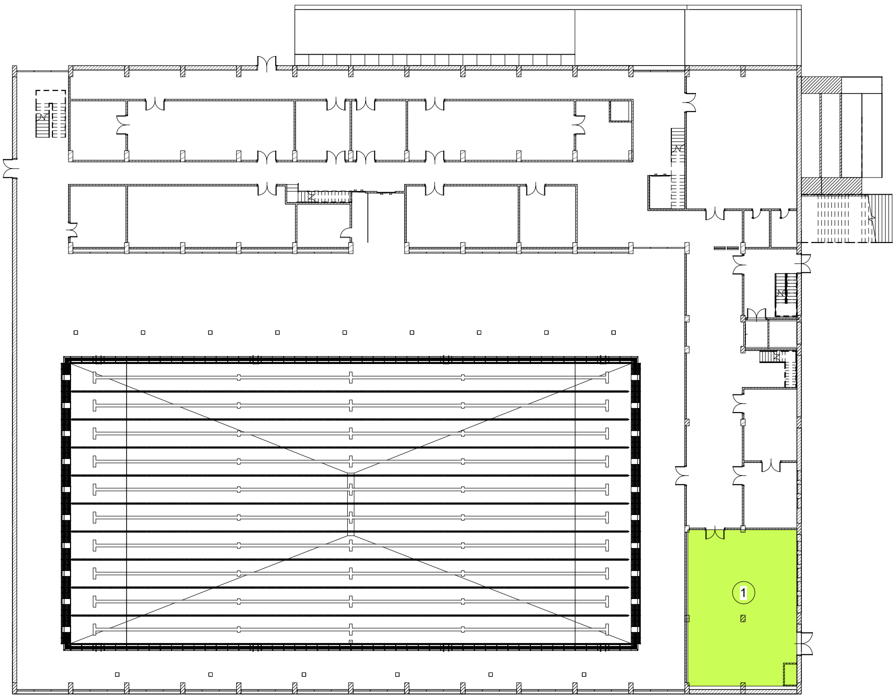


TV

In top-level competitions, television may be one of the most important infrastructures to consider and one which many facilities fail to provide for.

In addition to all of the spaces shown on the attached image, television crews need a space to broadcast from. Very often this is organised outside of the building in a mobile structure the crews bring with them, but it is always necessary to have a dedicated area, whether for production purposes or to store material **[1]**.

This area will have direct outdoor access, as shown on the attached plan, and wall bushing in the poolside area to run the camera and sound-equipment power lines.



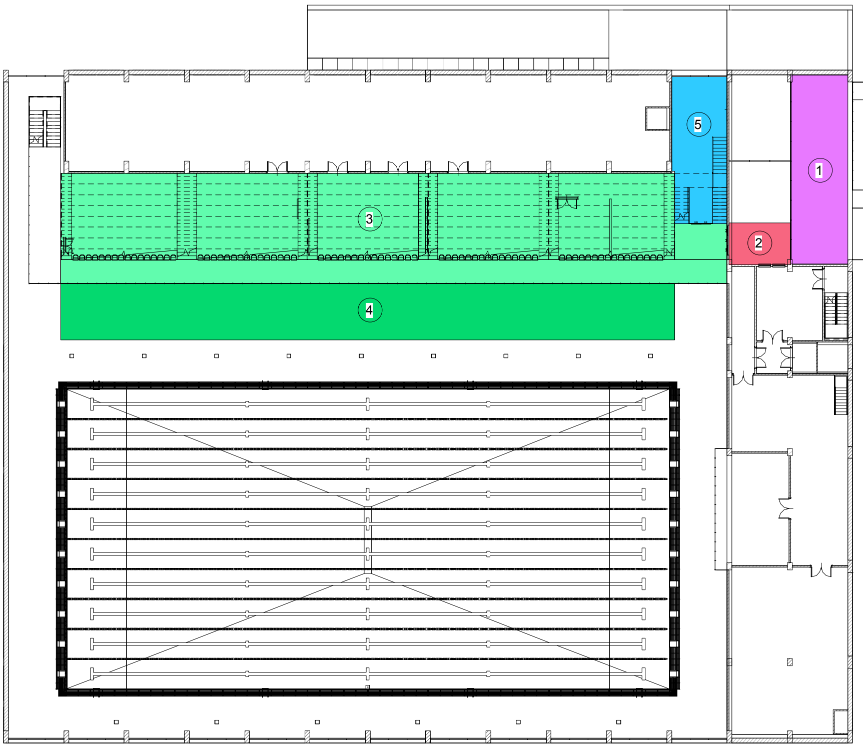
GENERAL PUBLIC

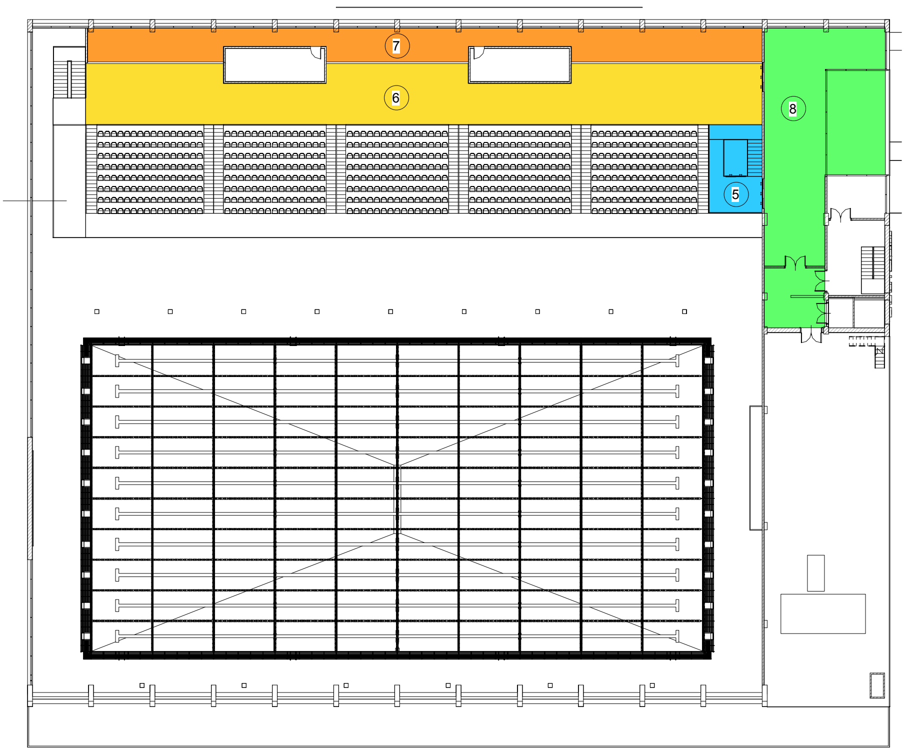
The general public enters the building via the main door **[1]**, into the hall **[2]** and reception area, where their accreditations can be checked and/or they can buy tickets.

Once inside, they can access the stands directly via the first floor **[3]**. To ascend to the cafeteria **[7]** or showroom **[6]** during competitions, they climb the stairs in the stands (handicapped persons can use the lifts) **[4]** to the corridor above the stands **[5]**.

This is to avoid them crossing with the press, who use the stairs and lifts to access the venue's different press areas.

Outside of competition times, the public can also access the stands via the lift or the access stairs **[4]**. During very important competitions when it is necessary to increase the capacity of the spectators' area, the venue can double its capacity by assembling temporary stands poolside, as shown in the following image. Access to the new stands is via the corridor beneath the main stands **[3]**.

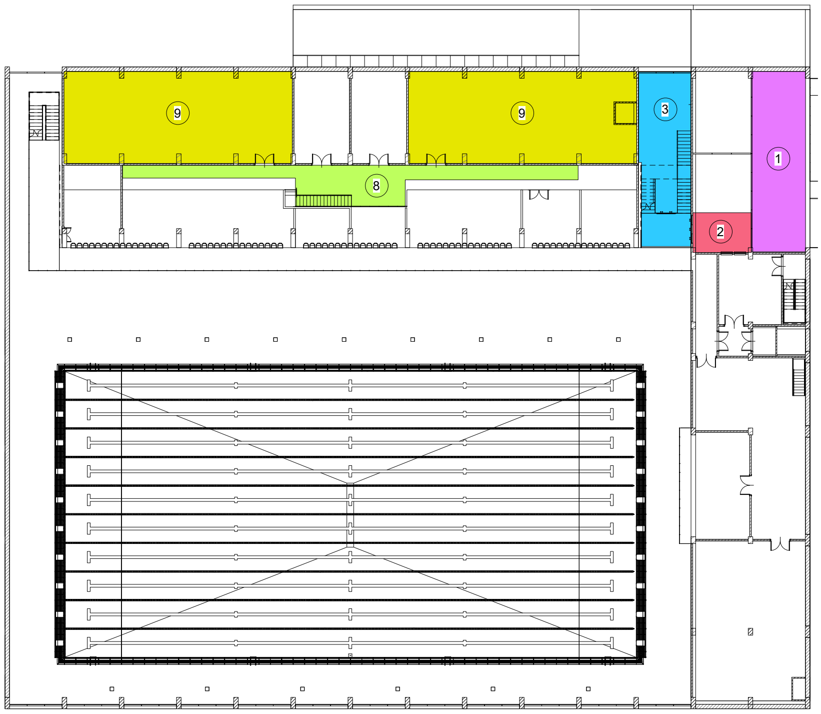

5
1
3
2
4

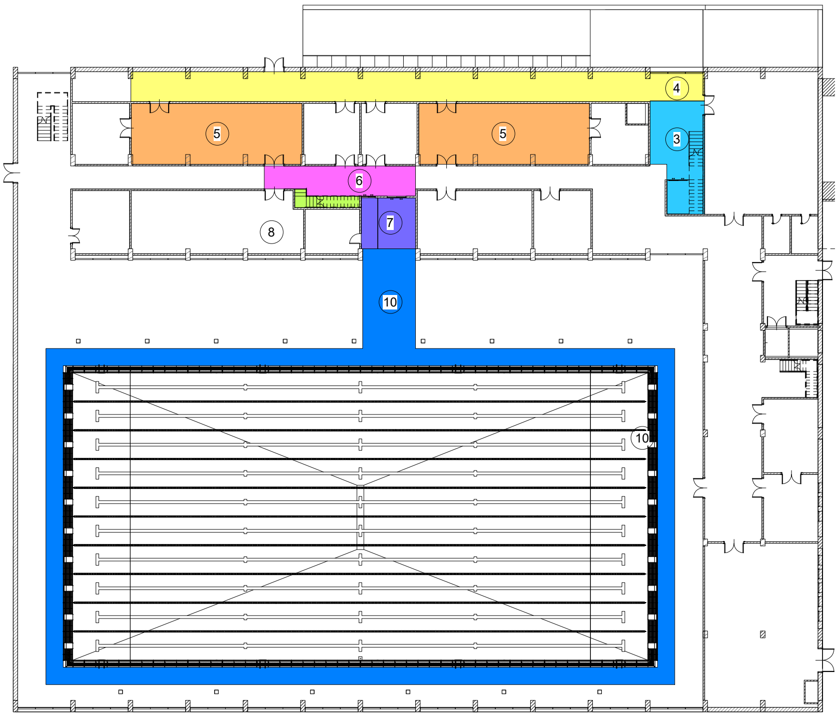

7
6
8
5

ATHLETES IN TRAINING AND LEISURE TIMES

Athletes and the facility's users in general can, outside of competition times, enter the building via the main door **[1]** into the hall **[2]**, where their accreditation can be checked or they can buy tickets, if necessary. Once inside, they descend to the ground floor **[3]**, where they enter the dressing rooms via the building's side corridors **[4-5]**.

After changing, the athletes step into the middle corridor **[6]** and can access the installations **[10]** either by crossing through the foot bath **[7]** to enter poolside, having previously showered, or they can go upstairs to the gym **[9]** via the central staircase **[8]** in the middle corridor, as shown in the attached plans.

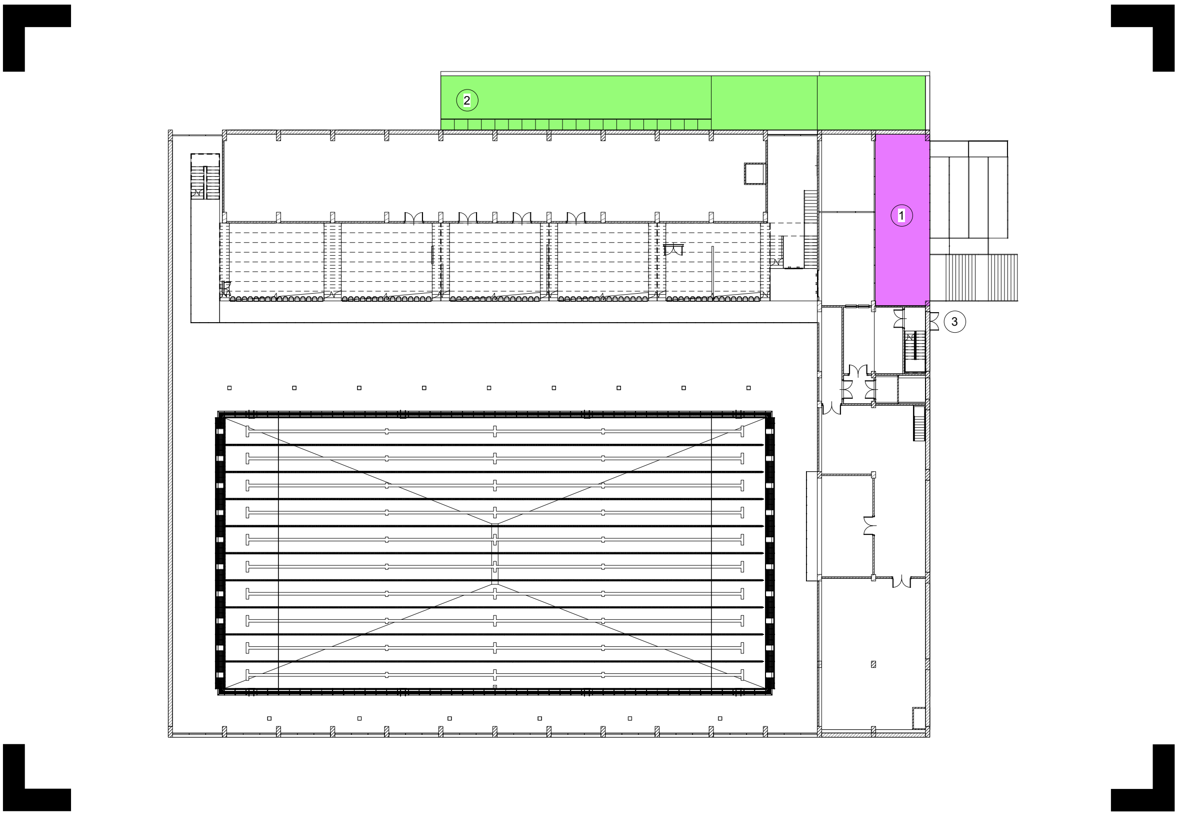




STAFF AND EXECUTIVES

These two groups of people usually enter via the main door **[1]**, the access ramp to basement floor 1 **[2]** or the side door on the ground floor **[3]**.The ground floor gives onto spaces that have a vertical projection of the whole of the building and which have access stairs and a goods lift.
The goods lift is next to the main installations (technical rooms, both above ground, terraces, and below ground, i.e., cafeteria, offices, etc.).

The access ramp **[2]** and the side door **[3]** are very important for the facility's logistics. The former because of the building's maintenance areas and the latter for logistical reasons concerning the cafeteria, offices, access to the different rooms, etc.



SOLUTION TECHNICAL DESCRIPTION

12.D_ POOL BASIN

D.1_ INTRODUCTION

The pool basin must be completely waterproof and comply with the measurements and tolerances established under FINA and NIDE (Spanish Sports Facilities Standards according to the National Sports Council) regulations.

The dimensional tolerances are:

[1] LENGTH TOLERANCE	50.30 m	+.003 m - 0.000 m	*Measurement from 0.30 m above the water surface to 0.80 m below the water surface.*
[2] WIDTH TOLERANCE	25 m	+.001m - 0.000 m	*Measurement on vertical plans parallel to the front walls, separated from each other and from the walls every 5 m.*
[3] MINIMUM DEPTH	2 m	+.001 m - 0.000 m	*Measurement in the minimum depth areas.*

The basin must be classified as type N7, suitable for holding Olympic Games and world championships.

The minimum depth is 2 m, with minimum gradients of 2%. Never to exceed 6%.

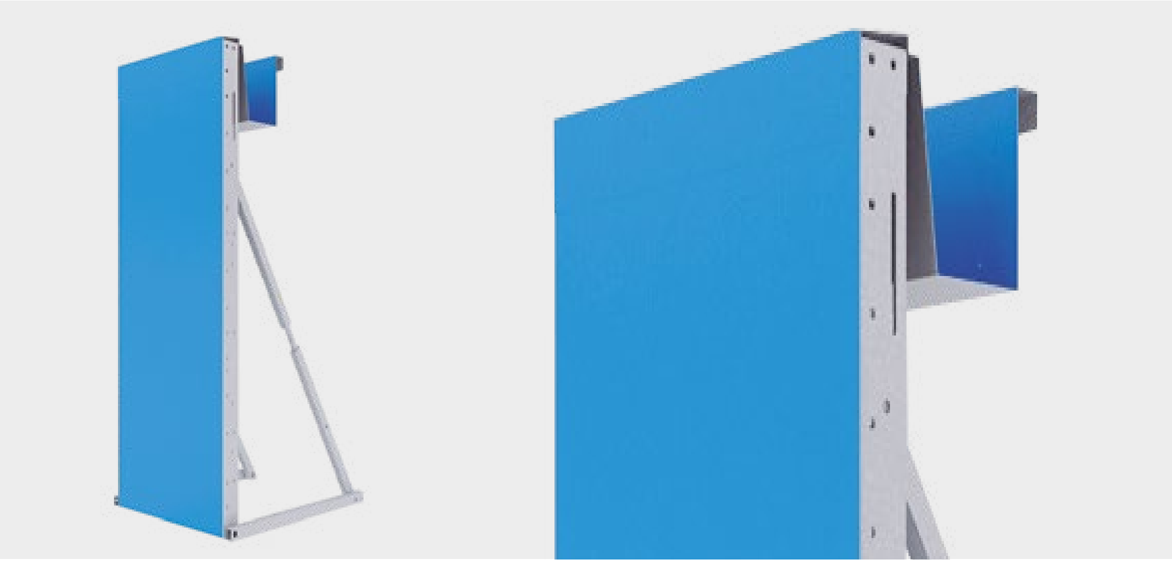
The pool will overflow on the 4 sides and all panels will have a perimeter step for swimmers at a depth beneath the water level of no less than 1.60 m. The width will range between 0.10 m and 0.15 m.

D.2_ SKYPOOL PANELS

Pools feature panels that are 1 m wide and a certain height depending on the type of pool, joined to each other so that altogether they have measurements with the tolerances permitted by FINA.

All of the marking work shall be done with laser levels.

To guarantee rigidity and prevent against the corrosion that occurs with these types of installations, the panels are built from 2 mm-thick hot-dipped galvanised steel. This is technically the best treatment. Other materials such as stainless steel, for example, are very functional in pools with electrolytes (underground pools) or in normal atmospheres. In our case the pool is elevated, with corrosive atmospheres (gases from water-treatment chemical products, incorrect ventilation, etc.) which directly attack the structure without an electrolyte conductor. A physical barrier (in this case, the galvanised steel) against this atmosphere is the most functional and safest guarantee against corrosion.



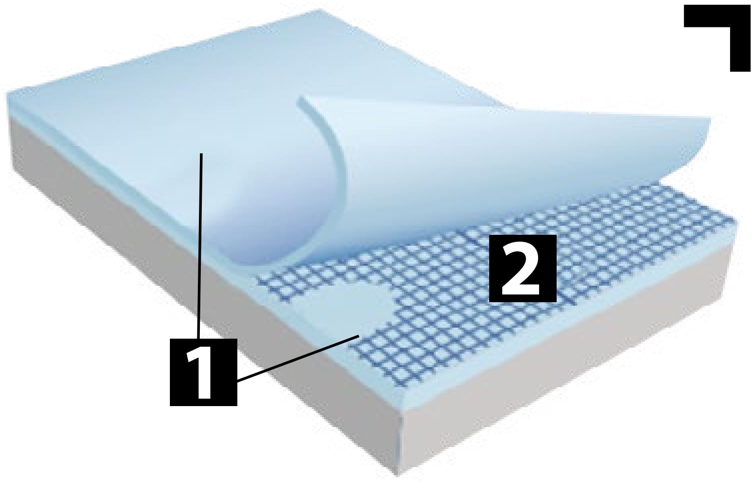
PANEL REGULATIONS: EN-10142

This facility, located in Barcelona, is classified C3, ensuring maintenance-free durability against corrosion of a minimum of 22.5 years and a maximum of 200 years, more than enough for pools with an anticipated service life of 20 years.

ENVIROMENT	V.CORROSION	ALLOY THICKNESS — MINIMUM (45)	MEDIUM LOW (55)	MEDIUM HIGH (102)	MAXIMUM (140)	DIFFERENT TYPES OF ENVIRONMENTS ACCORDING TO REGULATIONS UNE-EN ISO 14713:1999
		YEARS WITH NO MAINTENANCE				
C1	MINIMUM (<01 □m)	450	550	1020	1400	**OUTDOOR** Dry
	MEDIUM (<0.1 □m)	450	550	1020	1400	
	MAXIMUM	INF	INF	INF	INF	
C2	MINIMUM (0.7 □m)	64.28	78,5	146	200	**OUTDOOR** Occassional condensation **OUTSIDE** Rural type within the country
	MEDIUM (0.4 □m)	11.25	13.75	255	350	
	MAXIMUM (0.1 □m)	450	550	1020	1400	
C3	MINIMUM (2 □m)	22.5	27,5	51	70	**OUTDOOR** High humidity, air slightly contaminated **OUTSIDE** Urban in inland or coastal with low salinity
	MEDIUM (1.35 □m)	33,3	40.74	75.5	103.7	
	MAXIMUM (0,7 □m)	64.28	78.57	146	200	
C4	MINIMUM (2 □m)	11,25	13.75	51	70	**OUTDOOR** Pool facilities, chemical plants... **OUTSIDE** Industry within the interior of the country or city close next to the beach
	MEDIUM (3 □m)	15	18,33	34	46.66	
	MAXIMUM (4 □m)	22.5	27.5	25,5	35	
C5	MINIMUM (4 □m)	22.5	27.5	25,5	35	**OUTSIDE** Humid or coastal high salinity
	MEDIUM (6 □m)	7,5	9.1	17	23.33	
	MAXIMUM (8 □m)	5.62	6.875	12.75	17.5	
ANTICORROSIVE	Manufactured using materials suitable for corrosive environments (chlorine-saturated, acid, damp). **No anticorrosion maintenance required** (lacquers, paint, etc.).					

D.3_ LINER

Watertightness is ensured via a PVC liner. This building system is the most commonly used today. The liner will be reinforced, 1.5 mm thick and welded onsite.



1 HIGH RESISTANCE PVC

2 GLASS FIBRE REINFORCEMENT THE POLYESTER

It will be white (another colour can be used, if preferred) with the lane lines in black.

LINER REGULATIONS: UNE 53.221 / 53.358 / 53.165 / 53.104 / 53.358 / 53.326 / 53.358 / 53.127 / 57.114

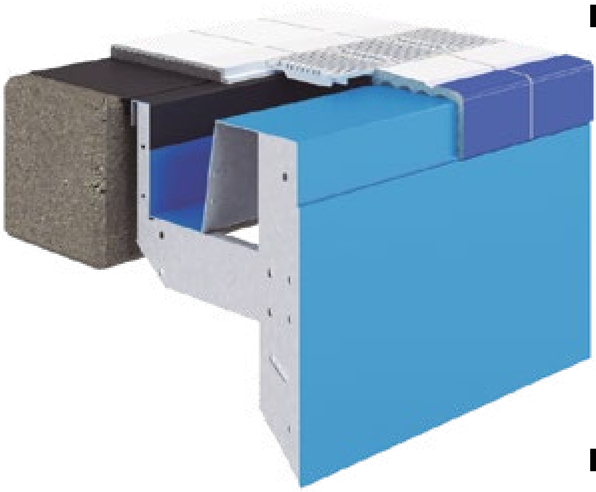
The delivery of the pool plus poolsides is a very important aspect to consider. A poor design or poor execution can produce constant leaks, which are very hard to fix after the pool has been executed. **Fluidra's** solution for these types of pools is very simple and easy to execute.

ARCHITECTURAL DETAILS

- STEEL STRUCTURE
- WATERPROOF DETAIL
- OVERFLOW AND TILE FINISH

ERGO SYSTEM

It's a ceramic finishing system that works perfectly with steel structures - liner finished swimming pool

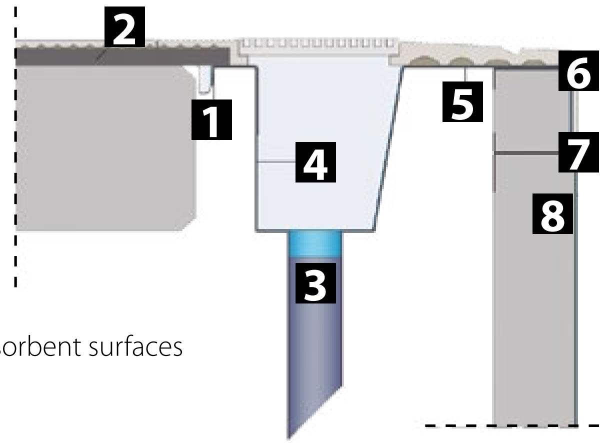


As can be seen in the above image, watertightness is ensured with an impermeable liner welded with the pool liner inside the waterproof channel.

This means that, even if the poolside incline runs in the opposite direction to the overflow, the water that can enter can never spill between the pool space and the poolside flagstone.

ERGO SYSTEM: CONSTRUCTION DETAIL

1. Expansion joints, essential all around swimming pool's perimeter
2. Filling mortar (FIX-REVOCO)
3. Drain pipes
4. Waterproof channel (HIDROFIX)
5. Holding mortar + PRIMFIX + water
6. Waterproofing (HIDROELASTIC)
7. Adhesive cements special for non-absorbent surfaces (TECNOCOL FLEX)
8. Liner



PREFABRICATED ARCHITECTURAL DETAILS

12.E_ SWIMMINGPOOL WATER TREATMENT

12.E.1_ BASIC PRINCIPLES

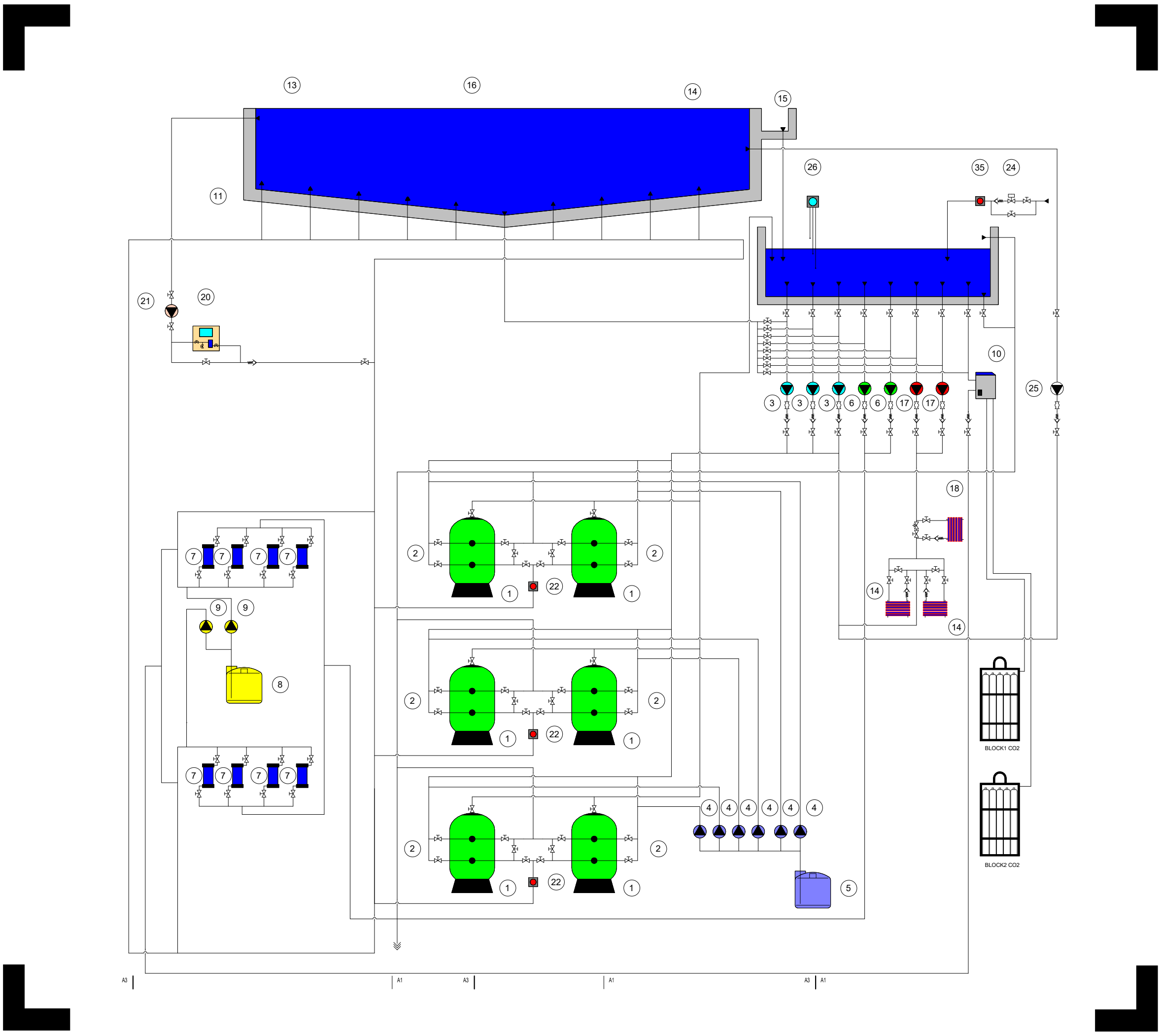
Pool water is generally regenerated in a closed circuit, i.e., the water that is progressively affected by swimmers and external agents is subjected to a suitable treatment and reintroduced into the pool. This regeneration is much cheaper than continually replenishing water, where the effect is to cause cooling and necessitates spending on conditioning chemical products. These problems must be corrected via, respectively, supplementary heating and the addition of products, both of which are clearly very costly. By contrast, our system delivers considerable economy of water, a very important factor.

It is, however, important to add new water every day to compensate for the different water losses and to reduce the concentration in the water of organic and ammonia or mineral compounds that rise continuously.

To prevent the latter (adding water to reduce the concentration of organic and ammonia or mineral compounds) and to ensure maximum comfort for bathers and spectators in general, **Fluidra** recomends the **Freepool** system in this installation to treat the pool water.

As seen in section F.5.4, the advantages of this new system are much greater than any others that exist, both in terms of user and athlete **health**, and water and energy savings.

The main reason for this is shown in the image below:



As can be seen, all of the pool water has to pass through the regeneration facility before being reintroduced into the pool; it must pass through different pieces of equipment to achieve the benefits explained above.

To understand the circuit properly, the treatment can be explained simply as involving two very well-defined phases: filtration and disinfection. Installations involve the following successive elements.

12.E.2_ PREFILTERS AND PUMPS

The water collected at the surface flows via a number of chutes arranged around or along the basin to a specially installed tank which is used for the suction of the circulation pumps in the regeneration circuit. At least one or more prefilters must be installed right at the pump entrances to mechanically protect them from the waste that can reach them with the pool water. The prefilter consists simply of a sieve arranged like a detachable basket which is easy to access and clean.

The number of pumps and prefilters depends on the importance of the recirculation flows (very important in ensuring uniformity of the pool water) and the possible combinations of these flows to adapt to the different cases of how often the pool is used.

The tank used for pump suction, called the compensation tank, will have a volume that enables the following parameters:

Immersion limit of the pump units:
In line with the recommendations of the US Hydraulic Institute (process pump selection).

- *Minimum height from centre of pipe and water level: > 592 mm*
- *Minimum height from centre of pipe and ground: > 250 mm*
- *Minimum distance between pump pipes: 500 mm*
- *Minimum height between centre of pipe and walls: 188 mm. Useful volume of the compensation tank needed to clean the filter (3 minutes: 26 m³). Recommended solution*

Useful volume of the compensation tank for users: 62.5 m³. Recommended solution.
The tank level will be controlled by level probe equipment to automate:

- Stoppage of the pumping groups if the water level falls below the minimum immersion level.
- Opening and closing of newly added water in the minimum filter cleaning level.

The compensation tank will feature the DN 50 entry circuit for new water, equipped with an electromagnetic pass valve and a Woltmann-type water meter, and another DN 150 mm waterproof channel circuit connected directly to the drainage channel.

This circuit will enter the pool directly by the pH regulation circuit, specifically by the CO_2, GVG Injector.

12.E.3_SYSTEM LOAD LOSS CALCULATIONS

The calculation of the pool equipment will always be performed using the formula:

Q (Flow) is equal to:
$Q = (s \times h)/t$

Where:
S = water surface in m^2
h = pool height in metres
t = pool volume recirculation time = ½ hour equivalent to t = 2
Q = (1,250 x 2) / 4 = 625 m^3/h

The flow rate needed for climate control is 75 m^3/h *(according to the exchanger needs calculated in section E.6.)*
The flow rate needed for disinfection is 128 m^3/h *(according to the needs of the NEOLYSIS equipment)*

Therefore:

Qtotal = Qfiltration + QClimate QDisinf = 828 m^3/h

The speed of the fluid in the pipe must be less than or equal to 2 m/s. At higher speeds the system would suffer a pressure surge and the parts and techniques needed to fix it would be much more expensive than the cost of the pipe itself.

The following formula is uded to calculate the pipe needed:

$$\varnothing \text{ PIPE} = \left(\sqrt{\frac{Q}{V\pi}}\right) \times 2$$

Where:

Q = Flow in m^3/sec V = Fluid speed in m/s

To calculate the fluid load loss and be able to calculate the pump, it is necessary to consider that the real fluid calculation is much more complex than that of an ideal fluid, which could be represented in Bernoulli's equation for incompressible flows with no contribution of exterior energy such as:

$$\int_{p1}^{p2} \frac{dp}{=} + \int_{v1}^{v2} \frac{vdv}{g} + \int_{z1}^{z2} dz + \int_{p1}^{p2} dh_1 = 0$$

Due to the viscosity of real fluids, shear forces appear in their movement between fluid particles and surrounding walls and between different fluid layers. The partial differential equations that would generally solve the flow problem (e.g., Euler equations) do not, generally speaking, admit a solution. Problems are therefore solved by drawing on experimental data and using empirical methods.

Firstly, to know the equations to use, it is necessary to calculate the Reynolds number to ascertain whether the flow is laminar or turbulent.

$$RE = \frac{VDP}{U} \text{ or } \frac{VD}{V} = \frac{V\,(2R0)}{V}$$

Where:

V = fluid speed in m/s
R_0 = pipe hydraulic radius in m
P = fluid density in Kg sec^2/m^4
D = pipe hydraulic diameter in m
V = fluid kinematic viscosity in m^2/sec
U = absolute viscosity in kg sec/m^2

In our case, the result of the equation at a fluid speed of 2 m/s with a water temperature of 26ºC has an average of:

Re= 157,435.38 > 2,000 so the fluid has a turbulent flow.

From there we can use the general load loss formula whereby:

$$PC = F \frac{LV^2}{D2G}$$

Where:

F= friction coefficient
V = fluid speed in m/s
G = gravity m/s2
L = pipe length in m
D = hydraulic diameter in m

The problem lies in calculating the friction coefficient. That's why there are many equations for turbulent flow, such as, for example, the Blasius formula, applicable to transitional flows, the Hermann Burbach formula, or the Nikuradse, Dupult, Darcy, Levy, Kutter, Bazin, Prony, etc... formula.

For all pipes, the US Hydraulic Institute and the majority of engineers consider the ***Colebrook equation*** to be the most acceptable one to calculate F:

$$\frac{1}{\sqrt{F}} = -2\log \left[\frac{E}{3,7\,D} + \frac{2.51}{RE\sqrt{F}} \right]$$

For accessories, the load loss is calculated using the formula:

$$PC = K \frac{V^2}{2G}$$

Where k is the friction coefficient of each accessory the manufacturer provides or which can be found in tables in textbooks. With these data, the load loss obtained by the **filtering circuit** according to the projected hydraulic circuit is:

PC = 12 mWC

The pump needed would be the 7.5 kW KIVU model with a power of 400 V III 50 Hz.
(see technical information in the attachments)

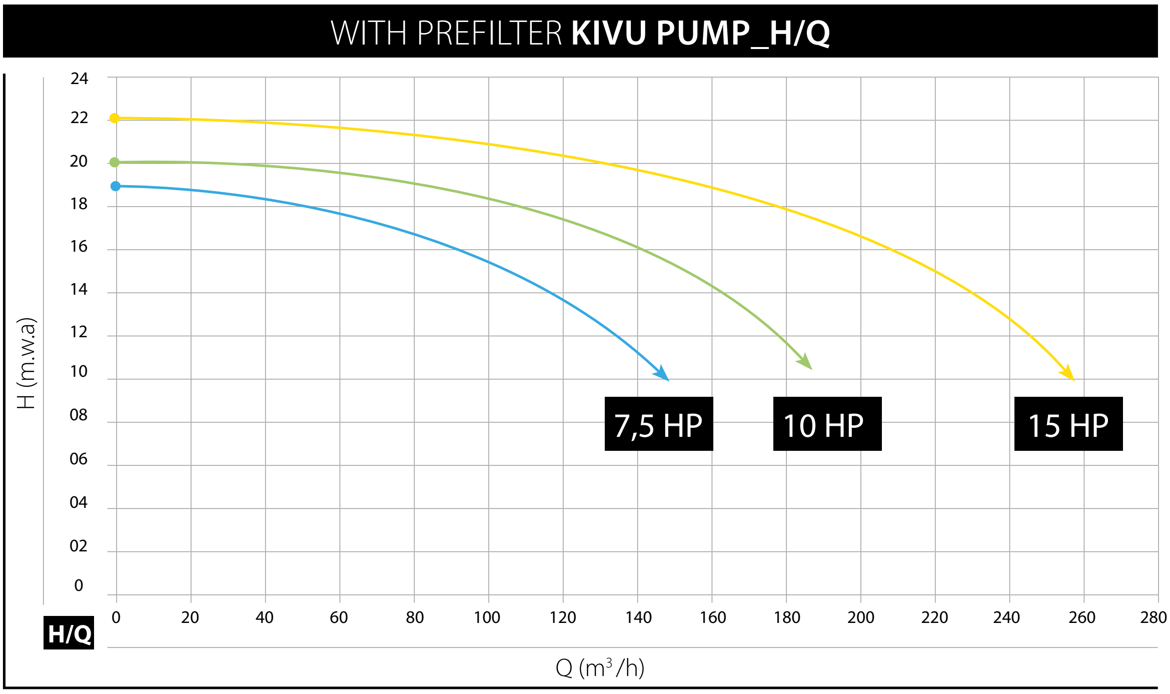
Three units will be installed. The load loss obtained by the HEATING circuit is:

PC = 28 mWC

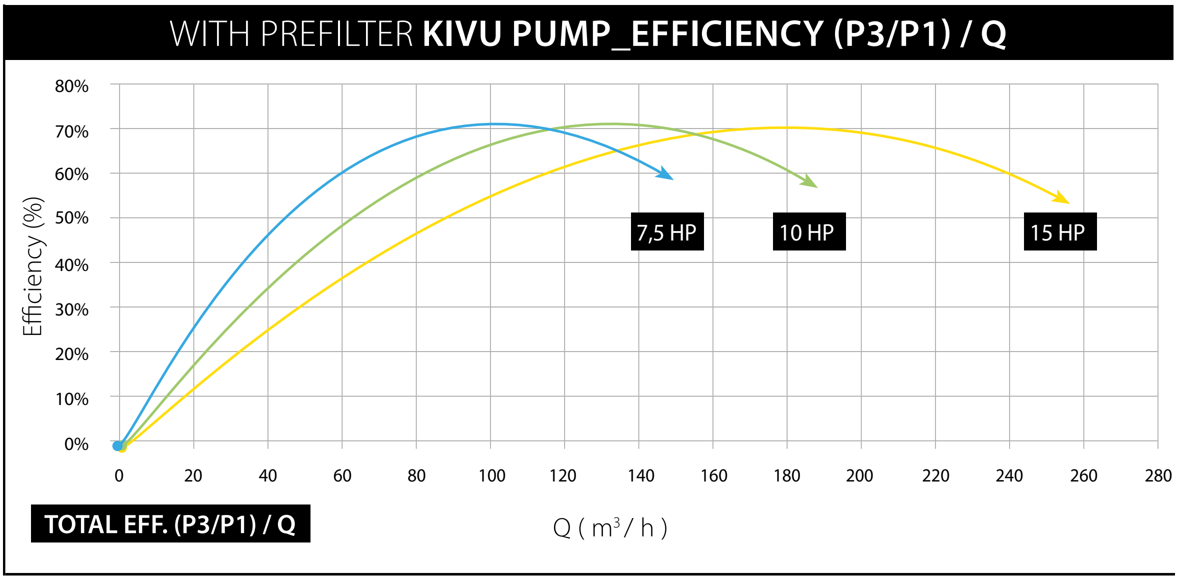
The pump needed would be the 3 kW NSCS model with a power of 400 V III 50 Hz or similar. Two units will be installed. The load loss obtained by the NEOLYSIS circuit is:

PC = 8 mWC

The pump needed would be the 5.5 kW KIVU model with a power of 400 V III 50 Hz or similar. Two units will be installed.



Pump output:



12.E.4_ FILTRATION

There are two main types of filters that can be used for filtering:

- **Pressure sand filters, loaded with sand.**
The scarce turbidity of the water enables high filtering speeds (between 15 m/h and 40 m/h) and enables fine-grade sand (0.4 mm to 0.8 mm).

A flocculation reagent must be added for perfectly clear water. Before filtering, take a small amount of aluminium sulphate (flocculant) to coagulate the matter in colloidal suspension, which will be retained at the top of the filter. If this precaution is not taken, the matter will cross the filter bed without being retained.

It should also be remembered that not using a flocculant results in a rise in chlorine consumption (or, generally speaking, disinfectant) because it combines with the non-retained matter, caused by the absence of coagulation. This high consumption of disinfectant is bad because of the rise in concentration in chloride it produces and because organic compounds also grow, and these are never desirable.

Because of their ease of cleaning, sand filters are recommended over other types of filters or absorbent-style filter beds (coal, perlite, etc.), where the amount of organic matter in them increases over time.

- **Candle filters, principally diatoms or perlite.**
They make water very clear so long as the filtering speed is limited to a maximum of 4 m/h. The water quality will depend on the filling method, the type of filter bed (diatoms or perlite) and, above all, how often the pool is used. If many swimmers use the pool it is highly risky to use these types of filters (Degremont Water Treatment Handbook 21.3.2.2.) because the filter bed clogs in a short period of time, resulting in a large consumption of electrical energy (the pumps have to work in high pressure curves), consumption of disinfectant and production of organic compounds (organic matter filling the filter bed), and consequently many daily changes of the filter bed (diatoms or perlite) with the major economic outlay this entails (cost of the diatom or perlite and work hours to make the change).

Filtration on the filter bed is employed when there is a lot of matter to be retained and the size of the particles contained in the water is fairly small.

This type of filtration consists in eliminating solids suspended in a liquid by passing the liquid through granular material. Various mechanisms are involved in this filtering process: physical separation through the bed's narrow channels, physical absorption by the granular particles and coagulation/flocculation. Because of these mechanisms, a filter of this type can retain particles of a much smaller grade than filters that are empty inside the bed. Given that granular filtering is more efficient, the full depth of the bed must be utilised.

Unlike candle filters, regenerating the filter bed with sand filters once they have been positioned is quick and easy to do. They simply have to be washed with upflow water (contrary to the filter flow) for a maximum of 3 to 5 minutes to recover 100% of the bed without having to change or add new sand. It could be said that a properly washed sand filter only has to be replaced as a result of friability (fines produced by larger products breaking into pieces during washing), which is clearly insignificant in a pool's service life.

Silica sand is the material that has traditionally most commonly been used in filtering and the one that is still used in most contemporary filters. The effective size used for pool water treatment is around 0.4 to 0.8 mm.

Using it together with a coagulation reagent delivers perfectly clear water, with a considerable saving on disinfectant.

BOBBIN WOUND FILTERS EXPLODED DRAWING_ **PRAGA FILTERS WITH COLLECTORS**

12.E.4.1_ FILTRATION CALCULATION

The following formula is used to calculate the filter diameter:

$$\oslash \text{FILTER} = \left(\sqrt{\frac{Q}{V\,\pi}}\right) \times 2$$

Where:

Q = Recirculation flow in m^3/sec

V = Speed in m/sec

The recommended speed for pools of this type has been justified previously as the slower the speed the better the filtering quality. That is why the recommended speed is 30 m/h.

With these data, the result will be:

- 6 units of **vertical** type bobbin-wound filters ⊘ 2,000 mm diameter, made from fibreglass and polyester resin. These filters are fully anticorrosive. The maximum operating temperature has to be 50ºC. The filter must comply with the European Pressure Equipment Directive 97/23/EC. The maximum work pressure is therefore 4 kg/ cm^2, while the hydrostatic test must be 1.5 times the maximum work pressure. The filter will include manual air and water purges, as well as an opening with a 400 mm diameter. The filter's hydraulic connections will be ⊘ 140 mm (DN 125).

The parts inside the filters will be made from PVC and PP and the screws from stainless steel. The PVC accessories and piping must comply with the DIN 8062, DIN 8063 and UNE 53112 standards and with the ISO R1 recommendations.

The resistance and thickness calculations of the filter wall will follow the BS-4994 standard and the safety coefficient used will be 10 (minimum coefficient according to standard 8).
The filters will be made using numeric control machines that make it possible to control the amount of reinforcement in each operation.

The resin to use must be polyester (GF-UP1 according to DIN 18820) and fibreglass.

The filter wall will have two very different parts:

1. Angled fibreglass laminate with a chemical protection layer of the following characteristics according to DIN 18820: LAMINATE DIN 18820-GF-UP1-M3-35B-CSS-2. The resin of the CSS chemical protection layer will be type UP3 according to DIN 18820 (isophthalic acid-neopentyl glycol based gelcoat). The areas where discharges are performed must be reinforced with an additional MW type sheeting.

2. Bobbin-wound laminate according to DIN 18820 of the type LAMINATE DIN 18820-GF-UP1. This sheeting will have a polar winding and a radial winding with the cylindrical part of the filter.

The filters will be subjected to five hours of curing at 80ºC on the inside.

The chemical protection layers must comply with German standard KSW (certified by LVHT).

BOBBIN WOUND FILTERS **PRAGA FILTERS 2,5 BARS**

	CODE	00687	00694	00688	00702	00689	00696	00703	00690	00697	00691	00698	00705	00692	00699	00706
Diameter	Ø	1050		1200		1400			1600		1800			2000		
Connections	inch	63	75	75	90	75	90	110	90	110	90	110	125	110	125	140
Filtering velocity	m³/h/m²	20	30/40	20/30	40	20	30	40	20	30/40	20	30	40	20	30	40
Filtration area	m²	0.56		1.13		1.54			2.01		2.54			3.14		
Flow	m³/h	17	25/34	22/33	45	30	46	61	40	60/80	50	76	101	62	94	125
Working pressure	bar	2.5														
Sand 0.4-0.8 mm	kg	950		1375		1650			2150		2800			3800		
Gravel 1-2 mm	kg	300		300		450			675		750			1050		
Service weight	kg	2000		2700		3700			4900		6100			7900		
Swimming pool	m³	136	200/272	176/264	360	240	368	488	320	480/640	400	608	808	492	752	1000
Box dimension	m	1,15 x 1,15 x 1,85		1,31 x 1,31 x 1,97		1,48 x 1,48 x 1.89			1,72 x 1.72 x 2		1,88 x 1,88 x 2,01			2,1 x 2,1 x 2,33		
Volume	m³	2,446		3,38		4,14			5,916		7,104			9,834		

A manifold of 5 butterfly valves of ∅ 140 mm (DN 125) that makes it possible to recirculate the water during filtering processes, backwashes and rinsing of the filter. The accessories, pipes and valves used in the construction of the manifold are made from PVC – PN 10.

Double pressure-gauge panel connected to the filter inlet and outlet. The function of the pressure gauges is to control water pressure during filter operations. The gauge display will indicate the time to perform the filter backwash.

12.E.4.2_ FLOCCULATION

The swimming pool may have a large user capacity and undergo use by a very large number of swimmers, especially if it is used for a championship. Before competitions, all athletes want to train and warm up in the competition swimming pool, which produces a large amount of organic matter that must be filtered out.

This high level of activity may affect the water quality level, above all in terms of its transparency.

The only way to prevent this problem is:

1. Installing enough quality filter units in accordance with the type of swimming pool.

2. Maintaining fresh water quality levels compliant with the required rules and regulations.

3. Proper chemical/physical treatment.

In order for these points to be dealt with as functionally as possible, the swimming pool water is treated using a flocculation system that makes it possible to increase the filter units and disinfectants' performance levels, resulting in a much better water transparency level.

The system consists of adding a flocculant prior to filtering. It is introduced after the pump but before the filter, in an accessory, to take advantage of the flow turbulence, using flocculant mixers.

As a result of this mixing, this chemical reacts with the colloidal particles that are responsible for making water cloudy and forms floccules of a much larger size that can then be removed by the filter.

In order to achieve the utmost efficiency when the flocculant is added, a constant injection system with a dosage measuring pump will be installed.

The flocculant used must always be of a liquid type

TECHNICAL CHARACTERISTICS OF THE FLOCCULANT TO BE USED

REFERENCE	041
PRODUCT	Liquid flocculant
PROPERTIES	Specification
Appearance	Liquid
Colour	Colourless
Apparent density	1.17 - 1.21 G/cm^3
Ph of a 1% aqueous density	1.5 - 2.5
Content (%): - al_2o_3 total	9.5 Min
Chlorides	11.5 ± 1.0
Sulphates	1.5 ± 0.5
Density (25 ºc)	1.21 ± 0.05
Ph (1 % 20 ºc)	2.5 ± 1.0

Description: Newly designed polymer with extra strength as a flocculant able to remove the colloidal particles found in swimming pool water.

Dosage and instructions for use:

Recovery Treatment

With the filtering unit turned off and no swimmers inside the swimming pool, add 10 ml of the product for every m^3 of water.

Pour the proper dosage of the product into a container full of water and distribute this solution over the swimming pool surface evenly.

After 8 hours, the layer of floccules that have settled on the bottom of the swimming pool may be collected and removed.

Maintenance treatment

This may be performed using a dosing pump, by injecting 0.5 ml of the product for every m^3 of circulating water before the filter.

SOLUTION TECHNICAL DESCRIPTION

CHARACTERISTICS
High coagulation speed.
Good decantation speed.
Satisfactory behaviour at low temperatures.
Possible use in a wide range of pH levels.
Eliminates use of products for adjusting pH.
Lesser tendency towards overdosing.
Removes metal ions such as iron and manganese.
Formation of floccules which are easy to filter.
Lower soluble aluminium content in treated water.
Removal of organic matter.
Effective against very cloudy water.
Improves the bacteriological quality of water and, as a result, lowers use of products required for disinfection.

12.E.5_ DISINFECTION

Disinfection is a very important stage within the treatment, because it is relied upon for preventing the transmission of contagious diseases among swimmers and preventing the development of microscopic algae that make the water cloudy.

Since October 2013, **Fluidra** has begun research studies on the benefits which may be achieved by using a new swimming pool water treatment system known as the ***FreePool system***.

Those facilities treated in a conventional manner, with chlorine and acid, are subject to a series of inconveniences, basically consisting of chlorinated by-products in the water and environmental pollutants (which require the use of large amounts of fresh water and air). These have a direct effect on users (swimmers, lifeguards, trainers, the public, etc.) in terms of both comfort and health: irritation in the eyes and nose, coughing, wheezing in the lungs, difficulty breathing, skin irritations, asthma, etc.).

The new treatment system, based on eliminating the dependence upon adding chemicals into the water (low-salinity saline electrolysis units, UV disinfection and controlled high-performance CO_2 injection), has made it possible to lower environmental pollutants by 400% and increase users' comfort level by more than 30%, thereby improving the health-related conditions in these installations.

The air exhaled by more than 50 volunteers was analysed, all of whom were world-class athletes (the CNAB water polo team, European champions in 2014). In addition to this, statistics were taken from a group of more than 600 individuals.

All of the results of the clinical studies and statistics are backed by the Hospital Clínic in Barcelona, as are all of the best water and environmental tests by the Universitat Autònoma of Barcelona (UAB).

The ***FreePool*** procedure for disinfecting water basically uses the following equipment:

Neolysis units with automatic hypochlorite production that do not require adding salt into the swimming pool water.

Hypochlorite injection will be performed from a main tank with a metering pump to keep the chlorine concentration levels adjusted properly in the event of extreme need.

pH regulation with CO_2, using a high-performance ***GVG-Injector***.

MCS management and control software.

freepool UAB CLÍNIC BARCELONA

12.E.5.1_ NEOLYSIS

Combining UV technology with low-salinity electrolysis into one single reactor has turned out to be a good solution for swimming pool water treatment and disinfection. The Neolysis system is able to combine the most notable features and advantages of each of these technologies on their own and mutually correct their flaws, inconveniences and limitations. Both UV technology and electrolysis are well-known and marketed, but up to now the surprising results of this combination in one single reactor has not been claimed or known.

Its main characteristics and advantages are:

- There is no need to add salt to the swimming pool.
- Dual high-strength disinfection (UVC + on-site chlorine / anodic oxidation).
- Increase in the ability to remove chloramines (UVC + cathodic reduction).
- Increases in the positive effects on sustainability due to the water and energy savings achieved. Filter backwashing for the sole purpose of lowering chloramine levels (<0.6 ppm) is no longer required.
- Synergistic treatment of great interest due to possessing oxidation capacity with residual effects.

12.E.5.2_ PH REGULATION WITH CO_2

The usual correction of pH in swimming pool water consists in decreasing pH or, in other words, in acidification, because normally the residual disinfectant added also causes a shift towards alkalinity, which is often not compensated even in cases in which the newly replenished water is slightly acidic. What is usually added are strong acids, such as hydrochloric or sulfuric acid.

The substitution of strong acid with carbon dioxide is now performed for many uses, including those with other purposes. For example, it is used inside greenhouses in Almería to prevent the build-up of chlorides, whose levels are already high in the local water. In swimming pools, it may also potentially be used, but with the objective of preventing the accidental mixture of bleach with hydrochloric acid.

The operating principle is that carbon dioxide turns into carbonic acid when it comes into contact with water. Although it is a weak acid, it is capable of maintaining the proper pH levels.

The dosage measurement system is similar. In other words, changing to this system does not cause increased complexity in the installation, but it does lead to a drastic reduction in the risk caused by storing and handling a strong acid and a chlorine-based disinfectant at the same time. The accidental mixture of these two chemicals translates into the constant occurrence of accidents due to the inhalation of chlorine gas, sometime causing serious injury. The use of carbon dioxide therefore entails the full elimination of this risk.

A GVG-Injector injection unit will be installed for the injection of CO_2. Its injection system which uses a suction effect and a high-performance contact chamber causes dioxide use to be far below the average for all other systems.

According to studies by the UAB, after months of effective operation of Fluidra's GVG, managing CO_2 use in an Olympic swimming pool measuring 25x17 m at the SAF of the UAB, as of February 2, 2015, this second operational report was drafted.

The objective of this study under way is to determine the effects of injecting pH-reducing gas through the GVG system instead of doing so directly. For this purpose, the SAF of the UAB considered data from prior years in which the addition of such gas was performed first, as of 2003, by direct injection into the water pipeline. Afterwards, as of 2008, this was done through a sintered filter, also in the case of the 25 m swimming pool, through a competitor's system that was more efficient in prior years. Therefore, the comparison performed herein is completed with this prior system, which can be considered the best of those which the UAB had tested up to the time.

The UAB possesses data from 2010 to 2014 which is separate from this pH reducer for the olympic swimming pool. Two periods have been compared from that time span:

1. From 2012 to 2012, with an experimental dissemination system.

2. The periods of February 2 to April 2 and June 16–30, 2015.

The prior years have been ruled out because the injection system was less efficient then.

The results found were as follows:

SYSTEM FOR SAF DISSEMINATION IN AN 881 M^3 SWIMMING POOL	
CO_2 usage in kg according to tank values, 2012	2,128
CO_2 usage in kg according to tank values, 2013	1,628
CO_2 usage in kg according to tank values, 2014	1,961
CO_2 consumption in kg according to average tank values from 2012 to 2014	1,906
Usage in kg/m^3 per day	5.22E-03

GVG SYSTEM IN AN 881M^3 SWIMMING POOL	
CO_2 usage in accordance with the values on sets of tanks from February 2 to April 2 and June 16-30, 2015	288
Projected usage for one year of CO_2 in kg, according to values on sets of tanks 2015	1,513
Usage in kg/m^3 per day	4.15E-03

This means that the GVG, although it was only used in the 881m3 swimming pool, allowed for a decrease in use which, if projected for one full year, would be equivalent to a savings of 20% on the gas used by that pool.

The second result found was a reduction in usage with the GVG linked to weekends and holidays, which may reflect the impact on CO_2 usage caused by a lower number of incoming pool users, because swimming pools are kept filtered with the same chlorine and pH levels 24 hours a day despite this.

Average use in kg on work days with gvg per m^3 and day	5.17E-03
Average use in kg on weekends and during easter week with gvg per m^3 and day	3.87E-03

In other words, the lesser use by the public leads to a 25% decrease in the use of pH reducers. This result matches that found by modelling usage in another project that the UAB presented has previously backed.

12.E.5.3_ MCS MANAGEMENT SOFTWARE

In order to achieve savings on energy and water in these types of installations, it is essential to use MCS monitoring and management software.

MCS software includes all of the knowledge from the results of **Fluidra's** R&D studies performed in conjunction with the UAB. All of the algorithms for calculation, prediction and management are included in the PLC control programs, and therefore it automatically manages the installation, allowing it to become much more efficient.

The maintenance staff has the same units as with a conventional swimming pool (which is why the installation is no more expensive or complicated), but the system monitors of the pool when it is in automatic mode.

To achieve this, the program communicates with the swimming pools' conventional devices, including the Cl and pH regulators, Redox, etc., and it interacts with the settings on the units in order to start up and stop different systems automatically.

Its maintenance is extremely simple, because most of its equipment is exactly the same as that normally used in any swimming pool, which is why any sort of repair or replacement part is the same with or without MCS.
For this installation, five management modules are used, as follows:

MODULE 1: CONTROL

This module, as its name indicates, is the one that controls the basic swimming pool parameters managed mainly by the prediction algorithms, along with the installation's occupancy control.
The disinfection and recirculation flow values are controlled in accordance with the installation's real needs, in accordance with the pool's capacity at the current moment. This leads to huge savings on energy and disinfectants.

This module controls:

OCCUPANCY_
Using software and special cameras that respect privacy, it determines the number of occupants in the installation at all times. By calculating the value of this variable, the management algorithms determine the installation's actual needs.

FREE CHLORINE_
We know a swimming pool's capacity and occupancy at all times. The MCS uses this to predict the amount of chlorine needed, by foreseeing required levels in order to prevent excess peaks and consumption levels.
In the event of excess occupancy at some specific time, it starts up the chlorine dose measurement pump so that chlorine is never lacking in the swimming pool water.

pH_
Altering a swimming pool water's pH is mainly caused by producing and adding chlorine, by the swimmers themselves and by adding fresh water. MCS pH control predicts a swimming pool's needs in advance so as to maintain the utmost water quality with the lowest consumption levels.

REDOX_
This value, which is very important for ensuring proper water disinfection, is read and monitored. If the values are not appropriate, a warning alarm goes off to check the water.

AMBIENT TEMPERATURE_
This monitors the ambient temperature, which is also affected by the number of users.HR. Reading on swimming pool users' comfort.

MODULE 2: MAINTENANCE

This module contains all of the installation's control and maintenance utilities, with historical data, alarms, control of records, etc.

Its greatest strength is that all of the data stored can be exported into standard files (such as Excel) so as to be able to complete the proper analyses on how the installation is running.

This module includes:

USER RECORDS_
This module makes it possible to manage the MCS's users (new users, removed users, user IDs, passwords, hierarchy, etc.). Without this module's permission, it is not possible to access the information.

MAN-MACHINE INTERFACE_
It is in this module that small adjustments can be made in an installation's setup, such as the nature of the water, the weather in the area, etc.

ALARM SETUP_
Module in which all of the desired alarm values are set up, who it is sent to, and historical data on all of this, etc.

GRAPHS AND CHARTS_
Graphs showing the historical values of the different variables being monitored.

REPORTS_
Daily, weekly, monthly or yearly reports on an installation's different data figures.

12.E.5.4_ ADVANTAGES OF THE FREEPOOL SYSTEM

The main advantages in using the **Freepool system** are:

- There is a reduction in the total content of oxidants in the atmosphere given off by the pool water, specifically chlorine gas, due to the use of CO_2 instead of hydrochloric acid and due to the addition of the ozonation stage. The users' discomfort and health problems arising from oxidising agents disappear completely.

- The water's conductivity increases more slowly when it is neutralised with dioxide instead of with hydrochloric acid. In fact, in the former case, it even stabilises against the apparently sustained growth generated by the hydrochloric acid. The trend observed in the level of chlorides at least partly explains this conductivity. Attributing the increase in conductivity in pools to a greater formation of salts and other solutes, the use of CO_2 to reduce the conductivity would also mean a reduction in the environmental impact that these facilities pose.

- It has been possible to establish a situation from this that indicates that the consumption of sodium hypochlorite is lower when the pH reducer is carbon dioxide.

- It is safer to handle and use because CO_2 is an inert, non-toxic gas that does not react with other chemicals used in these kinds of facilities.

- There is a reduction in the water's sub-products, thus making a great saving on not having to renew the water in the pool.

All of these advantages are fully reasoned in the reports from the Hospital Clínic of Barcelona and from the UAB University.

12.E.5.5_ HOSPITAL CLÍNIC REPORT

INTRODUCTION

In recent years there has been a growing interest and concern in evaluating potential risks there may be for the respiratory tree when there is repeated exposure to chlorinated products, particularly for those who do competitive water sports like swimming races or water polo, who are exposed for a long time to air contaminated with chlorine.

The pool water must undergo a procedure to prevent infections. Chlorination of water by adding small amounts of chlorine is the one most commonly used. The chlorine added to the water - usually in the form of sodium hypochlorite - almost completely hydrolyzes to form hypochlorous acid and a hypochlorite ion. To prevent evaporation of chlorine in outdoor pools, trichloroisocyanurate tablets can also be used that release chlorine continuously. There are several advantages of chlorine: it is cheap, easy to use and acts as a powerful germicide. The concentrations of chlorine must be strictly controlled to avoid negative effects on human health. The free chlorine levels considered to be acceptable vary widely by country. Generally, it is recommended that the level of chlorine in public pools should not exceed 3 mg/L.

There are other alternatives to chlorine that have been put forward as options to avoid its effects such as ozone, ultraviolet light and hydrogen peroxide, but they are all more expensive than chlorine and their effectiveness and effects on health have not as yet been evaluated in depth (Nieuwenhuijsen MJ. 2007).

The possible effects of exposure to chlorine in swimming pools on the development of asthma in children has been the subject of several studies with mixed results. In some cases, the differences in the prevalence of asthma in children in European countries have been attributed and related to the number of indoor pools in the communities (Nickmilder M, 2007). Other authors disagree with these interpretations and suggest that the acceptance of a relationship between the prevalence of asthma and the number of swimming pools requires a convincing demonstration of the existence of a causal relationship between the activity of swimming and the development of asthma (NEMERY, B. et al. 2002).

Several studies suggest that swimmers who do sports for competition show asthma symptoms more frequently than expected (Potts, J., 1998). Helenius et al (Helenius et al., 1998) found that elite swimmers had a higher proportion of eosinophils and neutrophils in their sputum than in healthy control individuals. They also found that these athletes had greater bronchial reactivity, particularly those with eosinophils in their in sputum. From these data, they concluded that prolonged exposure to chlorinated compounds may contribute to the development of bronchial inflammation and bronchial hyperresponsiveness. These same authors also investigated the behaviour of the parameters for inflammation and bronchial hyperresponse in elite swimmers who stopped doing the sport at a competitive level. They found that on stopping doing the sport professionally, there was an improvement in bronchial inflammation and bronchial hyperreactivity markers, while those who continued their sporting activity showed a greater trend towards increasing eosinophilic inflammation (Helenius et al. 2002).

Piacentini et al (Piacentini, G.L. et al., 2007) studied a group of professional swimmers and found an increase in levels of leukotriene B4 in the exhaled breath condensate, which they attributed to the presence of neutrophilic bronchial inflammation. In the same vein, Moreira et al (Moreira, A. et al., 2008) found that elite swimmers suffered from a mixed neutrophilic-eosinophilic bronchial inflammation, discovered on carrying out a cellular analysis of the induced sputum. Recently, a new study has shown that competitive swimming in chlorinated pools is associated with histological changes similar to those observed in asthma. In addition to this, there is increased activity in some genes (MUCs) that regulate bronchial secretion. These data confirm that the inflammation associated with exposure to chlorine is accompanied by bronchial remodelling phenomena (Bougault, V. et al. 2012).

The data gathered until now suggest that elite swimmers suffer from bronchial inflammation associated with bronchial hyperresponse and remodelling. This would be a form of asthma associated with exposure to high concentrations of chlorine, which acts as an irritant.

During training, these athletes move a large amount of air as they ventilate up to 200 L/min to do the sport, which can lead to inhalation of large quantities of air rich in the chlorine present near the water surface, which is ultimately responsible for the lesions described in the airways.

Although this is not the reason for this work, it is worth remembering that, despite being subject to debate, there are studies that indicate that the chlorine in swimming pools can also affect the health of those who do water sports in indoor pools for non-competitive or simply recreational sports (Bernard, A. et al. 2003).

The impact of chlorine on the airways has been measured using invasive methods (bronchial biopsies, analyses of blood markers) and non-invasive methods (exhaled breath condensate). The ideal methods for carrying out field studies on wide samples of populations are those that do not involve discomfort for the patients and which are sufficiently sensitive to be able to reveal relevant alterations.

On studying the effect of chlorine on the airways, the protein of Club (Clara) cells or CC16 has been measured, proving to be a sensitive, valid biological marker for evaluating pulmonary lesions and lesions that affect the respiratory epithelium (Bernard, A. et al. 1994; Hermans, C., Bernard, A., 1999).

This happens because CC16 is produced in the airways, and because of its small size (16 kDA) and high concentration in the lungs it can diffuse into the blood flow. Nonetheless, any increase in the permeability of the pulmonary epithelial barrier that occurs with a pulmonary lesion, or an increase in the production and secretion of this protein in response to the inflammation, gives rise to a higher diffusion rate of CC16 into the blood (Broeckaert, F., Bernard, A., 2000).

In spite of everything, its use is questionable since contradictory results have been found in different studies. In some cases, the changes have been related to simply doing physical exercise, without the levels being clearly changed by exposure to respiratory irritants (Font-Rivera, L. et al., 2010). For all of these reasons, it is not considered to be a reliable marker.

Measurement of the nitric oxide exhaled has been used in previous studies, but it has not been possible to demonstrate its use in detecting the presence of inflammation of the airways in swimmers exposed to breathing in chlorine (Font-Rivera, L. et al. 2010).

Out of all of the markers used until now, the measurement of the concentration of leukotrienes related to eosinophils (LTC4, LTDD4 and LTE4) and those related to neutrophils (leukotriene B4) in exhaled breath concentrate seems to be the one with the greatest sensitivity and reliability. Thus, it can be considered advisable for evaluating lesions made by chlorine in the airways (Piacentini, G.L. et al., 2007).

HYPOTHESIS

Given that exposure to chlorine in swimming pools causes inflammatory lesions and bronchial remodelling in elite sportspeople, by using a disinfectant system that does not use substances that are harmful to the respiratory system it will be possible to prevent lesions to the breathing apparatus detected when using chlorine.

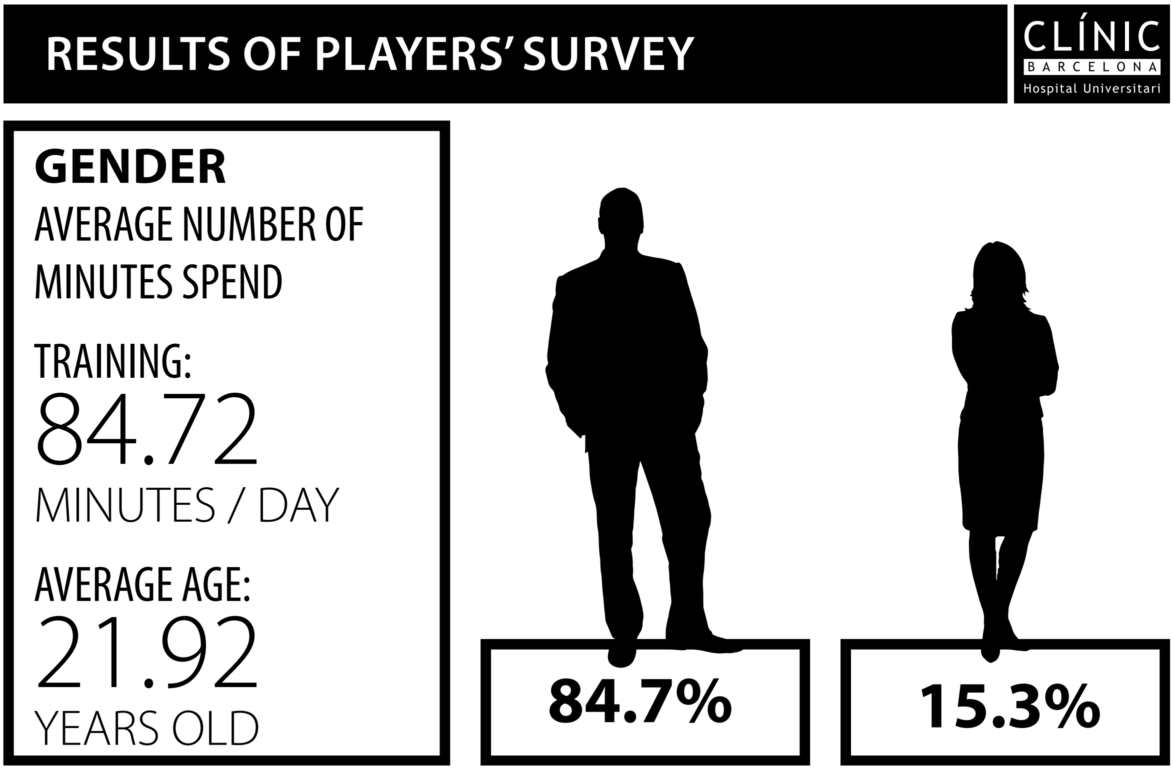
AIM

To study the benefits of a disinfection system for water in swimming pools that is not based on chlorine and to demonstrate that it is not harmful to the airways of professional swimmers or those of ordinary, non-competitive pool users.

INDIVIDUALS AND METHODS

1. STUDY ON SWIMMERS

Design. Fifty professional swimmers will be studied of both sexes who are non-smokers and over 18 years of age. All individuals participating shall be volunteers recruited from swimming or water polo teams of a high competitive level who for this reason undergo intense training schedules in indoor pools.

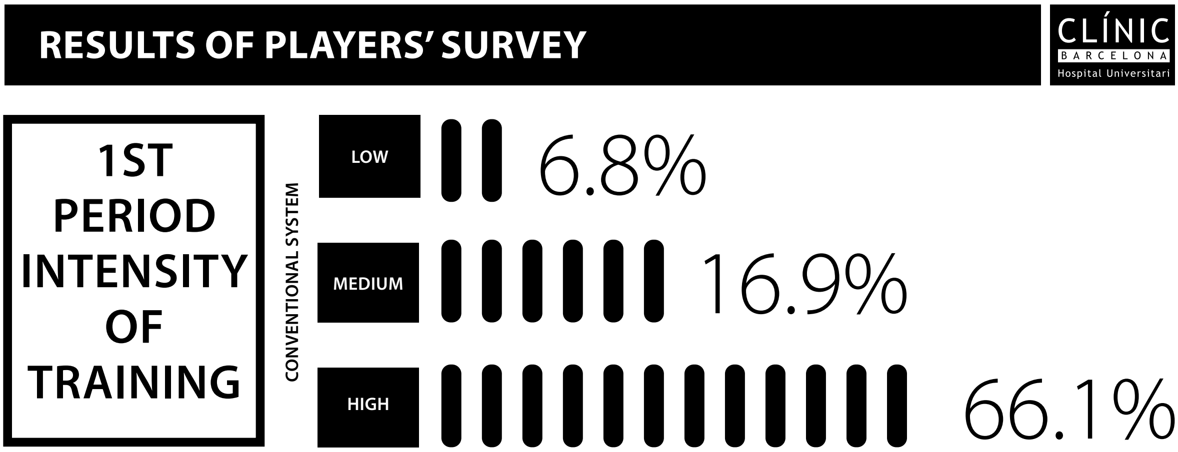


All volunteers shall be informed of the study and will have to give their permission in writing. By means of a questionnaire, information will be gathered pertaining to demographic data; personal and family medical history as regards atopy, weight and height; diagnoses of respiratory and non-respiratory illnesses; and time spent doing the sport in months.

The study will be a double-blind study, so that neither the swimmers nor the observers (pneumologist and nurse) shall know which method has been used to disinfect the swimming pool. It shall be decided by a random draw whether or not the study shall begin by using the disinfection method based on chlorine or not. The non-chlorinated method shall be implemented by means of technology that combines photo oxidation with electrochemical processes, and which also uses carbon dioxide to regulate the water's pH.

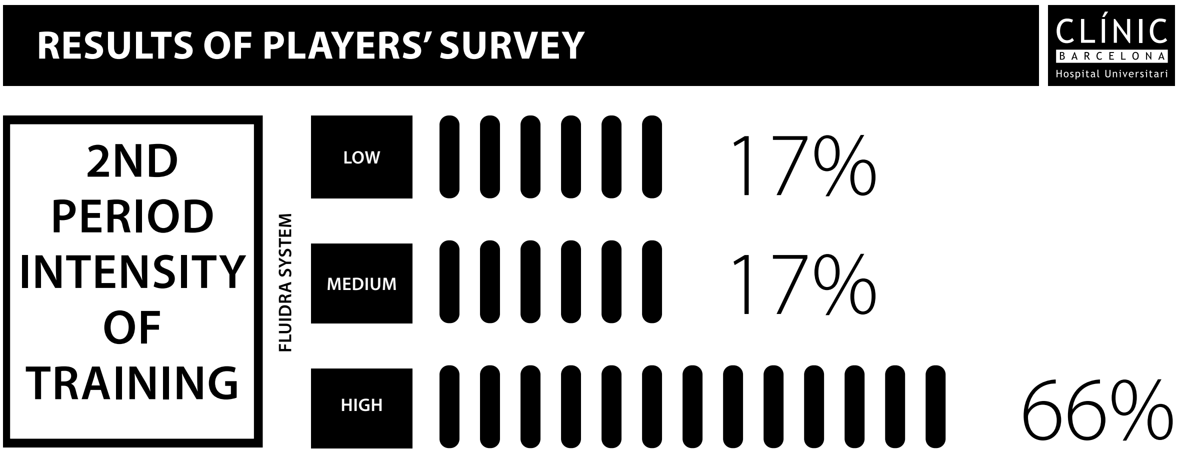
First part of the study (PHASE A) A single swimming pool shall be used. Each day, 2-4 volunteers shall be evaluated before and after exercising in the pool. They will carry out a series of procedures sequentially for three hours. First, exhaled breath condensate shall be collected using an EcoScreen condenser (Jaeger GMBH, Germany) following the recommendations from the ERS/ATS Task Force (Horwath I, et al. 2005). The samples shall be obtained while the individuals breathe normally until a total volume of 180 L has been attained. The tube for collecting the sample shall be centrifuged at 4°C and the liquid obtained shall be transferred to Eppendorf tubes to be quickly frozen with liquid nitrogen. The samples shall subsequently be freeze-dried and kept frozen at -80°C until they are to be analysed. The levels of LTC4, LTD4, LTE4 and LTB4 leukotrienes shall subsequently be measured using a commercial ELISA kit previously validated by liquid chromatography and mass spectrometry (Montushi P, et al. 2003) following the manufacturer's instructions (Cayman Chemicals, Ann Arbor, Michigan, USA).

After doing the usual training for 3 hours and after a rest period of 15 minutes, the exhaled breath concentrate shall be obtained again and new spirometric measurements shall be taken.



By means of a questionnaire, the symptoms shall be gathered and quantified using a scale of 1 to 4 to judge the presence of ocular symptoms (stinging, tears), nasal symptoms (itchiness, hydrorrhea), bronchial symptoms (coughing, feeling of irritation in the airways, wheezing) and skin symptoms when doing the sport.

Second part of the study (PHASE B). The system for disinfecting the pool shall be changed. Five weeks after changing the system, the second part of the study shall begin in which the same sequence of examinations as in the first study shall be reproduced: collecting the exhaled breath condensate and ocular, nasal, bronchial and skin symptoms.



2. STUDY OF USERS

A study shall be carried out on the repercussions of the pool environment on the respiratory systems of the users who swim routinely in the pool for non-competitive purposes.

The study shall be carried out by using a survey made in the pool premises answering via a computer program. The survey shall be made in the two situations of water treatment for the pool (PHASES A and B).

Statistical analysis. The distribution characteristics of the variables shall be analysed by means of appropriate tests. Means and medians shall be used to show the variables. The basal values obtained and those obtained after doing the sport with the two methods of disinfection (with and without chlorine) shall be compared using parametric and non-parametric tests depending on the distribution characteristics of the variables. The limit to consider the result to be statistically significant shall be $p<0.05$.

RESULTS

The two study phases are called PHASE A (basal) and PHASE B (after changing the water treatment system).The two phases were separated by a period of five weeks between the ending of PHASE A and the beginning of PHASE B.

Study of users: There were 320 users of an average age studied with a gender distribution of 37% women and 63% men.

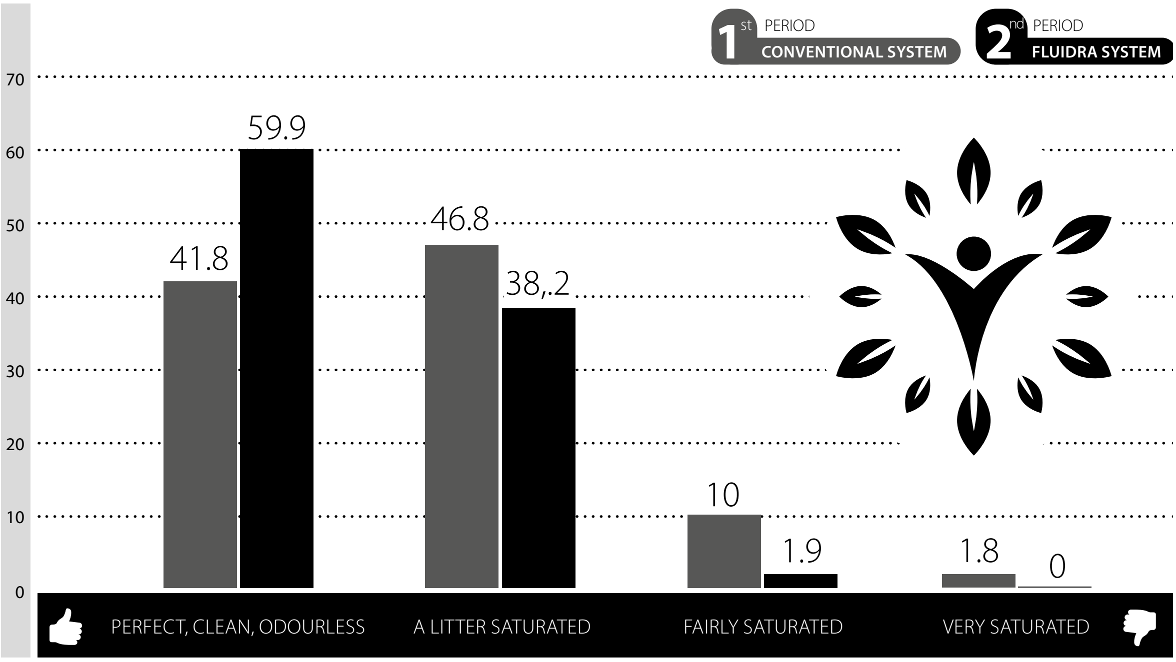
The frequency with which the users went to the swimming pool varied from 3% who only went once a week, to 16%, 47% and 34% who did so once or twice, 2 to 4 times or 4 to 7 times respectively. The time dedicated to swimming varied from those who did it for 30 minutes or less (42.1%) to those who swam from 30 to 60 minutes (36.5%) and those who did so for over 60 minutes (21.4%).

As for the clinical history, it was noteworthy that 5.8% had been diagnosed with asthma, and 14.6% suffered from or had suffered from a process diagnosed as being due to allergies. There were 2.8% who were receiving anti-asthmatic treatment and 1.8% anti allergic treatment. The ocular, nasal, respiratory (coughing, breathlessness and wheezing) and skin symptoms were evaluated. The symptoms were evaluated according to a scale of 1 to 4 from lesser to greater severity, where 1 meant no discomfort, 2 meant slight symptoms, 3 mild symptoms and 4 severe symptoms.

In PHASE A, most users said they did not have symptoms or had slight symptoms in their eyes, nose and breathing when swimming. A low percentage had mild ocular, nasal and breathing (mainly coughing) symptoms, whereas severe ocular and nasal symptoms were only present in a very small number of users. As regards breathlessness and wheezing, these were only present in a few users (Table 1).
In PHASE B, an increase in the number of users who did not have symptoms was observed in line with the decrease in the number of users who had slight, moderate or severe symptoms. The statistical study shows a statistically significant improvement in the ocular ($p<0.0001$) symptoms, nasal symptoms ($p<0.0001$), and coughing (<0.0001), breathlessness ($p<0.003$) and skin ($p<0.006$) symptoms.

In the case of wheezing, there were no statistically significant changes observed, most certainly due to the fact that in PHASE A only 1.2% of the users had this symptom and therefore the margin for detecting improvement in this symptom was very slim. The survey also included a question regarding the evaluation of the environment (atmosphere) in the swimming pool premises, classified as in the case of the symptoms into four levels: hardly saturated at all, slightly saturated, mildly saturated and very saturated. Compared with PHASE A, the users detected a statistically significant improvement in PHASE B ($p<0.0001$) in the swimming pool's general environment. The subjective sensation that the environment was perfect, clean and with no smell rose from 42% to 60%.

RESULTS OF THE SURVEY OF USERS



The conclusion from the study carried out on the users of the pool is that the change in treatment of the water meant an improvement in the sporting facility's general environment and a significant improvement as regards discomfort (symptoms) usually suffered by the users of indoor pools, which have been attributed to the use of chlorine to disinfect water.

Study of the sportspeople: There were 53 sportspeople studied with an average age of 22 years: 85% men and 15% women; water polo players (64%) and swimmers (36%).

As for the clinical histories, it was noteworthy that 8% had been diagnosed with asthma, and 25% suffered from or had suffered from a process diagnosed as being due to allergies. There were 7% who were receiving anti-asthmatic treatment and 11% anti allergic treatment.

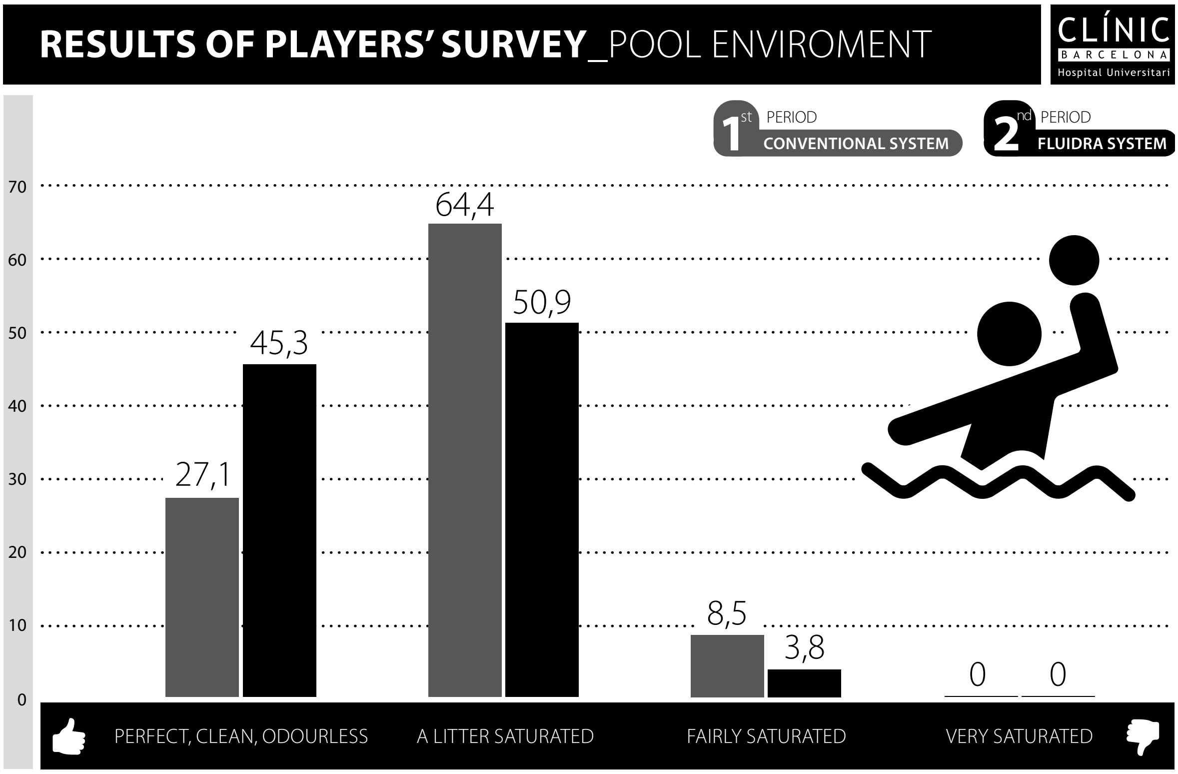
In PHASE A, most of the sportspeople said they did not have symptoms or had slight symptoms in their eyes, nose and breathing when swimming. A low percentage had mild ocular, nasal and breathing (mainly coughing) symptoms, whereas severe ocular and nasal symptoms were only present in a very small number of users. As regards breathlessness and wheezing, these were only present in a few sportspeople (Table 1).

The comparison of the symptoms explained by the users compared to the sportspeople showed that is the percentage of sportspeople with symptoms in their eyes was higher (47.5%) than for users (17.2%), as was seen in the nasal symptoms (42.3% of sportspeople, 12.5% users), coughing (33.9 cent sportspeople, 5.8% users) and breathlessness (11.9% sportspeople, 3.9% users). Very possibly, these differences may be explained at least partly by the fact that the sportspeople were in contact with the swimming pool water for longer times than the users.

In PHASE B, an increase in the number of sportspeople who did not have symptoms was observed in line with the decrease in the number of sportspeople who had slight, moderate or severe symptoms.

The statistical study showed a statistically significant improvement in the ocular symptoms ($p<0.007$). Even though a decrease was observed in nasal, coughing, breathlessness and skin-related symptoms, this did not reach statistical significance mostly because the size of the sample ($n=53$) restricted its statistical weight compared to the users' sample ($n=320$).

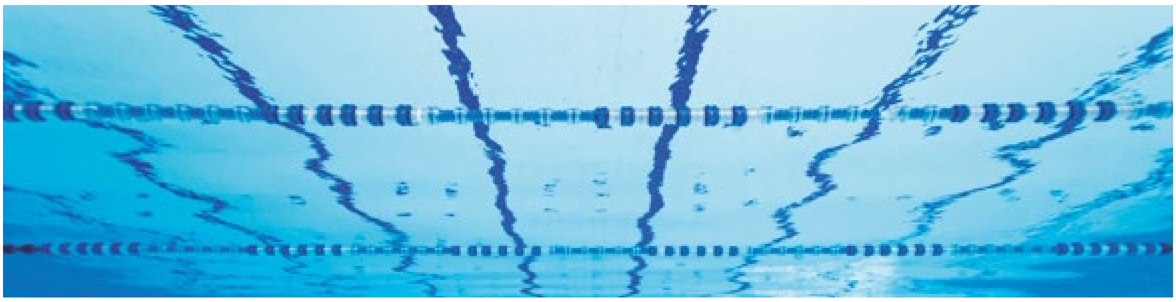
As for the question regarding the evaluation of the environment (atmosphere) in the swimming pool premises, classified as has been explained, it was evaluated in four levels: hardly saturated, slightly saturated, mildly saturated and very saturated. Compared with PHASE A, the sportspeople detected a statistically significant improvement in PHASE B ($p<0.001$) in the swimming pool's general atmosphere. The subjective sensation that the atmosphere was perfect, clean and with no smell rose from 16% to 80%.



The proinflammatory effect of chlorine on the airways was evaluated by measuring the levels of cysteinyl leukotrienes (LTC4, LTD4 and LTE4) and of the B4 leukotriene in PHASE A and PHASE B before and after doing the sport. As a control group ($n = 50$), a group of healthy people were included who were not users, swimmers or water polo players, and who were of similar ages and genders to the sportspeople.

The study of the levels of leukotriene B4 in the exhaled breath condensate did not reveal differences between the healthy control individuals and the sportspeople (Figure 1). There were no differences seen between the levels in PHASE A and PHASE B, either (Figure 1). Finally, neither were there significant changes detected in the LTB4 levels after swimming, whether for PHASE A or PHASE B.

The study of the levels of cysteinyl leukotrienes (LTC4, LTD4 and LTE4) did not show differences between the control individuals and the sportspeople (Figure 3). On the other hand, there were changes seen in the levels between PHASE A and PHASE, B with a statistically significant decrease in PHASE B compared to PHASE A detected.



CONCLUSIONS

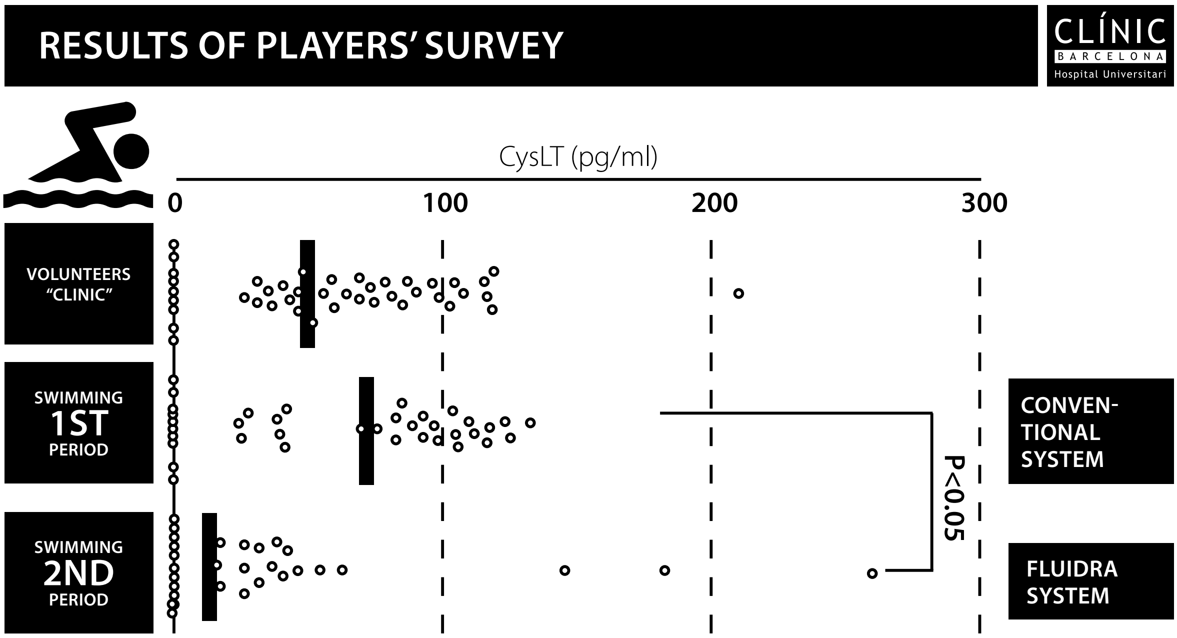
The results from the study lead to the conclusions that:

1. The water treatment system in PHASE B substantially improves the general environment of the pool all and significantly reduces the ocular, nasal, respiratory and skin symptoms of the sporting premises' users.

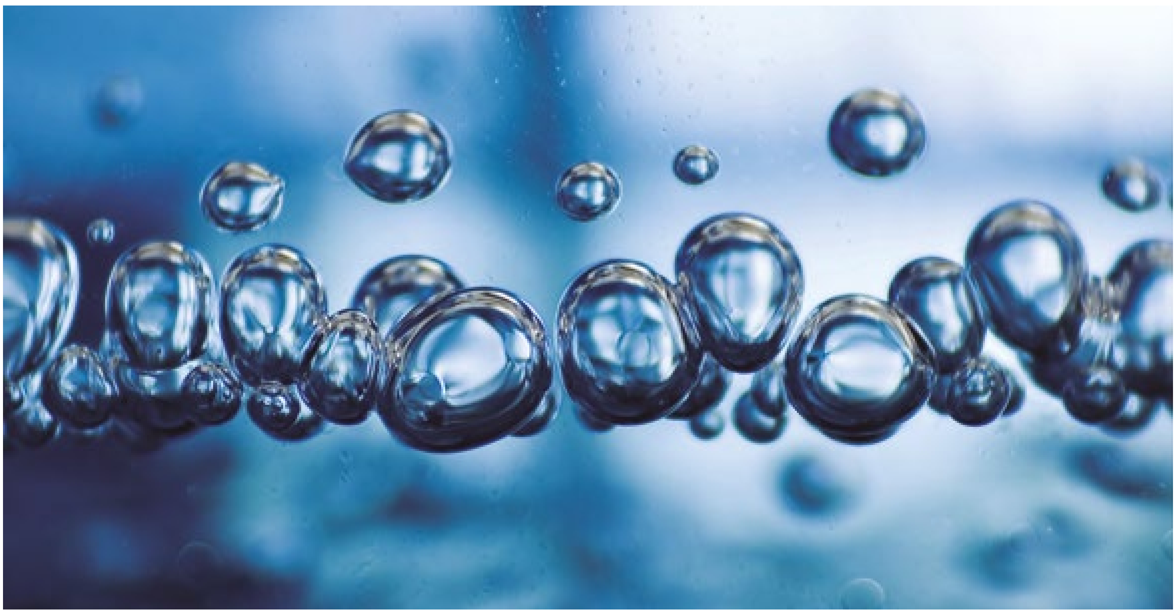
2. The effects on the pool's atmosphere were also detected by the athletes, with the treatment used in PHASE B resulting in a significant improvement in ocular symptoms and an improvement that did not reach statistically significant levels in the other symptoms.

3. Furthermore, measurement of the inflammatory response of the airways to the irritant effect of the chlorine by quantifying the cysteinyl leukotrienes shows a decrease in the levels of this marker. This suggests that the system used in PHASE B has lower irritant/inflammatory effects on the airways.

RESULTS OF PLAYERS' SURVEY



ANALYTICAL RESULTS



12.E.5.6_ REPORT BY UNIVERSITAT AUTÒNOMA DE BARCELONA

INTRODUCTION

Pollution due to chlorinated compounds in indoor swimming pools has been found to be the origin of different airway disorders in swimmers.

Dispensing with a strong acid, like hydrochloric, as a pH reducer in swimming pools and replacing it by carbon dioxide results in less oxidant concentration in the air, while salt electrolysis and UV are also considered cleaner disinfectant systems than the simple addition of halogenated compounds, normally sodium hypochlorite.

This report describes the changes observed in the environmental conditions in the indoor swimming pool of the Club Natació Atlètic Barceloneta in Barcelona after the change to the cleaner water treatment system provided by Fluidra under the name of Salut. Changes in health indicators of bathers and pool attendants were conducted by Hopital Clínic de Barcelona, whose final report was drawn up by Dr César Picado.

STUDY DESIGN

The study was prepared in order to compare the effects in the same group of swimming pool attendants who were exposed to two sets of different environmental conditions due to two different water treatments, in the same pool and in two different time periods, namely:

A. Usual levels of pollutants due to conventional water treatment with sodium hypochlorite as a disinfectant and hydrochloric acid as a pH reducer.

B. Reduced levels of disinfection by-products due to a water treatment based upon:

- Replacement of the strong acid used to reduce pH by carbon dioxide.
- Inclusion of a low concentration salt electrolysis system to produce hypochlorous acid as a complement to the addion of sodium hypochlorite.
- Inclusion of an UV phase in order to reduce combined chlorine and to reduce the concentration of free chlorine needed because of its sanitising effect.

Pollutant content in the air of indoor swimming pools may vary strongly in a matter of hours because of splashing water and because of changes in natural or mechanical ventilation (free-cooling systems). Hence, besides fixing mechanical ventilation and choosing similar occupancy periods, calculations were made simultaneously in a two-hour period both in swimmers and in their environment, that is, air and water inside the swimming pool.

Prior to the study, the worst point in the swimming pool, in terms of smell and accumulation of air pollutants, was determined by preliminary measurements. The resulting sampling point P is situated at 5 cm over the water surface level and at 20 cm from its lateral edge, just over the perimeter drain.

Measurements at this point included monitoring the speed of the air in the three axes in order to discard interfering air-currents. To minimise seasonal changes, two similar periods were chosen in terms of occupancy, maintenance routines, air conditioning needs, characteristics of water from the network supply and expected condition of fitness of the competition swimmers:

A. November – January **B.** February – April

MATERIALS AND METHOD

Swimming pool facility.
The chosen indoor pool was the Club Natació Atlètic Barceloneta, placed in Barcelona at 3 m LMSL. Its characteristics were:

PARAMETER	PHASE A	PHASE B
Volume (m^3)	1,815	1,815
Dimensions (length, width, height, in m)	24 x 33 x 2,2	25 x 33 x 2,2
Water temperature set-point (ºC)	26.5	26.5
pH set-point	7.25	7.45
Free chlorine set-point ($mg\text{-}L^{-1}$)	1.1	1.1
Daily renewal volume (%)	1	0,3
Residence time (d)	100	300

The higher pH set-point during B was chosen in terms of costs, since it would be too expensive for any swimming pool facility to reach 7.3 by means of CO_2. Sanitising local rules accept a range of 7.2 to 8.

Always in terms of management, the renewal water volume was adjusted during PHASE B to economise water, energy and additives while fitting combined chlorine regulated range (< 0.6 ppm).

Atmospheric CO_2 was measured with a Testo 535 (Testo AG. Lenzkirch, Germany). Atmospheric pressure was determined with a Suunto X3HR (Suunto. Vantaa, Finland). Air speed at the sampling point was measured with a Testo 405-V1. TO in air were determined with a Dräger CMS (Drägerwerk AG & Co. KgaA, Lübeck, Germany) as chlorine with its own chips measuring in a range of 0.59–29 mg.m-3. Chlorine species in water was determined with a photometer Lovibond Photometer-System MD200 (Tintometer GmbH, Dortmund, Germany).

	PHASE A			**PHASE B**		
	Mean value	Standard deviation	n	Mean value	Standard deviation	n
Bathers	30.0	18.5	23	32.4	14.5	11
Water temperature	26.80	0.20	1.991	26.41	0.64	14.444
pH	7.21	0.07	17	7.46	0.07	9
Free chlorine (ppm)	1.08	0.24	40	1.15	0.18	49
Combined chlorine (ppm)	0.50	0.19	20	0.40	0.08	23
Monochloramine (ppm)	0.19	0.1	19	0.16	0.0	25
CO_2 indoor (ppm)	647	83	22	564	170	11
CO_2 outdoor (ppm)	440	21	22	424	120	11
CO_2 indoors-outdoors (ppm)	207			140		
Atmospheric pressure (hPa)	1.019	8	22	1.012	6	11
Indoor temperature ºC	28.85	0.92	3.176	28.90	0.80	5.039
Relative indoor humidity %	56.56	6.35	3.176	56.97	3.95	5.039
Vx at P. $m.s^{-1}$	0.13	0.11	18	0.13	0.05	9
Vy at P. $m.s^{-1}$	0.05	0.03	18	0.03	0.01	9
Vz at P. $m.s^{-1}$	0.13	0.13	18	0.04	0.04	9
TO $mg.m^{-3}$ at P	6.15	5.45	24	1.52	0.65	11
THM ug/L in swimming pool water	18	3.6	27	20	4.0	16
THM ug/L in supply network	20	13.4	10	25	11.0	6
Turbidity (UNF)	0.3	0.2	4	0.2	0.0	1
Oxygen in water	7	0.5	3	8	0.0	1

RESULTS

Regarding the environmental conditions achieved, the following parameters were determined:

The 75% reduction of the concentration of TO in the air is the most significant consequence of the change of the water treatment system, confirming results of a previous study. Such a reduction was achieved keeping the free chlorine concentration, hence the sanitising guaranties, while number of bathers was similar during both phases.

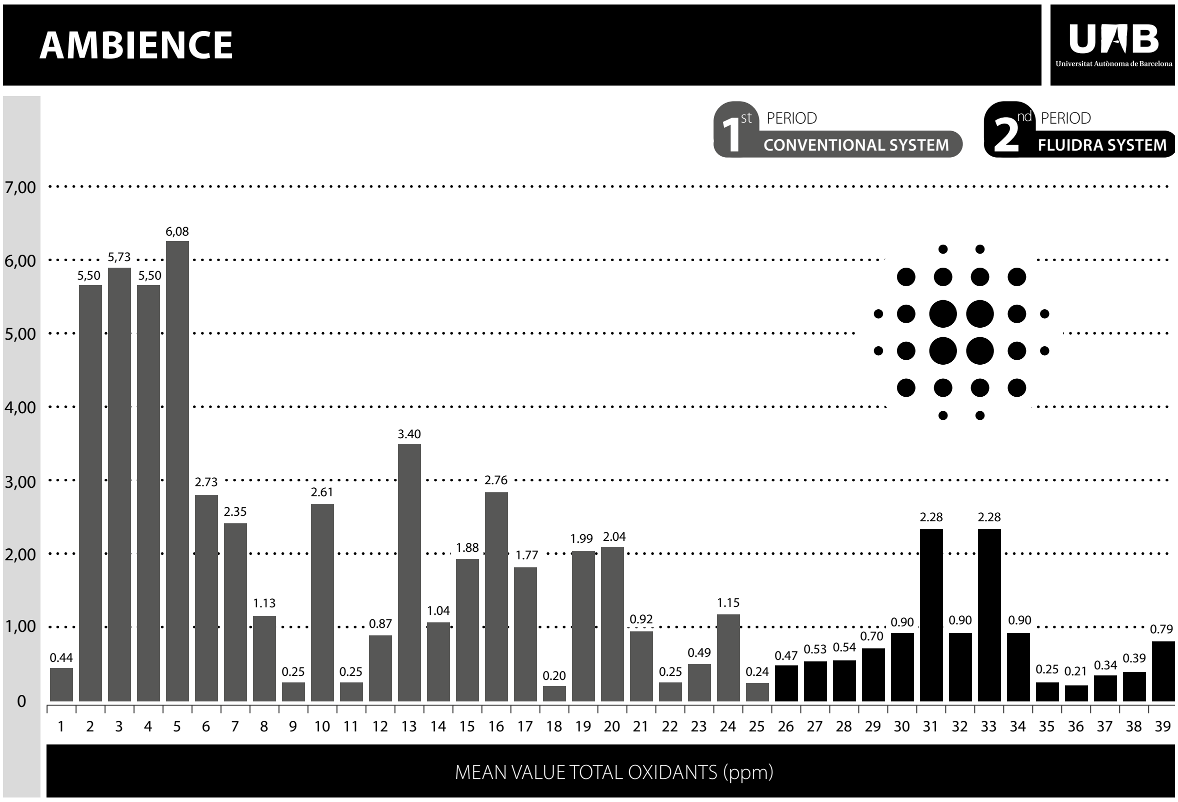
Combined chlorine, however, was also reduced a 20%. That reduction was achieved even despite filter back-washes were limited from three times a week during phase A to a once a week frequency during PHASE B.

Reduction of monochloramine was of a 17%, similar to that of the total combined chlorine.

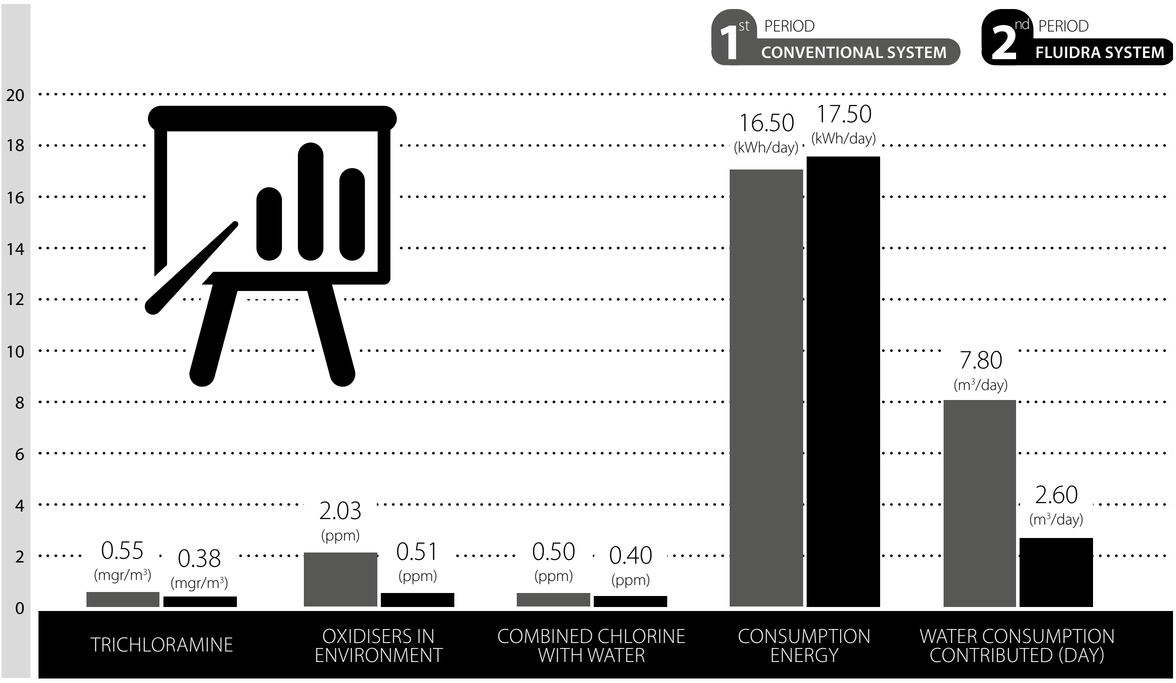
Indoor and outdoor CO_2 were measured to monitor changes in ventilation system. Although difference between them was slightly lower during phase B, no changes in that system were reported. That could indicate an effect of the lower atmospheric pressure or the effect of a different breathing regime of swimmers during that second phase. Nevertheless, in both cases ventilation can be considered very correct since regulations accept a maximum of 500 ppm as difference between those two parameters. Measures of air speed in the three spatial axes at P show there were not air currents interfering samples. Indoor temperature and relative humidity were highly steady.

The reduction of THM in the swimming pool water vs the concentration in the supply network is in both cases (conventional and "Salut" system) of the 10%.

Neither turbidity, nor oxygen in water showed differences between the two systems.



ANALYTICAL RESULTS



12.E.5.7_ POOL FLOOR CLEANING

To clean the pool's floor, a standalone circuit will be fitted that will be run by a 2 kW Victoria pump.

The reason for using a standalone circuit and pump instead of filtration pumps is that the latter have a high flow rate and they would be subject to cavitation if they were used for this purpose.

The circuit will have four manifolds on each corner of the pool so that the connection hose for manual cleaning is as short as possible.

12.E.5.8_ WATER TESTING CIRCUIT

It is extremely important to conduct accurate water tests to treat pool water properly. There are three extremely important factors to take into consideration in order to ensure the whole water treatment system works reliably: filtration, disinfection and heating.

1. High quality testing equipment that gives the right margin of error for each type of reading to be made.

2. Water recirculation time for tests to be conducted as quickly as possible in order to avoid disparities in readings.

3. Energy saving. As little energy as possible should be used for testing the water.

Therefore, the water testing circuit is completely separate from all other circuits (filtration, dosing and heating).

A **smart control** system will be used. The readings will be picked up by MCS software so that it is able to manage the facility by switching its systems on and off whenever needed.

A 100 W recirculation pump will be fitted for water recirculation. This low power pump will be able to perfectly control all of the pool's settings.

12.E.5.9_ WATER FLOW CIRCUIT

Having a good water flow circuit design is essential for a pool to work properly. In order to comply with standard EN-15288, safety requirements, it must be of the right shape and size, and have components especially designed for this purpose.

Insofar as size and shape are concerned, in order to attain an even rate of flow across the whole surface of the pool without causing turbulence when competitions are being held (if there is turbulence, the water treatment systems will not work), 90 return nozzles will be evenly distributed across the pool floor. Specially designed to be fitted underwater, these nozzles direct the water sideward rather than in an upward stream, as a result of which they are effective over a much larger surface area.

They are fitted at the same time as when the concrete slabs are put in, which is an extremely straightforward operation.

ARCHITECTURAL DETAILS_
ADJUSTABLE BCN 03
NOZZLE FOR LINER PVC POOL

In order to ensure that the water will be properly distributed at the design stage, the model is exported to a computational fluid dynamics (CFD) program to simulate the behaviour of convection in the water treatment system.

12.E.6_ HEATING AND COOLING

12.E.6.1_ PURPOSE

The purpose of this project is to evaluate the different alternatives for heating and cooling a sports facility with a 50 m x 25 m x 2 m competition size swimming pool and provide all of the services required to host swimming and water polo competitions.

Since the main objective is to serve as an example of a global solution for heating and cooling facilities of this kind, different technical scenarios are considering based on a mix of hot and cold water production composed of:

- Natural gas boiler
- Solar power
- Geothermal heat pump
- Absorption heat pump

The reason for using all of these systems is to create an environment that guarantees the comfort of pool users, spectators, media, staff, etc. in both the winter and the summer with maximum energy efficiency.

This project, based on the geographical area of Barcelona, can be extrapolated to any geographical area in the world.

Obviously, depending on the location, the different systems may have to be adjusted accordingly to make them as energy-efficient as possible, but the same basic principles can be used to design any facility.

12.E.6.2_ DESCRIPTION OF THE ECO-COMFORT SYSTEM

For facilities of this kind where the demand for hot and cold water production is continuous, **Fluidra** recommends the use of renewable energies which can be used throughout the year, always supported by conventional energy systems to ensure the right set point needed to guarantee the comfort of users and to comply with local codes.

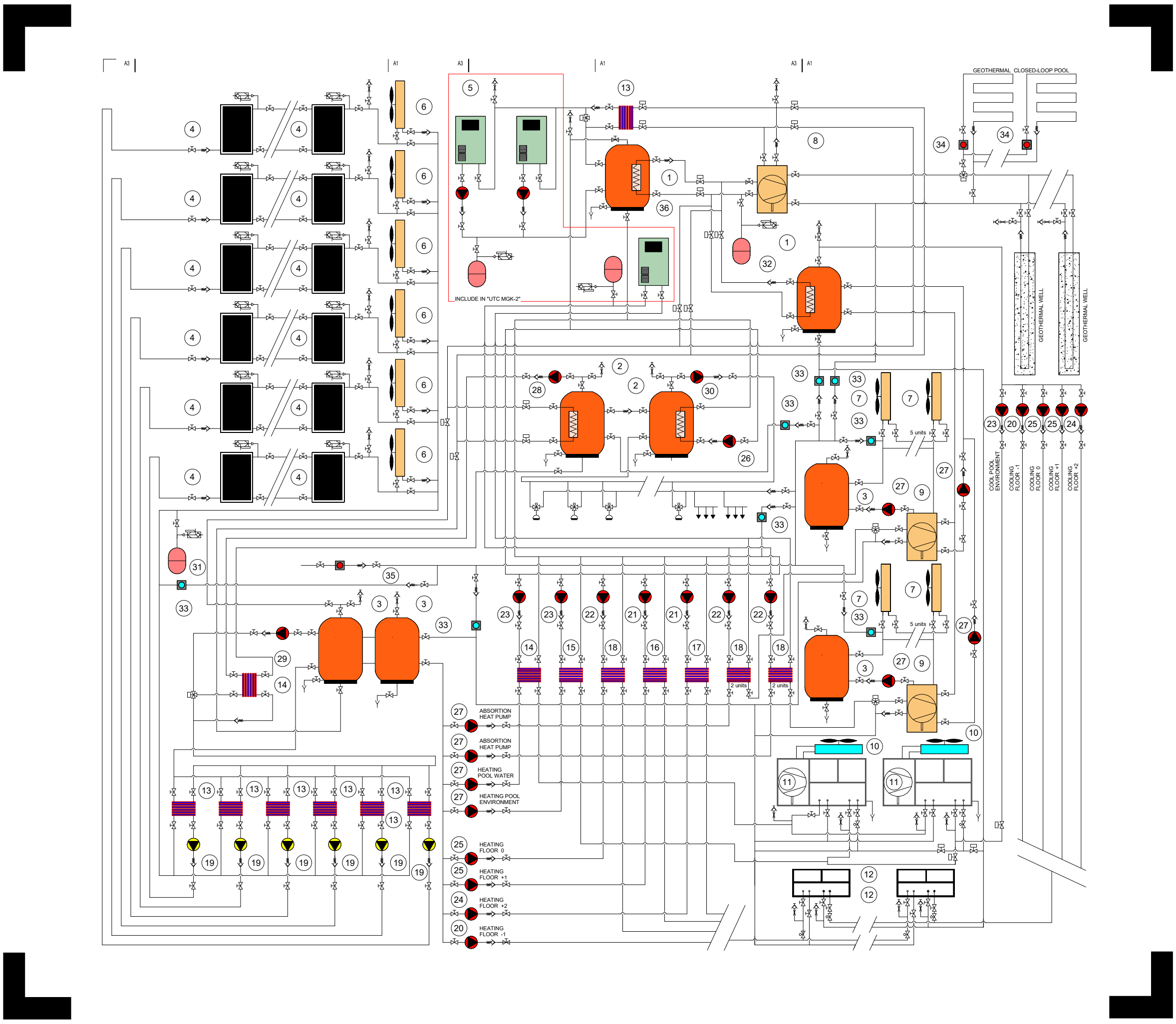
The system works with heat exchangers and circulation pumps which are controlled by the MCS software that manages the facility's heating and cooling needs based on the readings of the different circuits and the set point introduced.

The equipment (dehumidifiers, air conditioners, boilers, etc.) operates autonomously according to factory settings and the facility's requirements. This simplifies the management of the system and makes it more energy efficient.

The basic principle behind the Eco-Comfort system is that it uses solar energy as the basic heat source for the entire facility and a geothermal heat pump and heat absorption system for cooling by drawing excess heat from the solar collectors, all supported by a gas boiler system.

As shown on the diagram below, the solar thermal collectors [4] convert the solar radiation into heat energy. The system converts the heat in storage tanks [3] using heat exchangers [13] which then supply the hot water to the facility's heating and cooling circuits.

The different heat exchangers servicing the facility's systems (level 0, 1, 2... hot water and absorption equipment) are supplied by recirculation pumps connected to the hot water tanks powered by solar energy [3].



To ensure that the correct temperature is maintained at all times according to the system's needs, the boiler circuit [5] which is kept at 100ºC, provides additional power as needed through the corresponding heat exchangers (14, 15, 16...). For example, it guarantees that the activation temperature of the absorption pump, which is 100 ºC, is maintained at all times. The same applies to the hot water system.

Another very important circuit is the one on the geothermal pump. Since the facility has a variety of thermal needs (hot and cold), this system is very efficient due to the fact that it can provide heating or cooling to different systems at the same time. As seen on the diagram, the heat can be recovered in the pool itself or in the boiler or hot water system and cool the entire the absorption system.

Finally, apart from the boiler heating system, there is also a heat recovery system to produce cooling. This system absorbs the excess heat from solar panels, especially in summer, to produce cold water between 7º and 10º. Significant savings can be obtained by facilities located in regions where the use of solar power is prevalent (southern Europe, northern Africa, etc.).

For a better understanding of the solution proposed by **Fluidra**, below we will provide a general introduction to the basic principles of the different heating and cooling systems proposed prior to the section that deals with the calculations and choice of equipment.

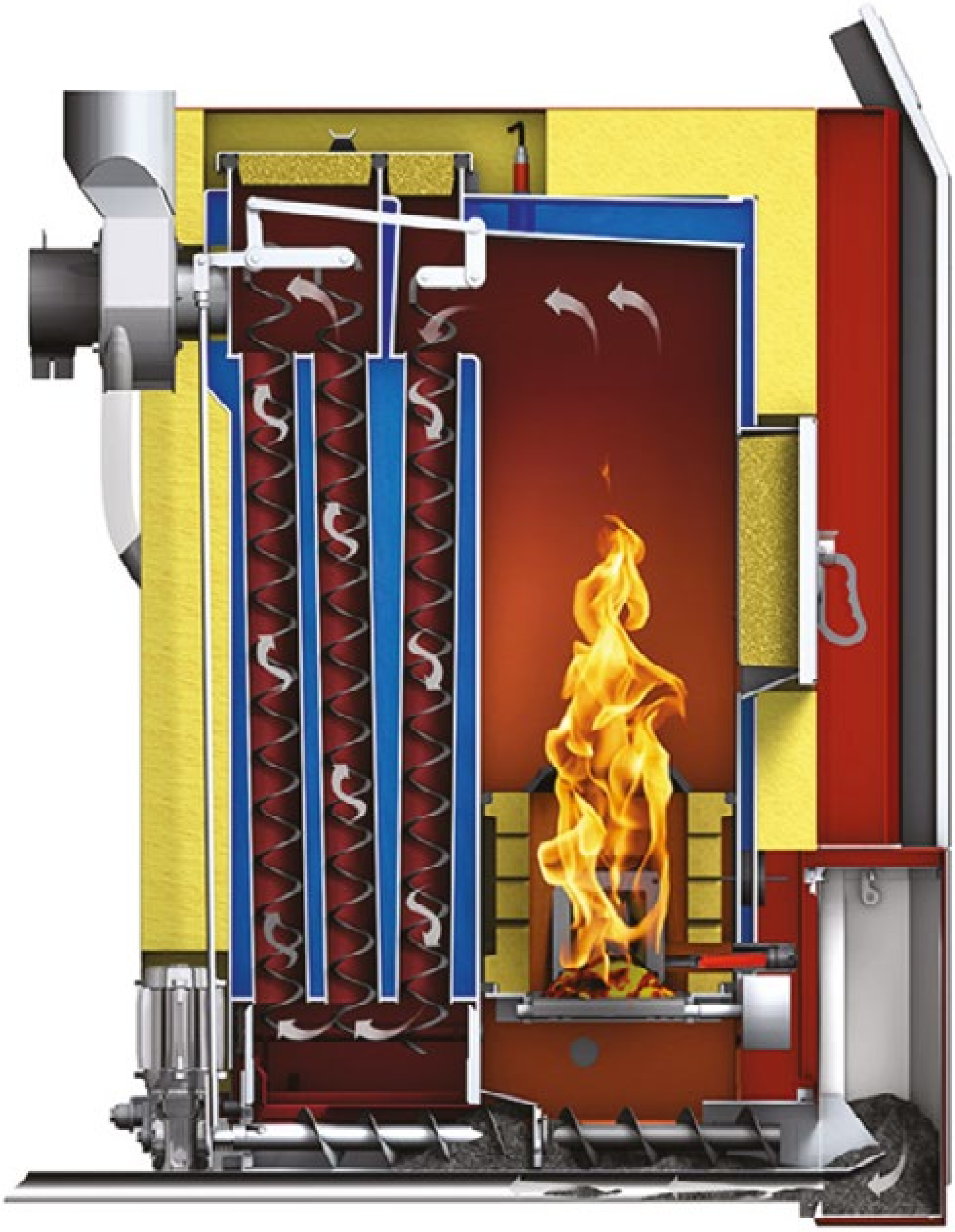
12.E.6.2.1_PRODUCTION SYSTEMS THAT USE BOILERS

The basic principle of the boiler is to transfer the heat produced by combustion to the facility's water system. There are three different parts to the transmission of heat in a boiler.

1. The first part, in which the heat is basically transmitted by the flame, which is kept at a very high temperature.

2. The second part, in which the conduction-convection mechanism comes into play.

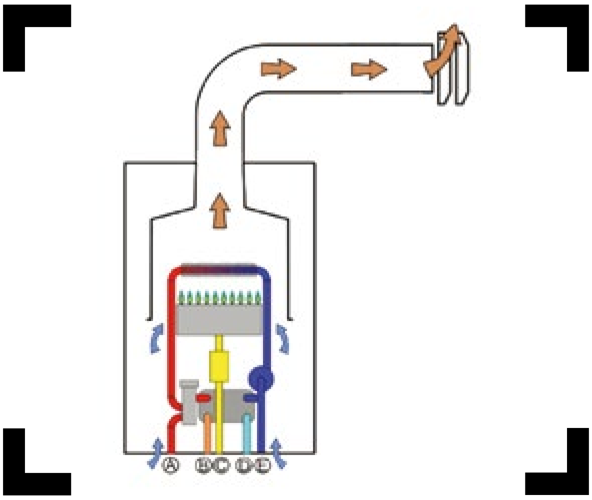
3. The third part, which only pertains to condensing boilers, in which the heat from the condensation of steam from the combustion is transmitted by conduction-convection.



According to European Directive 92/42/ EEC, boilers in general and condensing boilers in particular can be classified as follows:

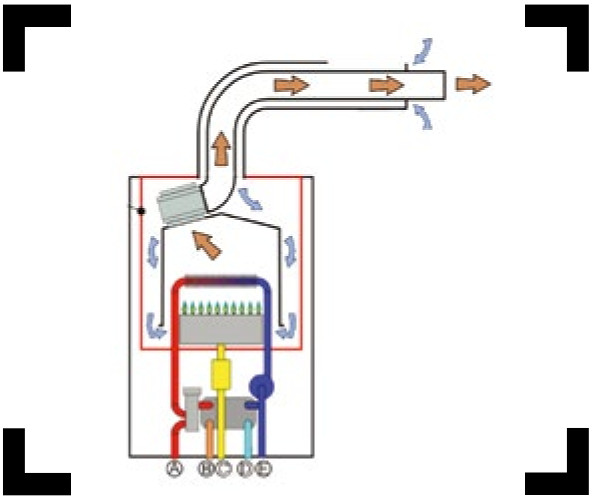
STANDARD BOILER

One that does not support the effects of condensation of vapours, i.e., if condensate forms inside the boiler it can be ruined, which means that the return temperature must always be kept above the dew point. The return water must be higher than 55 ºC.



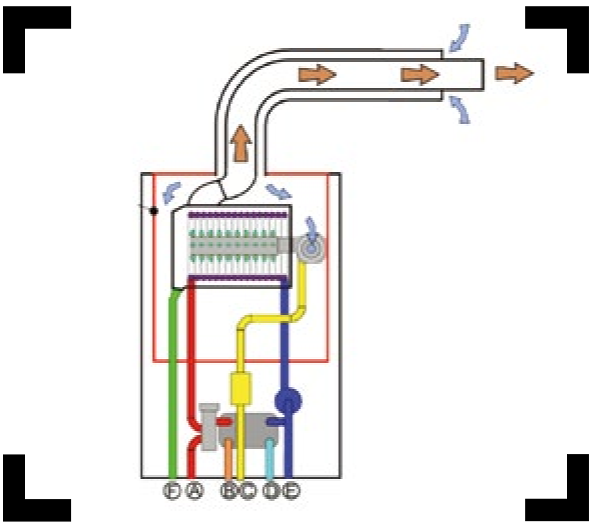
LOW TEMPERATURE BOILER

One that is designed so that even if the temperature of the return water is lower than the dew point, the water does not condense to form dew. The return water is typically between 35° and 40 ºC.



CONDENSING BOILER

Made of special materials in order to withstand condensation without being ruined, a phenomenon which increases the boiler's performance. The working return temperature of these boilers is between 35 ºC and 40 ºC. These are the types of boilers proposed by FLUIDRA in the solution.



The basic principle of condensation is that of a physical process in which a substances changes from a gas to a liquid state. This change of state generates a certain amount of energy called "latent heat". The transition from gas to liquid depends on pressure and temperature, among other factors.

At a certain temperature, condensation leads to a release of energy. Liquid is therefore the preferred state from an energy point of view.

EC Directive 92/42/EEC establishes the minimum yields for water boilers by type and useful output (q_u).

TYPE OF BOILER	NOMINAL POWER		PARTIAL LOAD	
	Tm (ºC)	MINIMUM OUTPUT	Tm (ºC)	MINIMUM OUTPUT
STANDARD	70	84+2*log qu	50	84+2*log qu
LOW TEMPERATURE	70	87.5+1.5*log qu	40	7.5+1.5*log qu
CONDENSATION	70	91+1*log qu	30	91+1*log qu

The type of boiler to be used with the **Fluidra** system will be a condensing boiler composed of a single compact module with the required number of boilers (depending on the project) as well as recirculation pumps, exhaust pipes and all of the operating and control elements of a boiler room.

These modules can work with modular power (maximum/minimum) depending on the specific needs of the installation and can be managed remotely by the MCS system.

For this project we propose two MGK condensing boilers of 550 kW each.

12.E.6.2.2_PRODUCTION SYSTEMS THAT USE SOLAR PANELS

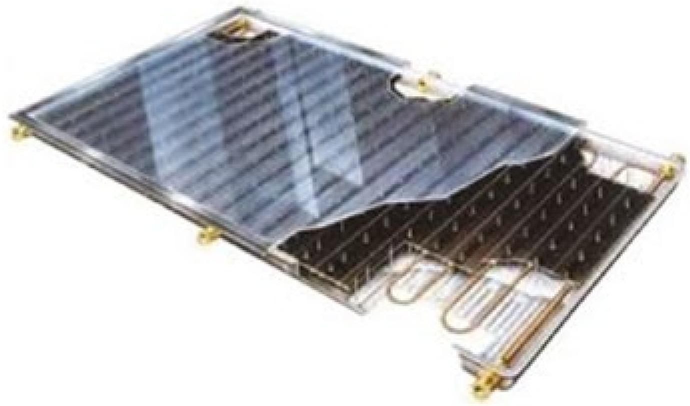
Solar thermal energy uses solar radiation to generate heat. Solar energy is converted into heat.

Depending on the working temperature, solar energy can be classified as:
- Low temperature
- Average temperature
- High temperature

Low temperature is the most commonly used kind (around 100 ºC) and the one proposed for this project as it is the most efficient in terms of absorption/price.

The dimensions of the facility are clearly defined in standard CTE-2006-2009. However, it is important to remember that there are often aspects which can cause the calculations to fall outside of the expected range.

The first aspect to be considered is the collection system. This is composed of:
- A housing or casing that holds the assembly
- A transparent cover located on the side that is exposed to the sun
- A metal absorber that transfers the solar energy into thermal energy and converts it to a fluid that circulates inside
- Insulation of the back and side of the housing to reduce heat loss



The transparent cover is the collection element that ensures the greenhouse effect. High transparency to solar radiation (centred on a visible wavelength between 0.4 and 0.7 µm long) and a low transmission rate of the infrared radiation emitted by the absorber (wavelength longer than 3 µm) are therefore required.

The collector's output, which varies from one manufacturer to the next, can be calculated using the following expression:

$$\eta = \eta_0 - m_1 * \left[\frac{Tm - Ta}{I}\right] - m_2 * \left[\frac{Tm - Ta}{I}\right]^2$$

Where:

η = Collector output in parts per unit.

η_0 = Optimum collector output. A dimensionless value provided by the manufacturer. This information is very important when it comes to choosing the collector.

m_1, m_2 = loss factor. Provided by the manufacturer once the panel is reset (W/m^2 ºC). Like η_0, this value is very important when it comes to choosing the collector.

T_m = Average collector temperature.

T_a = Average ambient daytime temperature while sun is shining.

I = Average radiation intensity during sunlight hours (W/m^2).

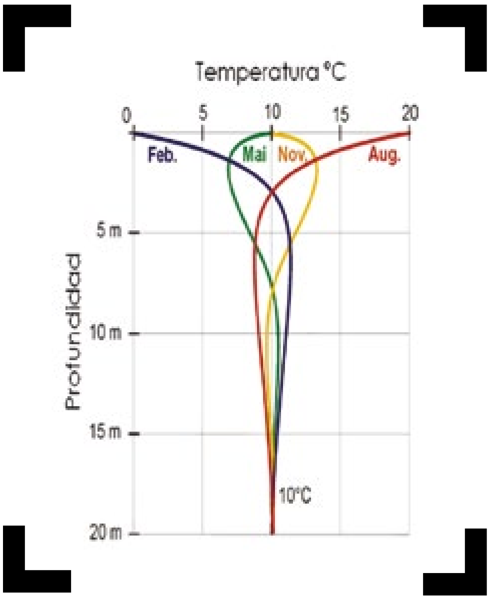
This allows us to determine exactly what the output of our solar power installation will be.

12.E.6.2.3_PRODUCTION SYSTEMS THAT USE GEOTHERMAL HEAT PUMPS

A large quantity of heat inside the Earth, that still exists today, makes the Earth an enormous natural boiler.

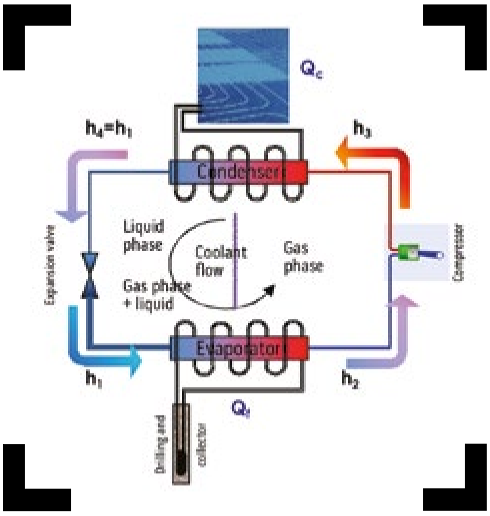
Practically the entire crust of the planet Earth is a bed of geothermal resources at very low temperatures. At any point along the Earth's surface, the heat stored in the superficial layers of the subsoil or in aquifers located just a few metres below the ground can be collected and used to heat and air condition individual homes and buildings using geothermal heat pumps.

The most common way to collect the energy stored inside the earth (or dissipate it) is to bore one or more vertical holes in the soil. Holes can be drilled into both soft earth and hard rock down to about 200 m deep, although we do not recommend going any deeper than 150 m.



There is also a possibility of drilling horizontally, although this is not recommended for building cooling systems. In this case, **Fluidra** will install a parallel horizontal type system in the pool to recover heat from the water.

The operating principle of a geothermal heat pump is to extract the heat from the earth's substrate in order to heat a highly compressible fluid with a low boiling point (secondary circuit) in order to transmit the heat to an installation in the winter, inverting the process in the summer.



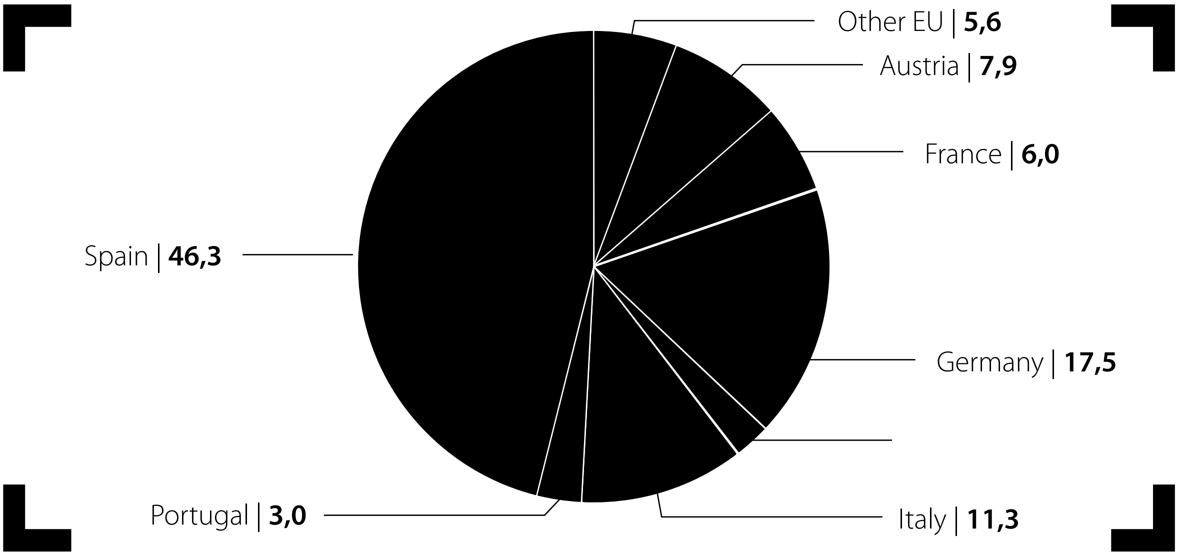
12.E.6.2.4_PRODUCTION SYSTEMS THAT USE ABSORTION PUMPS

Energy usage for cooling or air conditioning has increased dramatically in recent decades in most European countries, even in northern Europe. An increase in the demand for comfort in the workplace and at home, architectural changes with a higher percentage of transparent surfaces, adverse external conditions in urban environments, the increase in internal loads and the decline in the price of air conditioning units over the past decade have caused a significant increase in the air conditioning units installed in buildings.

To date, most of this cooling had been produced by mechanical vapour compression equipment. These systems required mechanical energy that is usually produced by electricity. However, electricity is not always available or may be too expensive or there may be residual thermal or renewable energy that can be used to operate cooling systems. In these cases, cooling systems that use thermal energy can be interesting alternative.

In addition, the profile of the demand for cooling coincides almost perfectly with the thermal energy present in the solar thermal energy collection system. In addition to the economic aspect, if one considers European policies intended to decrease dependence on fossil fuels in order reduce CO_2 emissions as called for in the Kyoto Protocol, it is easy to understand the renewed interest in the development of cooling systems powered by solar energy that has occurred in Europe in the last decade.

The chart below shows the increase in demand for cooling equipment in the last 10 years.



In our case, the high-performance solar powered system can heat the entire building in the winter, but in the summer we have a great deal of excess energy.

The existing heat transformation technologies are based on reversible thermo-chemical absorption reactions in which a gas is trapped by a solid surface or by a liquid current.

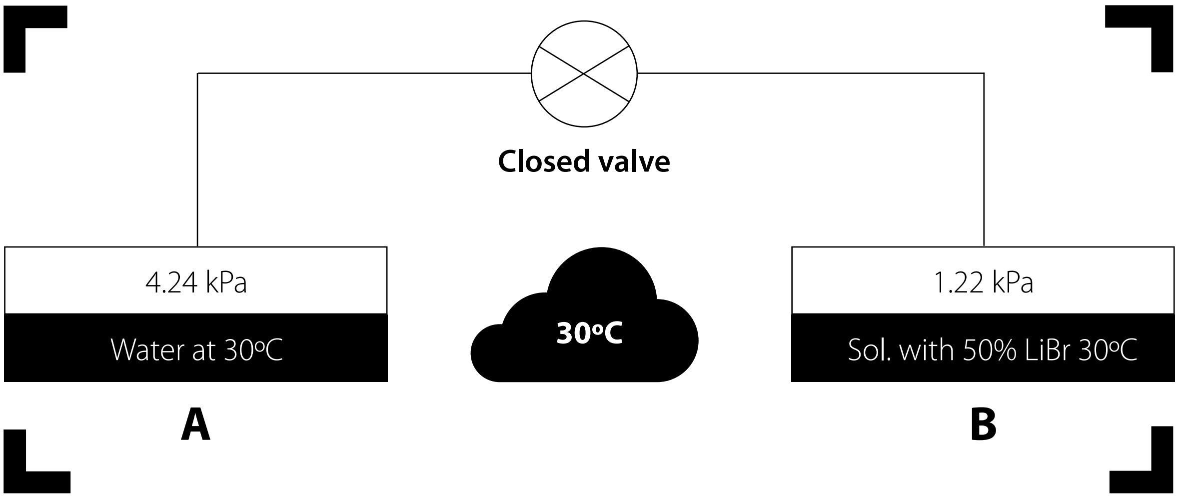
The absorption cycle is based on the fact that when a solution such as lithium bromide is dissolved in a solvent like water, the boiling point of the solvent (water) is higher. On the other hand, if the temperature of the solution (solvent + solute) is kept constant, when the solute is dissolved the vapour pressure of the solvent is reduced to below the saturated pressure of the solvent at that temperature.

If the solute itself has its own vapour pressure (i.e., the volatility of the solute), then the total pressure exerted by the solution is the sum of the partial pressures of the solute and the solvent. If the solute is non-volatile (e.g., lithium bromide salt) or if there is a considerable difference between the boiling point of the solution and the solvent (>300 ºC), the total pressure exerted by the solution will be equal to the vapour pressure of the solvent only.

In an absorption cooling system, the coolant is obtained by connecting two tanks:
- One which contains pure solvent.
- Another which contains a solution.

If the pressure is almost the same in the two interconnected tanks, the temperature of the solution will be higher than that of the pure solvent. This means that if the solution is at ambient temperature, the temperature of the pure solvent must be lower than ambient temperature. The cooling effect is produced in the tank containing the pure solvent due to the difference in the ambient temperature. The solvent evaporates due to the transfer of heat, flows into the tank containing the solution and is absorbed by the solution. The process continues as long as the composition and the temperature of the solution are maintained and there is liquid solvent available in the tank.

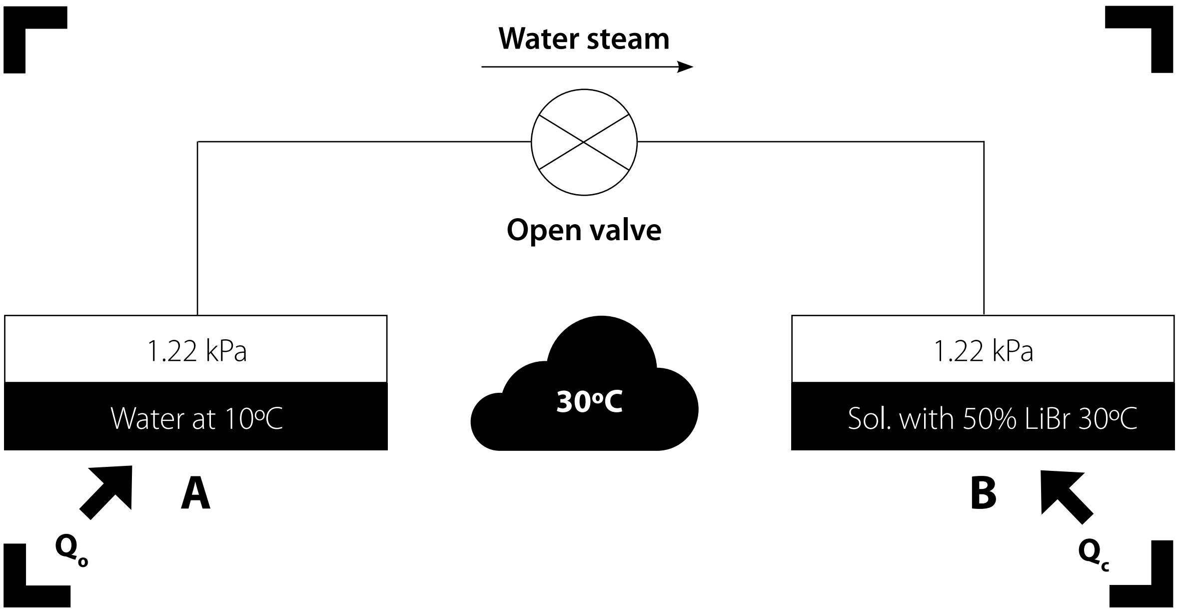
The figure below (initial state) shows two tanks, A and B, connected by a tube and a valve. Tank A contains pure water, while tank B contains a solution of 50% water and 50% lithium bromide (LiBr salt).



The valve connecting the two tanks is initially closed and both are operating in thermal equilibrium at an ambient temperature of 30 ºC. At this temperature, the saturation pressure of water is 4:24 kPa and the vapour pressure of the (50:50) water/LiBr solution is 01:22 kPa.

Under the initial conditions of equilibrium, the pressure in tank A is 04:24 kPa, while the pressure in tank B is 1:22 kPa. The valve connecting the two tanks, A and B, is opened.
At first, because of the difference in pressure, the water vapour from tank A flows into tank B and this vapour is absorbed by the solution in tank B., Because the absorption is exothermal, heat is released in tank B.

Now let's suppose that there is a way to keep the concentration and temperature in tank B at 50% and 30 ºC, respectively. The pressure in the entire system (both tanks) will be the lower pressure of the two, i.e., 1.22 kPa (the equilibrium vapour pressure of 50% of the LiBr solution at 30 ºC).

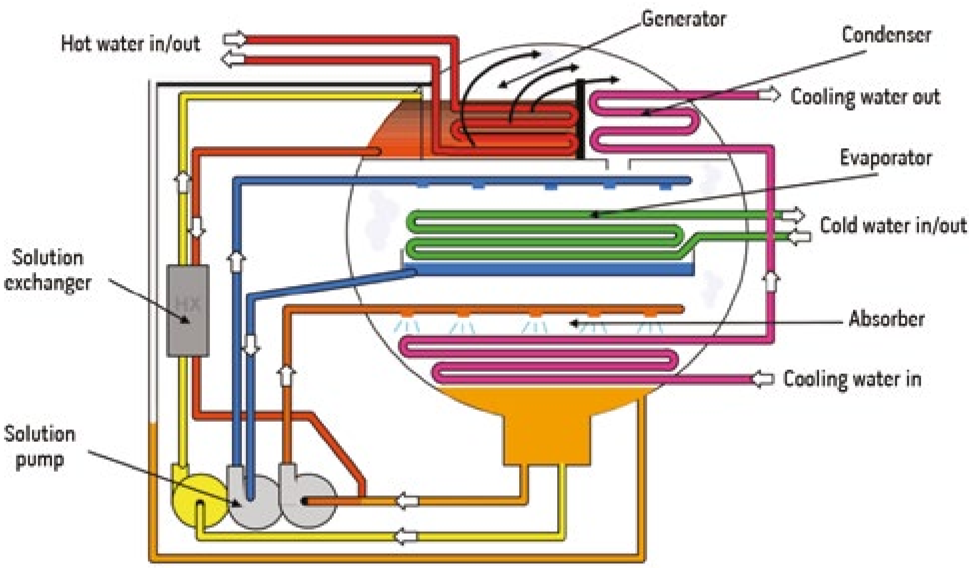


The temperature of the water inside the tank will be the saturation temperature corresponding to 1.22 kPa, which is equal to about 10°C (see image above). Since the temperature of the water in tank A is lower than the ambient temperature, a cooling effect (Qe) is produced by transfer the heat from the environment to the water at 10°C. Due to this heat transfer, the water in tank A evaporates, flows into tank B and is absorbed by the solution in tank B. The exothermal absorption reaction (Qa) dissipates into the environment.

In order for the process described above to continue, there must always be pure water in tank A and the concentration and temperature in tank b must be 50% and 30°C, respectively, at all times.

The system described above is known as an intermittent absorption refrigeration because in order to initiate the cycle again, the process needs to start over from the beginning. A continuous refrigeration system can be obtained by modifying the system, adding two A and B tanks, additional expansion valves and a solution pump.

The operating principle of continuous absorption equipment is similar to that of a mechanical vapour compression system. The cycle includes an evaporator, a capacitor and an expansion valve for the coolant. The only difference is that the mechanical compressor is replaced by what is known as a thermal compressor which comprises two main components: the absorber and the generator, in addition to a pump and expansion valve for the solution.



Commercial absorption equipment uses two solutions, depending on the evaporation temperature.

When the desired temperature in the evaporator is 5°C or higher, a solution of water/lithium bromide is used. In this case the refrigerant is water and the solution that circulates between the absorber and the generator is composed of water and lithium bromide. This is the type of equipment commonly used for solar heating and air conditioning systems, since it offers better COPs and requires lower activation temperatures.
In the case of FLUIDRA's system and for the Barcelona facility in particular, the activation temperature is 100 ºC and there is no need for refrigeration towers since these have been replaced 41 m3/h air dissipaters with thermal salt at 45º-40 ºC.

The COP for these machines (2 units required) is 0.7.

It should be noted that this type of system can be used in much warmer climates. In order to do so, the activation temperature must be raised and the flow rate and the dissipation thermal relay must be recalculated.

12.E.6.3_CALCULATION OF THE BUILDING'S HEAT DEMAND

12.E.6.3.1_CALCULATION OF OUTDOOR CONDITIONS

The data used for the calculation are from the State Meteorological Agency for all weather stations for which ambient temperature records were available for at least the last ten 10 years (1998-2007).

The quality and precision of the measurements provided by this Agency are guaranteed by the calibration and control systems it uses.
Dry temperature data. Hourly data (24 h/day).

Relative humidity. Depending on the station, there are 4 possibilities:

1. 24 data sets/day (hourly data).

2. 4 data sets/day at 0, 6, 12 and 18 h before 2006 and 10 data sets/day after 2006.

3. 4 data sets/day at 0, 6, 12 and 18 h before 2006 and 24 data sets/day after 2006.

4. 4 data sets/day for the entire period.

Soil temperature data at 20 cm, 4 sets per day at 0, 6, 12 and 18 h.

Hourly radiation data from 5h to 20h (16 data sets per day). For each weather station (under the heading of "no. of observations and period"), the records show the quantity of data collected for each variable, the frequency of relative humidity data collected (in parenthesis and based on the previous classification) and the data period (years in parenthesis when known for sure).

Province	Weather station	Indicative
Barcelona	Granollers	0208

LOCATION: CITY CENTER		
a.s.n.m. (m)	Lat.	Leng.
154	41º36'27"	02º17'27"E

NUMBER OF OBSERVATIONS AND PERIOD			
Dry Temp.	RH	Ground Temp.	Rad
14.550	14.518		

PROJECT HEATING CONDITIONS (MINIMUM OUTDOOR DRY TEMPERATURE)					
TSMIN (ºC)	TS_99,6 (ºC)	TS_99 (ºC)	OMDC (ºC)	HUMcoin (%)	OMA (ºC)
-5,2	-0,2	1,2	11,8	75,2	33,8

PROJECT COOLING CONDITIONS (MAXIMUM OUTDOOR DRY TEMPERATURE)							
TSMAX (ºC)	TS_0,4 (ºC)	THC_0,4 (ºC)	TS_1(ºC)	THC_1 (ºC)	TS_2 (ºC)	THC_2 (ºC)	OMDR (ºC)
38,2	33,6	22,1	32,2	22,0	30,8	21,8	13,8

PROJECT REFRIGETRATION CONDITIONS (MAXIMUM OUTSIDE WET TEMPERATURE)					
TSMIN (ºC)	TS_99,6 (ºC)	TS_99 (ºC)	OMDC (ºC)	HUMcoin (%)	OMA (ºC)
23,8	23,8	23,0	23,0	22,4	22,4

MONTHLY AVERAGE							
Month	TA (ºC)	TASOL (ºC)	GD_15(ºC)	GD_20	GDR_20	RADH (kWh/mª day)	TTERR (ºC)
January	8,5	11,8	34	59	0		
February	9,5	12,8	27	49	0		
March	12,2	13,5	19	41	1		
April	14,2	15,2	12	31	2		
May	18,2	19,1	3	16	7		
June	22,7	23,8	0	4	17		
July	24,3	25,1	0	1	23		
August	24,3	25,1	0	1	23		
September	20,9	21,8	0	6	11		
October	17,5	19,9	4	17	4		
November	11,9	15,5	18	40	0		
December	8,8	11,6	32	57	0		

In case of no soil temperature records available, the following equation can be used:

$$T_{soil} = 0.00068\ T^2_{amb} + 0.963\ T_{amb} + 0.6865$$

12.E.6.3.2_DESCRIPTION OF THE FACILITIES

The building to which this project refers is divided into the following areas:

NAME	AREA (m^2)	VOLUME (m^3)
TECHNICAL OFFICE	24	71
FLOOR -1		
ATHLETES PREPARATION ROOM 1	30	74
ATHLETES PREPARATION ROOM 2	28	67
TV ROOM	133	418
JUDGES MEN	25	71
MEN'S LOCKER ROOM	78	218
JUDGES WOMEN	25	71
WOMEN'S LOCKER ROOM	78	218
MASSAGE & TREATMENT MEN	82	200
STAFF	27	85
MASSAGE & TREATMENT WOMEN	80	195
STAFF	29	104
STAFF	18	68
LATERAL CORRIDOR	174	488
PRESS ROOM	120	379
PLANT 0		
GYM 1	158	618
STAFF	39	151
GYM 2	158	618
STAFF	39	151
PLANT 01A		
CONFERENCE ROOM	133	414
ENTRANCE	17	53
SHOP	61	192
MIXED ZONE	27, 887	27, 887
STAFF 53	53	27, 887
PLANT 01B		
CAFETERIA	137	385
KITCHEN	17	48
PLANT 2		
POOL		
POOL ROOM	2,324	14,327
HOT WATER		
TOTAL	**4,193**	**20,187**

12.E.6.3.3_OPERATING TEMPERATURE AND RELATIVE HUMIDITY

The interior design conditions of operating temperature and relative humidity are determined based on people's metabolic rate, their level of clothing and the predicted percentage of dissatisfied (PPD) in each case:

For persons with a sedentary metabolic rate of 1.2 met, a clothing level of 0.5 clo in summer and 1 clo in winter and a PPD between 10 and 15%, operating temperature and relative humidity values will fall within the limits shown on the following table.

INTERIOR DESIGN CONDITIONS		
SEASON	**Operating temperature ºC**	**Relative humidity %**
Summer	23 - 25	45 - 60
Winter	21 - 23	40 - 50

The dry air temperature in heated swimming pool facilities is kept between 1°C and 2°C above the temperature of the pool water, up to maximum of 30°C. The facility's relative humidity is kept below 65% at all time to protect against the formation of condensation.

According to FINA and NIDE standards, the water in competition swimming pools must be maintained at 26ºC ± 1ºC and no more than 28ºC of the ambient (NIDE 2015).

NAME	WINTER CONDITIONS		SUMMER CONDITIONS	
	TEMPERATURE (ºC)	RH(%)	TEMPERATURE (ºC)	RH(%)
TECHNICAL OFFICE	22	50	24	50
LEVEL -1				
ATHLETES PREPARATION ROOM 1	23	50	25	50
ATHLETES PREPARATION ROOM 2	23		25	50
TV ROOM	22	50	24	50
JUDGES MEN	23	50	25	50
MEN'S LOCKER ROOM	23	50	25	50
JUDGES WOMEN	23	50	25	50
WOMEN'S LOCKER ROOM	23	50	25	50
MASSAGE & TREATMENT MEN	23	50	25	50
STAFF	-	-	-	
MASSAGE & TREATMENT WOMEN	24	50	24	50
STAFF	22	50	24	50
STAFF	22	50	24	50
LATERAL CORRIDOR	23	50	25	50
PRESS ROOM	22	50	24	50
LEVEL 0				
GYM 1	21	50	23	50
STAFF	22	50	24	50
GYM 2	21	50	23	50
STAFF	22	50	24	50
LEVEL 01A				
CONFERENCE ROOM	23	50	23	50
ENTRANCE	22	50	24	50
SHOP	22	50	24	50
MIXED ZONE	20	50	24	50
STAFF	--		--	
LEVEL 01B				
CAFETERIA	23	50	23	50
KITCHEN	22	50	25	
LEVEL 2				
POOL	26		26	
POOL ROOM	28	65	28	65

12.E.6.3.4_INDOOR AIR QUALITY

A ventilation system provides sufficient air flow from the outside to prevent the formation of high concentrations of pollutants in areas of human activity. The procedure established in UNE-EN 13779 is considered valid for these purposes.

Depending on the intended use of each are, the minimum indoor air quality (IDA) is as follows:

- IDA 1 (ideal air quality): hospitals, clinics, laboratories and child care facilities
- IDA 2 (good air quality): offices, residential buildings (hotels and similar, retirement homes, student housing), libraries, museums, courts, classrooms and similar and swimming pools
- IDA 3 (average air quality): commercial buildings, cinemas, theatres, auditoriums, hotel rooms and similar, restaurants, cafes, bars, banquet halls, gymnasiums, athletic facilities (except pools) and computer rooms
- IDA 4 (low air quality)

For all areas except where the swimming pool is located the air change values will be as follows:

- IDA 1 (ideal air quality, 20 l / s · pers)
- IDA 2 (good air quality, 12.5 l / s · pers)
- IDA 3 (average air quality, 8 l / s · pers)
- IDA 4 (low air quality, 5 l / s · pers)

In the heated swimming pool area, the outdoor air needed to dilute contaminants will be 2.5 dm^3/s per square metre of water surface (does not include the spectator area). If necessary, additional air flow may be needed to control relative humidity. The area will be kept at a negative pressure between 20 and 40 Pa compared to the contiguous areas.

12.E.6.3.5_NUMBER OF USERS

To calculate the density for each area and intended use we will use the information in the technical building code, specifically the Basic Fire Safety Document.

This code stipulates as follows:

Intended use	Zone, type of activity	Occupancy (m^2/person)
Any	Zones that are occupied occasionally and accessible for maintenance only: machine rooms, cleaning supply rooms, etc.	Nil occupancy
	Public toilets	3
Residential buildings	Floors	20
Public Residential	Accommodation zones	20
	All-purpose rooms	1
	Vestibules and lobbies, general use areas on basement, ground and mezzanine levels.	2
Parking areas	Connected with activities that have specific hours of operation: commercial, performing arts, offices, etc.	15
	Other cases	40
Administrative	Offices	10
	Lobbies and general use areas open to the public	2
Schools	Entire floor or building	10
	Areas other than classrooms such as laboratories, shops, gymnasiums, art rooms, etc.	5
	Classrooms (except nurseries)	1.5
	Pre-school classrooms and reading rooms in libraries	2
Hospitals	Waiting rooms	2

Busy public spaces	Zones for seated spectators: seating defined in the plans	1 person per seat
	Zone for seated spectators: seating not defined in plans	0.5
	Standing room for spectators	0.25
	Spaces for patrons inside discotheques	0.5
	Standing room for patrons in bars, cafes, etc.	1
	Public areas in gymnasiums: with equipment	5
	Public areas in gymnasiums: without equipment	1.5
	Swimming areas at public swimming pools (pool surface area)	2
	Public areas at outdoor swimming pools	4
	Multi-function buildings, conference halls, hotels, etc.	1
	Public areas in "fast food" restaurants (e.g. hamburger and pizza places).	1.2
	Public seating areas in bars, cafes, restaurants, etc.	1.5
	Waiting rooms, reading rooms in libraries, public spaces in museums, art galleries, fairgrounds and exhibit halls, etc.	2
	Lobbies in general, public spaces on basement, ground and mezzanine levels	2
	Lobbies, locker rooms, dressing rooms and similar areas annexed to performing arts and meeting spaces.	2
	Public areas in public transport terminals	10
	Service areas in bars, restaurants and cafes, etc.	10
Archives, warehouses		40

When the result is a decimal, we need to use the next closest whole number.

Once we calculate the capacity in each type of space and the required flow rate per person, we can calculate the facility's air change rate.

NAME	CTE DB SI3 OCCUPANCY	EXTERIOR AIR CHANGE RATE (m^3/h)
TECHNICAL OFFICE	3	43.2
LEVEL -1		**43.2**
ATHLETES PREPARATION ROOM 1	3	86.4
ATHLETES PREPARATION ROOM 2	3	80.64
TV ROOM	13.3	383.04
JUDGES MEN	3	72
MEN'S LOCKER ROOM	26	748.8
JUDGES WOMEN	2.5	72
WOMEN'S LOCKER ROOM	26	748.8
MASSAGE & TREATMENT MEN	15	432
STAFF	4	115.2
MASSAGE & TREATMENT WOMEN	15	432
STAFF	4	115.2
STAFF	4	115.2
LATERAL CORRIDOR	18	501.12
PRESS ROOM	12	345.6
LEVEL 0		**4.248**
GYM 1	15.8	455.04
STAFF	4	115.2
GYM 2	16	455.04
STAFF	4	115.2
LEVEL 01A		**1.140**
CONFERENCE ROOM	67	1915.2
ENTRANCE	9	244.8
SHOP	21	585.6
MIXED ZONE	11	305.28
STAFF	4	115.2
LEVEL 01B		**3,166**
CAFETERIA	92	2630.4
KITCHEN	4	115.2
LEVEL 2		**2,746**
POOL	625	
POOL ROOM	960	**5,810**
TOTAL		**17,153**

SOLUTION TECHNICAL DESCRIPTION

Ventilation air from the outside is filtered before it enters the building. Depending on outdoor air quality (ODA) and indoor air quality (IDA), the minimum types of filters to be used will be as described below:

PRELIMINARY FILTERS					
		IDA 1	**IDA 2**	**IDA 3**	**IDA 4**
ODA 1	Pure air	F7	F6	F6	G4
ODA 2	Air with high particle concentrations	F7	F6	F6	G4
ODA3	Air with high concentrations of contaminating gases	F7	F6	F6	G4
ODA 4	Air with high concentrations of particles and contaminating gases	F7	F6	F6	G4
ODA 5	Air with VERY high concentrations of particles and contaminating gases	F7	F6	F6	G4

FINAL FILTERS					
		IDA 1	**IDA 2**	**IDA 3**	**IDA 4**
ODA 1	Pure air	F9	F8	F7	F6
ODA 2	Air with high particle concentrations	F9	F8	F7	F6
ODA3	Air with high concentrations of contaminating gases	F9	F8	F7	F6
ODA 4	Air with high concentrations of particles and contaminating gases	F9	F8	F7	F6
ODA 5	Air with VERY high concentrations of particles and contaminating gases	F9	F8	F7	F6

Prefilters will be used to keep the components of the ventilation and air treatment units clean and to prolong the filters' useful life. The prefilters will be installed on the outdoor air intake, on the treatment unit and on the return air intake.

Extraction air is classified in the following categories:

- AE 1 (low level of contamination)
- AE 2 (moderate level of contamination)
- AE 3 (high level of contamination)
- AE 4 (very high level of contamination)

Only air in category AE 1, free of tobacco smoke, can be returned to the facilities. Air in category AE 2 can be used as recirculation air or transferred from the building to service areas, toilets or garages. Air in category AE 3 and AE 4 cannot be used as recirculation or transfer air.

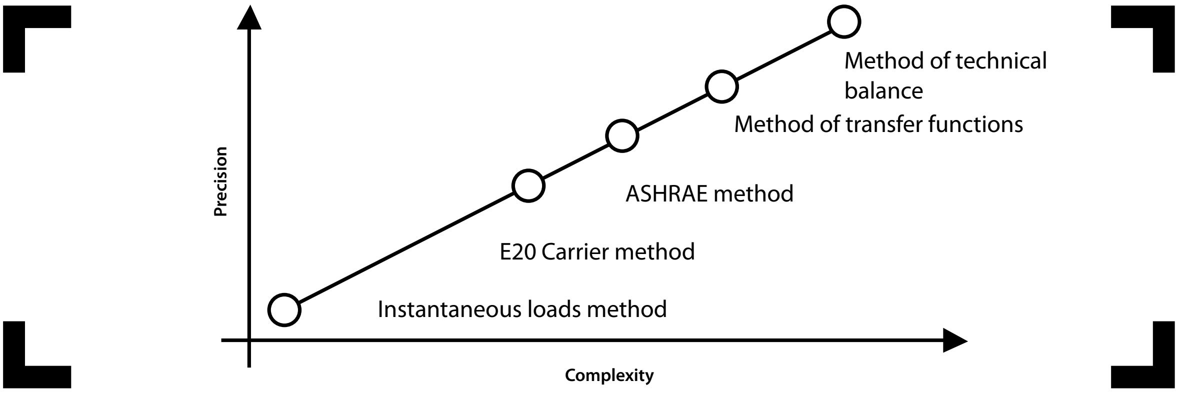
In our case, for quality and comfort reasons, no air from any room will be used by any other contiguous room.

All heating and air conditioning units in the facility will be equipped with automatic free-cooling systems for air renovation.

This circuit will be equipped with an air-to-air cross-flow recuperator to save energy by exchanging the heat between the air exiting the facility and the new air coming in.

12.E.6.3.6_THE BUILDING'S ENERGY DEMAND

There are different methodologies that can be used to calculate the building's energy demand, the complexity of which depends on the type of calculation (heating and/or cooling) and the desired precision.



INSTANTANEOUS METHOD

- Load = Heat gain.
- Does not consider heat accumulation.
- Load per wall: Qwalls = A · K · ΔT
- Simpler --> less precise.

CARRIER E20 METHOD

- Load calculated under conditions of reference (standard).
- Load correction in specific situations.
- Heat accumulation factors considered.
- Load per wall: Qwalls = A · K · ΔT
- An equivalent temperature difference is defined that takes incident solar radiation, accumulation, etc. into account.

ASHRAE METHOD

- Similar to the E20 method.
- Calculates cooling load temperature differences (CLTD) and cooling load factors (CLF).

THERMAL BALANCE METHOD

- Three heat transmission and accumulation mechanisms.
- Balance of energy in all elements --> coupled equations.
- Few simplifications --> Very real model --> Highly precise.
- Exhaustive calculations and data, requires the use of a computer.

ESTIMATION METHOD

- Demand/m2 rate for both heating and cooling .
- Greatly simplified --> Functional --> Low precision.

12.E.6.3.7_CALCULATION OF POOL'S ENERGY DEMAND AND AMBIENT DEHUMIDIFICATION

According to the C.T.E., the conditions for an indoor pool are as follows:

For indoor pools, the ambient temperature and humidity values must be established in the plans; the dry air temperature in the facility must be between 2ºC and 3ºC higher than the water temperature, at least 26ºC but not more than 28ºC, and the relative humidity must be between 55% and 70%.

According to FINA and NIDE 2005, for competition pools the temperature of the pool water must be 26ºC ± 1ºC, air temperature, 28ºC and relative humidity between 60%-65%.

According to RITE, the measurement must be taken in the middle of the pool at a depth of 20 cm below the water's surface with a tolerance of 1ºC in the horizontal and vertical space.

There are various types of heat loss that can affect an indoor pool, such as:

- Evaporation of the water into the air from the surface of the pool water, from the wet floor around the pool and even from swimmers' bodies.
- Convection of the air from the surface of the water.
- Conduction through the walls of the pool.
- Radiation on the surface of the water to the outside.
- Renovation of pool water.

The following equation is used to calculate the loss due to conduction through the walls of the pool:

$$Q_{transmission} = S_{pool\ enclosure} * C_t * (T_{water} - T_{walls})$$

Where:

$\mathbf{Q}_{transmission}$ = Heat loss by transmission.
$\mathbf{S}_{pool\ enclosure}$ = Surface area of pool enclosure.
$\mathbf{C}_t$ = Conduction coefficient of the walls of the pool.
$\mathbf{T}_{water}$ = Water temperature.
$\mathbf{T}_{walls}$ = Temperature of pool walls

Losses due to conduction are considered negligible compared to others. In our case, where the entire perimeter of the pool is walkable and the Δ of the indoor temperature and the pool water is negligible, the losses due to conduction are minimal. On the other hand, evaporation of water on the wet floor and people's bodies can affect air conditions but not water conditions.

The calculations normally consider four types of losses:

- Evaporation of water
- Convection
- Radiation
- Renovation of pool water

EVAPORATION

Evaporation is the physical phenomenon in which a liquid turns into a gas. This change of state requires energy, called latent heat, which is not reflected in an increase in the ambient temperature.

The latent heat in the vaporisation of water is:

$$L = 2.255 * 103 \ J / Kg = 40.65 \ KJ / mol = 540 \ cal / gr$$

The energy that is consumed during evaporation is provided by the water, which cools the surface. The thermal load that passes from the water to the air is expressed simply as the product of the latent heat times the evaporated mass.

$$Q = L{*}m_y$$

The evaporated mass per unit of time depends on many factor including:

- The gains from solar radiation (negligible in the case of indoor pools)
- The humidity of the air on the water's surface
- The speed of the air on the water's surface

Relative humidity is normally considered constant or equal to 60-65% and considering the air speed in indoor spaces, the value is 0.1 m/s.

Under these conditions, the Tonthwaite-Holzman equation provides the evaporated mass of the floor space around the swimming pool:

$$mv = \frac{0.622 \ K^2 * Pa * (Pvsa - PVA) * V2}{Pa * [Ln(\frac{Z_1}{Z_2})]^2}$$

Where:

mv = evaporated mass of water in gr/Cm^2
K = Von Karman constant = 0.4
$\mathbf{P}_{vsa}$ = saturated vapour pressure at room temperature in mmHg.
$\mathbf{P}_{vs}$ = pressure of vapour in the air in mmHg.
$\mathbf{P}_{a}$ = the density of dry air which, at sea level and 25ºC is 1,184 Kg/m^3.
$\mathbf{Z}_{1}$ = The elevation of reference of the pool's surface which is assumed to be 1 m.
$\mathbf{Z}_{2}$ = The elevation of reference of the pool which is normally 5 m.
$\mathbf{V}_{2}$ = Air velocity at elevation Z_2 in Cm/s.

Saturated vapour pressure can be calculated considering the water vapour as an ideal gas using the Clauslus-Clapeyron equation:

$$LnP_{vsa} = \frac{L}{R} * \left(\frac{1}{T}\right) + C$$

Where:

L = enthalpy of water vaporisation (latent heat = 540 cal/gr)
R = constant of perfect gases = 8.31451 J/molºK.
T = Absolute temperature in ºK
C = constant

In our case it is preferable to use the Antolne equation which is better for calculating the behaviour of real gases at room temperature:

$$LnP_{vsa} = A - \left(\frac{B}{T+C}\right)$$

Where in the case of the water, the constant values are:

A = 18.304
B = 3,816.4
C = 46.13

The pressure can be calculated once the absolute temperature is known.

$$P_{vsa} = e^{[A-(\frac{B}{T+C})]}$$

Which provides the results in mmHg directly.

Vapour pressure is obtained from relative humidity:

$$P_{va} = P_{vsa} = * \frac{RH}{100}$$

The following equation is used to calculated monthly energy loss:

$$Q_{ev} = L * m_v * S * 24 * N$$

Where:

S = pool surface
N = number of days in the month

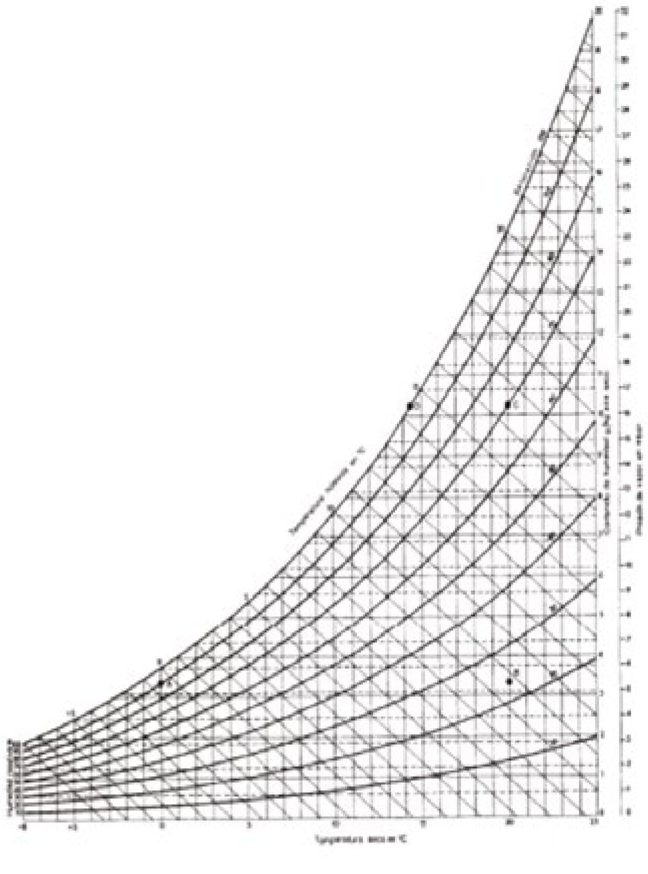
The Bernier equation is used to calculate the evaporated mass of the pool since it includes two very important terms in the calculation which are the coefficient of agitation of unused water over time (coefficient 16) and used water over time (coefficient 133 where *n is the number of users).

$$M_{ev} = S *[(16 + 133 * n) * (W_e - G_a * W_{as})] + 0.1 * N$$

Where:

M$_{ev}$ = mass of evaporated water (Kg/h)
S = pool surface.
W$_e$ = absolute humidity of saturated air at water temperature.
W$_{as}$ = absolute humidity of saturated air at indoor air temperature.
G$_a$ = level of saturation (60-65%)
n = total number of swimmers.
N = total number of spectators

For W_e and W_{as} the psychrometric charts can be consulted:



In this case, the following equation will be used to calculate evaporation losses:

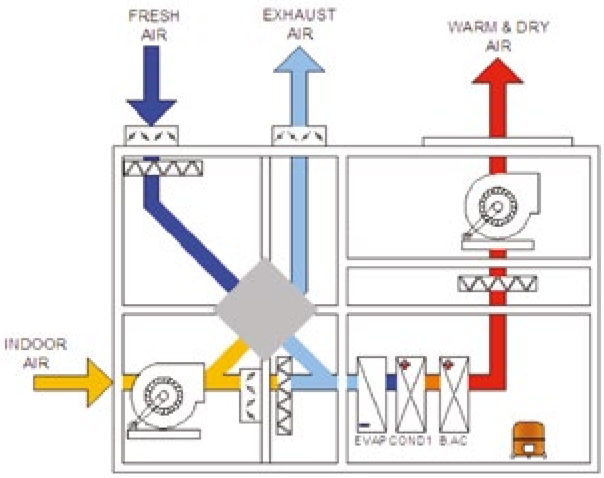
$$Q = L*m_y$$

A heat pump equipped with free-cooling may be used to dehumidify the air, or cooling equipment when the outdoor conditions are adverse or outdoor air recirculation when the outdoor conditions are ideal (see psychrometric diagram).

During the hottest days of summer when the outdoor ambient temperature is higher than the 28ºC required in the area, the dehumidifying equipment will have an outdoor capacitor to produce cooling.

The batteries will also be equipped with a heat exchange system in order to use the cold water in the absorption pump to cool the spectator area.

To recover the energy from the air extracted from the free cooling system, the dehumidifier will be equipped with a cross flow air-to-air heat exchanger.



LOSSES DUE TO CONVENTION

The air-to-water heat exchange by convection in a pool should, if C.T.E. is followed to the letter, result in a heat gain for the water since the air temperature is higher. However, it is very unlikely that an indoor swimming pool will be kept at a constant ambient temperature 24 hours a day. Also, some heat loss occurs at night from the surface of the water due to the greater inertia of water compared to air.

Heat loss due to convection can be calculated using the equation:

$$Q_c = h * S * (T_m – T_a) * 24 * N$$

Where:

S = pool surface.
h = natural convection coefficient (4 Kcal/m2hºC)
$\mathbf{T}_m$ and $\mathbf{T}_a$ = water and air temperature.

LOSSES DUE TO RADIATION

Losses due to radiation are generally expressed by the Stefan Bolzmann constant:

$$Q_r = \varepsilon * \sigma * S * (T^4_m – T^4_a) * 24 * N$$

WHERE:

ε = emissivity of water (0.095)
σ = the Stefan-Boltzmann constant (5.67 * 108 W / m2 / K4)
S = surface.
$\mathbf{T}^4_m$ and $\mathbf{T}^4_a$ = the absolute temperature of the water and the air (considering the walls to be in equilibrium with the interior)

LOSSES DUE TO POOL WATER RENOVATION

The water in a swimming pool may need to be replaced for any of the following reasons:

- To comply with the health code. It used to be 5%, but nowadays it depends on the correct maintenance of the chemical-sanitary parameters required by public health authorities. The amount of water that needs to be replaced for this reason is directly proportionate to how the pool water is treated.
- Due to evaporation. Previously calculated.
- Due to use. Primarily, splashing, waves and swimmers getting in and out of the pool.
- Filter washing.

Since the water comes from the public main, it needs to be heated to the temperature of the water in the pool (26ºC). Hence, the loss would be:

$$Q_{ren} = \frac{pcq}{3.6*s} * (Tm - Ta)$$

Where:

p = water density.
c = specific heat of water.
q = flow of replacement water (m3 / h)
Tm and Ta = Temperature of the water in the pool and the public system.

12.E.6.3.8_CALCULATING THE DEMAND FOR HOT WATER (HW)

Section HE4 of C.T.E. establishes that the demand for hot water will be calculated using the information on the following table (UNE 940002: 2005):

DEMAND CRITERIA	LITRES OF HOT WATER/DAY AT 60 ºC	
Single-family homes	30	Per person
Multi-family homes	22	Per person
Hospitals and clinics	55	Per bed
Hotels****	70	Per bed
Hotels ***	55	Per bed
Hotel/Hostel **	40	Per bed
Campgrounds	40	Per site
Hostel/Pension	35	Per bed
Residences (retirement homes, student housing, etc.)	55	Per bed
Dressing rooms/collective showers	15	Per service
Schools	3	Per student
Barracks	20	Per person
Factories and shops	15	Per person
Administrative	3	Per person
Gymnasiums	20 to 25	Per user
Laundries	3 to 5	Per Kg of laundry
Restaurants	5 to 10	Per place setting
Cafes	1	Per breakfast

The demand can be calculated using the following equation:

$$D = Tacs \frac{Tacs - Tf}{T\text{-}Tf}$$

Where:

T$_{acs}$ = Desired temperature of hot water
T = Accumulation temperature
Tf = Water main temperature

12.E.6.4_INSTALLATIONS

12.E.6.4.1_AVERAGE AIR VELOCITY

The velocity of the air in the occupied zone will be kept within comfortable limits, considering the people's activities and their level of clothing as well as the air temperature and turbulence intensity.

The average admissible air velocity in the occupied area (V) is calculated as follows:

For dry air temperatures ranging between 20°C and 27°C, the following equations are used:

In diffusion by mixture (supply zone above the respiration zone) for a turbulence intensity of 40% and PPD of 15% due to drafts, the average air velocity is between:

$$V = \frac{t}{100} - 0.07 = m/s$$

- Winter: 0.14 to 0.16 m/s.
- Summer: 0.16 to 0.18 m/s.

In diffusion by displacement (supply zone occupied by people over an extraction zone), for a turbulence intensity of 15% and PPD due to drafts less than 10%, the average air velocity would fall within the following range:

$$V = \frac{t}{100} - 0.10 = m/s$$

- Winter: 0.11 to 0.13 m/s.
- Summer: 0.13 to 0.15 m/s

12.E.6.4.2_QUALITY OF ACOUSTIC ENVIRONMENT

To ensure the quality of the acoustic environment, measurements will be taken in compliance with UNE 100153.

Generally speaking the sound levels throughout the facility should be consistent with the information on the following table:

TYPE OF FACILITY	Maximum sound level	
	dB A	N.C.
Restaurants and cafes		
Restaurants	50	45
Banquet halls	50	45
Cafes	55	50
Athletic facilities		
Sports arenas	45	40
Gymnasiums	50	45
Indoor pools	60	55
Offices		
Conference halls	40	35
Offices	45	40
General offices	50	45
Lobbies and corridors	55	50
Public buildings		
Libraries	45	40
Museums and courts	45	40
General purpose rooms and lobbies	50	45

12.E.6.4.3_SIMULTANEITY CALCULATION

The simultaneity of the facilities will be calculated according to UNE 149.201: 2008, which specifies that sports complexes where the total water demand is > 20 lts/s, the equation to be used is:

$$Q_c = -22.5 * Q_t^{-0.5} +11.5$$

Where:

Q_c = Simultaneous flow calculation.
Qt = Minimum flow according to DB HS4.

12.E.6.4.4_DUCTS

All air ducts will be designed according to UNE-100-101-84.
For rectangular or oval ducts, the ratio of the sides will be as follows:

$$r = \frac{a}{b}$$

Where the following will always be true:

a ≥ b
r ≤ 4

The ducts will be made of B.1 class metal with a maximum pressure of 150 Pa and an average maximum velocity of 5 m/s (UNE 100-102-88).

They will be thermally insulated according to RITE to ensure that the heat loss will never be greater than 4%.

The airtightness of the ducts is determined according to the following equation:

$$f = c*p^{0.65}$$

Where:

f = air leaks in $dm^3/s\ m^2$
p = static pressure in Pa.
c = coefficient that defines the class of sealant.

There are four different types of sealant:

CLASS	COEFFICIENT "c"
A	0.027
B	0.009
C	0.003
D	0.001

In this case, the sealant class must be class B or higher.

12.E.6.4.5_WATER PIPE CALCULATIONS

In order to calculate the load loss of a flow and also the pump and pipe characteristics, it is important to remember that calculating a real flow is much more complex than calculating an ideal flow, which could be represented in the Bermoulli formula by incomprehensible flow with no outside energy input.

$$\int_{p1}^{p2} \frac{dp}{w} + \int_{v1}^{v2} \frac{vdp}{g} + \int_{z1}^{z2} dz + \int_{p1}^{p2} dh_1 = 0$$

Due to the viscosity of real fluids, as the fluids moves, cutting forces appear between the fluid particles and the contour walls and between the different layers of the fluid. As a rule, the differential equations in partial derivatives that would, for the most part, resolve the flow problem (e.g., the Euler equations) do not offer a solution. Consequently, the problem must be resolved using experimental data and empirical methods.

First, to determine which equations to use, we need to calculate the Reynolds number to determinate whether the flow is laminar or turbulent.

$$Re = \frac{vdp}{u} \text{ o } \frac{vd}{v} = \frac{v(2r0)}{v}$$

Where:

V = Flow velocity in m/s
d = hydraulic pipe diameter in m.
r0 = hydraulic pipe radius in m.
v = kinematic viscosity of the flow in m^2/sec
p = flow density in kg sec^2/m^4
u = absolute viscosity in kg sec/m^2

In our case, the result of the equation at a flow velocity of 2 m/s with a water temperature of 26ºC gives an average of:

Re = 157,435.38> 2,000 which means that the flow is turbulent.

At this point we can calculate a load loss using:

$$PC = f \frac{LV^2}{de2g}$$

Where:

f = friction coefficient
L = pipe length in m.
V = flow velocity in m/s
d = hydraulic diameter in m
g = gravity in m/s^2

The problem is calculating the friction coefficient. To do so there are countless equations for calculating turbulent flow such as the Blasius formula for transitory flows, the Hermann Burbach formula or the formulas of Nikuradse, Dupult, Darcy *, Levy, Kutta, Bazin,* Prony etc.

For all kinds of pipes, the Hydraulic Institute of the Unites States of America and most engineers consider the COLEBROOK equation to be the best option for calculating f:

$$\frac{1}{\sqrt{f}} = -2\log\left[\frac{\varepsilon}{3.7d} + \frac{2.51}{Re\sqrt{f}}\right]$$

For accessories, the load loss is calculated using the following formula:

$$PC = K\frac{V^2}{2g}$$

Where **k** is the friction coefficient of each accessory provided by the manufacturer, which can also be found in specialised publications.

12.E.6.4.6_SOLAR COLLECTOR CALCULATIONS

The F-CHART method is commonly used to calculate the solar collectors needed to satisfy the facility's energy demand (remember that this includes not only the pool and hot water production but also the absorption pump in the summer).

It is therefore important to have reliable data for sunlight and average daily temperatures in the place where the facility is located.

In this case, the data were obtained from IDAE and the Catalan Meteorological Institute.

The amount of radiation that will be gathered by the collectors can be calculated as follows:

$$H_{mo} = K_{mo} * H_{day} * N$$

Where:

H_{mo} and **H_{day}** = average monthly and daily radiation values.
K = coefficient depending on the month, latitude and inclination.
N = number of days.

The daily radiation values on the surface of the collectors can be calculated using the available information for radiation on horizontal surfaces (e.g., for Cataluña, this data can be obtained from IDAE).

The C.T.E. determines the maximum permissible losses from collectors, identifying three different scenarios:

- General
- Superimposition
- Architectural integration

Obviously, all three conditions must be met and the total permitted loss will be less than the other two. The ideal conditions are those indicated in the D.T.E. - southern orientation and optimum summer tilt - as we need to generate as much energy as possible during this time to power the absorption pumps.

The tilt of the collectors will be 10º, perfect for working in the summer and for blending in architecturally.

In any event, the losses from tilt are evaluated according to the C.T.E. (HE-4).

Note once again that in this project there are no losses due to shade, since the collectors are fully south-facing.

Based on this information and the facility's energy requirements, the collector to be used in this project will be a high-performance 2m x 1m CFK-1 panel with an effective radiation surface of 2.3 m^2.

6 rows with 48 panels each grouped into 4 units will be installed. Each row will have its own safety air dissipater and all necessary safety and cut-off components.

12.E.6.4.7_GEOTHERMAL HEAT PUMP COLLECTOR CALCULATIONS

In order to calculate the geothermal pump collectors, it is first essential to characterise the soil where the facility is located geologically in order to evaluate the sizing.

The table below, provided by IDAE, shows the thermal conductivity of each type of soil.

ROCK TYPE	Thermal conductivity (W/mK)			Volumetric heat capacity
	Minimum	Typical value	Maximum	(MJ/m3K)
MAGMATIC ROCKS				
BASALT	1,3	1,7	2,3	2,3 - 2,6
GREENSTONE	2	2,6	2,9	2,9
GRABO	1,7	1,9	2,5	2,6
GRANITE	2,1	3,4	4,1	2,1 - 3,0
PERIDOTITE	3,8	4	5,3	2,7
RHYOLITE	3,1	3,3	3,4	2,1
METAMORPHIC ROCKS				
GNEISS	1,9	2,9	4	1,8 - 2,4
MARBLE	1,3	2,1	3,1	2
METACUARCITA		aprox. 5,8		2,1
MICASQUITOS	1,5	2	3,1	2,2
MUDSTONE	1,5	2,1	2,1	2,2 - 2,5
SEDIMENTARY ROCKS				
LIMESTONES	2,5	2,8	4	2,1 - 2,4
LOAM	1,5	2,1	3,5	2,2 - 2,3
CAERCITA	3,6	6	6,6	2,1 - 2,2
SALT	5,3	5,4	6,4	1,2
SANDSTONE	1,3	2,3	5,1	1,6 - 2,8
SILTSTONES AND ARGELLITES	1,1	2,2	3,5	2,1 - 2,4
NON-CONSOLIDATED ROCKS				
DRY GRAVEL	0,4	0,4	0,5	1,4 - 1,6
WATER-SATURATED GRAVEL		aprox. 1,8		aprox. 2,4
DRY SAND	0,3	0,4	0,8	1,3 - 1,6
WATERLOGGED SAND	1,7	2,4	5	2,2 - 2,9
DRY CLAY /SILT	0,4	0,5	1	1,5 - 1,6
CLAY /SILT, SATURATED WITH WATER	0,9	1,7	2,3	1,6 - 3,4
PEAT	0,2	0,4	0,7	0,5 - 3,8
OTHER MATERIALS				
BENTONITE	0,5	0,6	0,8	aprox. 3,9
CONCRETE	0,9	1,6	2	aprox. 1,8
ICE (-10 ºC)		2,32		1,87
PLASTIC (PE)		0,39		
AIR (0-20 ºC, dry)		0,02		0,0012
STEEL		60		3,12
WATER (+10 ºC)		0,58		4,19

Vertical collection consists of boring one or more holes into which the energy collectors are inserted. The holes are between 50 and 200 m deep. The advantages are that they occupy little space and provide a great deal of temperature stability. The horizontal option, on the other hand, is more expensive. In this project we will use a combination:

1. A horizontal collector in the slab of the pool to heat the water.

2. Vertical collectors around the building. The heat capacity of the soil must be considered when using this type of system.

To determine the dimensions, we will use the information published by ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers): "Commercial / Institutional GSHP Engineering Manual (1995)".

ASHRAE proposes the following equation to determine the approximate length. The length of the collectors can then be calculated with more precision, which is why it is important to know the convection coefficient of the fluid with the subsoil.

$$L = 0.05506 \frac{Eex}{Te\text{-}Ts}$$

Where:

L = length of bore hole.
$\mathbf{E}_{ex}$ = energy extracted from the soil.
$\mathbf{T}_{s}$ = soil temperature (ºC).
$\mathbf{T}_{e}$ = entry temperature.

For this project we will install a THHEY-2130 heat pump with high pressure reversible water-water recuperator, 130 kW for cooling and 147 kW for heating.

The number of vertical collectors must be calculated for each installation in particular and the justification of those calculations falls outside the scope of this report.

This system will support the absorption pumps in summer to satisfy cooling demands, recovering the heat from the swimming pool by means of a coil installed in the slab; in the winter it will support the solar panels, hot water production and boilers, sending the coolant to the cold circuit accumulators (if there is a demand) or to the geothermal tanks.

12.E.6.5_THE BUILDING'S TOTAL ENERGY NEEDS.

There are different methodologies that can be used to calculate the building's energy demand, the complexity of which depends on the type of calculation (heating and/or cooling) and the desired precision.

Since we do not have architectural data for the building, we will use an estimative method which can be very useful as an initial approximation when there is sufficient information available on the location where the facility will be built. This fits in well in our case, since the building will presumably be built in Barcelona.

The recommended calculation method is the thermal balance method, which is the most precise.

With this in mind, the building's energy demand is based on the following values:

- Heating rate: 80 W/m^2
- Heating rate: 80 W/m^2

NOTE: these rates only apply to Barcelona.

AREA	FLOOR	HEATING LOAD (W)	COOLING LOAD (W)
TECHNICAL OFFICE	-1	1,920	2,791
LEVEL -1		**1,920**	**2,791**
ATHLETES PREPARATION ROOM 1	0	2,400	3,488
ATHLETES PREPARATION ROOM 2	0	2,240	3,256
TV ROOM	0	10,640	15,465
JUDGES MEN	0	2,000	2,907
MEN'S LOCKER ROOM	0	6,240	9,070
JUDGES WOMEN	0	2,000	2,907
WOMEN'S LOCKER ROOM	0	6,240	9,070
MASSAGE & TREATMENT MEN	0	6,560	9,535
STAFF	0	2,160	3,140
MASSAGE & TREATMENT WOMEN	0	6,400	9,302
STAFF	0	2,320	3,372
STAFF	0	1,440	2,093
LATERAL CORRIDOR		13,920	20,233
PRESS ROOM	0	9,600	13,953
LEVEL 0		**74,160**	**107,791**
GYM 1	01A	12,640	18,372
STAFF	01A	3,120	4,535
GYM 2	01A	12,640	18,372
STAFF	01A	3,120	4,535
LEVEL 01A		**31,520**	**45,814**
CONFERENCE ROOM	01B	10,640	15,465
ENTRANCE	01B	1,360	1,977
SHOP	01B	4,880	7,093
MIXED ZONE	01B	8,480	12,326
STAFF	01B	4,240	6,163
LEVEL 01B		**29,600**	**43,023**
CAFETERIA	2	10,960	15,930
KITCHEN	2	1,360	1,977
LEVEL 2		**12,320**	**12,320**
POOL		563,000	
POOL ROOM	0	654,000	
HOT WATER		17,000	
TOTAL	**-**	**1,533,040**	**211,739**

12.E.7_ ELECTRICS

SCOPE

Description, calculation and rationale of the power supply installed in the building, specifically:

- To supply all of the water treatment units.
- To supply all of the air-conditioning and heating units.
- To supply all of the building's lighting.

None of the above units or circuits have been included in this report, nor have any others not mentioned in it.

DESCRIPTION OF THE WIRING

The wiring will be installed in compliance with the additional technical instructions (ITC) in the Regulations on Low Voltage, and the cross-sections and protection ratings as per ITC BT 17, 19, 21, 22 and 23.

The wiring in rooms with special characteristics, or that are damp or wet, will be subject to ITC BT 30, the pools and fountains to ITC BT 31, and toilets and shower rooms to ITC BT 27.

There will be no light-receiving elements or sockets inside the pools.

There will be an equipotential line around the pools made of bare copper joined to metal features such as ladders and tanks.

The installation will have a general circuit breaker in the machine room that includes circuit breakers and controls for the motors so that they can be operated manually or automatically (see diagram).

The junction box does not fall within the scope of this report.

The mains distribution unit is fitted with the various power circuits of the different systems installed, as described below.

Distribution board for water treatment units:

- Filtration pumps: 2 units of 3 kW, 2,880 rpm, 400 V III 50 Hz.
- Heat pump: 1 unit of 2.2 kW, 1,450 rpm, 400 V III 50 Hz.
- Cascade pump: 1 unit of 2.2 kW, 1,450 rpm, 400 V III 50 Hz.
- UV unit: 1 unit of 1 kW, 230 V II 50 Hz.
- Chemical dispenser unit: 1 flocculant dispenser of 0.2 kW, 240 V II 50 Hz.

36.60 distribution board:

- Pump for water features: 1 unit of 0.76 kW, 1,450 rpm, 400 V III 50 Hz.
- Water bed turbo-blower pump: 1 unit of 1 kW, 400 V III 50 Hz.
- Hydromassage pump: 1 unit of 0.43 kW, 2,880 rpm, 400 V III 50 Hz.
- Massage turbo-blower pump: 4 units of 0.4 kW, 400 V III 50 Hz.

Luminaire distribution board. Luminaires:

- 10 units I3014NWHBM X-LED (75 W) Class I electrical appliance (230 V~) with IP65 and IK10 (7600 lm) protection rating.
- 6 units I5003NWLS LINEAR LUMINAIRE (54 W) Class I electrical appliance (230 V~) with IP20 (3500 lm) protection rating.

■ 2 units I5001NWLS DOWNLIGHT (24 W) Class II electrical appliance (230 V~) with IP20 (1714 lm) protection rating.
■ 10 units I1222 PICOLED (1 W) Class III electrical appliance (24 VDC) with IPX8 (50 lm) protection rating.
■ 60 units I1234 MIR NANO (3 W) Class III electrical appliance (24 VDC) with IPX8 (150 lm) protection rating.

All of the wiring that comes out of the distribution board will run through galvanised steel cable trays with a waterproof upper cover.

The metal cable trays will have suitable electrical continuity to ensure an equipotential connection in compliance with standard IEC EN 61537.

12.E.7.1_LIGHTING

The facility's general lighting will comply with standard EN-12193, NIDE regulations and, obviously, the Spanish Ministry of Public Works' general technical guidelines on lighting.

The lighting in work areas (machine rooms, offices, etc.) will be fitted as per standard EN 12464 1996.

LED lighting will be fitted throughout the building.

This system will make it possible to light up all spaces without any problem whatsoever, as well as making a huge saving on energy and maintenance, as LED lights consume approximately 10 times less than conventional lighting and the bulbs last 50,000 hours on average with no maintenance required.

Maintenance will be factored in for all of the luminaires depending on the type used as agreed with the manufacturer, in this case SACOPA, according to the specifications of CIE-97 2005.

12.E.7.1.1_LIGHTING IN THE POOL AREA AND GRANDSTAND

The artificial lighting in the pool area will be uniform so that it does not hinder the vision of swimmers, judges, time keepers or spectators. It should likewise not cause reflections in the water.

The light levels in the pool area will be as follows:

MINIMUM LIGHT LEVELS FOR SWIMMING (indoors and outdoors)		
COMPETITION LEVEL	HORIZONTAL LIGHTING	
	E med (lux)	Uniformity E mín/E mit
International competitions (1)	1,500	0.7
National and regional competitions, and high level training sessions (2)	500	0.7
Local competitions, training sessions, school and recreational use (3)	300	0.5

This pool will fall into the international competitions category (1) and will be of at least 1,500 lux with a level of uniformity of 0.7.

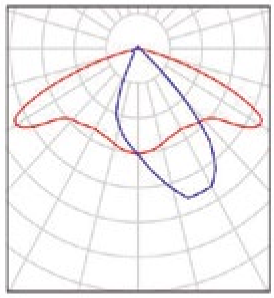
The luminaires will be fitted vertically around the pool. Therefore, a metal structure will be fitted that hangs from the ceiling from steel cables with servomotors so that they can be lowered for maintenance.

This structure will have a transversal walkway for maintenance staff to move around (see detailed plans).

Type of lighting used: this luminaire will be fitted 10 m above the water level.

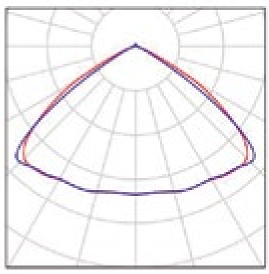
EXTERIOR SCENE 1 / LUMINAIRE PARTS LIST

38 Pieces



IGNIALIGHT I3012NWHBM TLED-NW-300W-Asi Med
Article Nº: I3012NWHBM
Luminous flux (Luminaire): 27771 lm
Luminous flux (Lamps): 27800 lm
Luminaire Wattage: 300.0 W
Luminaire classification according to CIE: 99
CIE flux code: 44 77 98 99 100
Fitting: 1 x I3012NWHBM (Correction Factor 1.000)

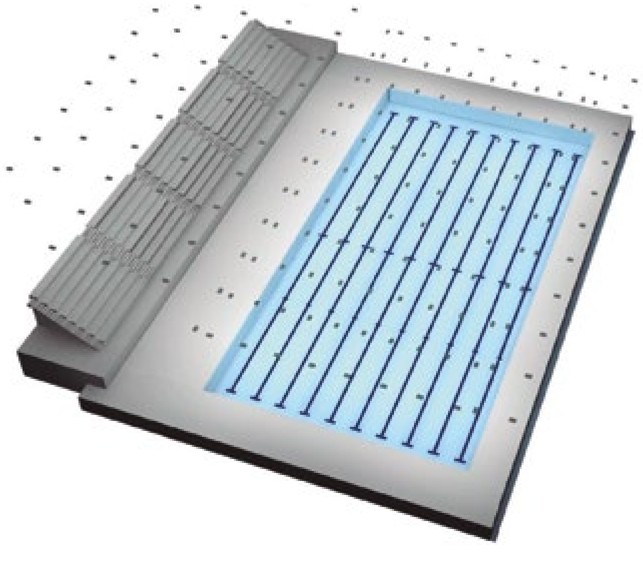
144 Pieces



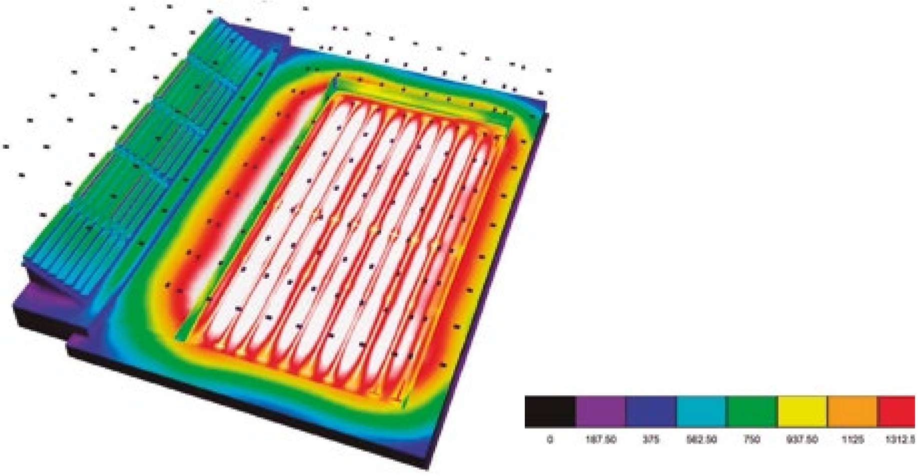
IGNALIGHT I3012NWHSWM T-LED
Article Nº: I3012NWHSWM
Luminous flux (Luminaire): 31302 lm
Luminous flux (Lamps): 31350 lm
Luminaire Wattage: 300.0 W
Luminaire classification according to CIE: 99
CIE flux code: 48 92 99 99 100
Fitting: 1 x I3012NWHBM (Correction Factor 1.000)

See our luminaire catalog for an image of the luminaires.

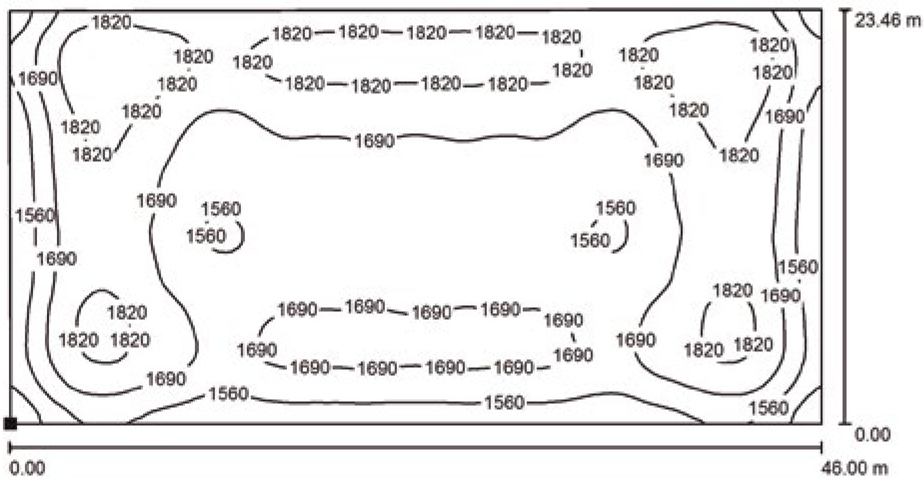
EXTERIOR SCENE 1 / 3D RENDERING



EXTERIOR SCENE 1 / FALSE COLOUR RENDERING



EXTERIOR SCENE 1 / CALCULATION SURFACE 1 / ISOLINES (E, PERPENDICULAR)



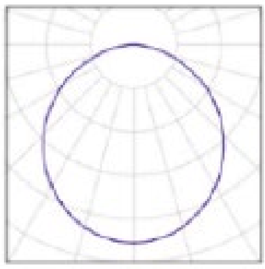
12.E.7.1.2_LIGHTING ON THE GROUND, 1ST AND 2ND FLOORS

Linear spotlights will be used that hang from the ceiling from steel cables.

EXTERIOR SCENE 1 / LUMINAIRE PARTS LIST

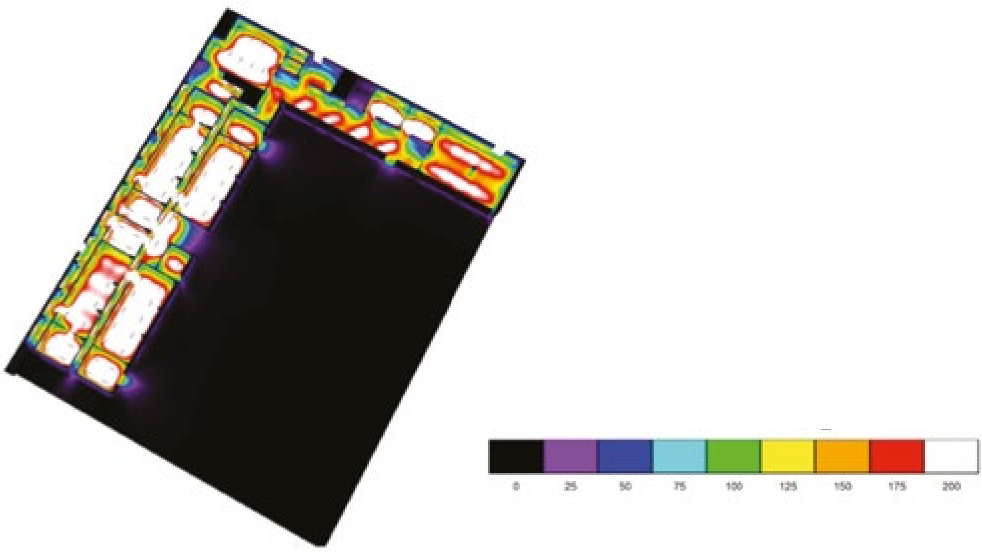
132 Pieces

IGNIALIGHT I5003NWLS LLUMINARIA LINEAL
Article Nº: I5003NWLS
Luminous flux (Luminaire): 3496 lm
Luminous flux (Lamps): 3500 lm
Luminaire Wattage: 54.0 W
Luminaire classification according to CIE: 100
CIE flux code: 48 79 96 100 100
Fitting: 1 x I5003NWLS (Correction Factor 1.000)



EXTERIOR SCENE 1 / 3D RENDERING

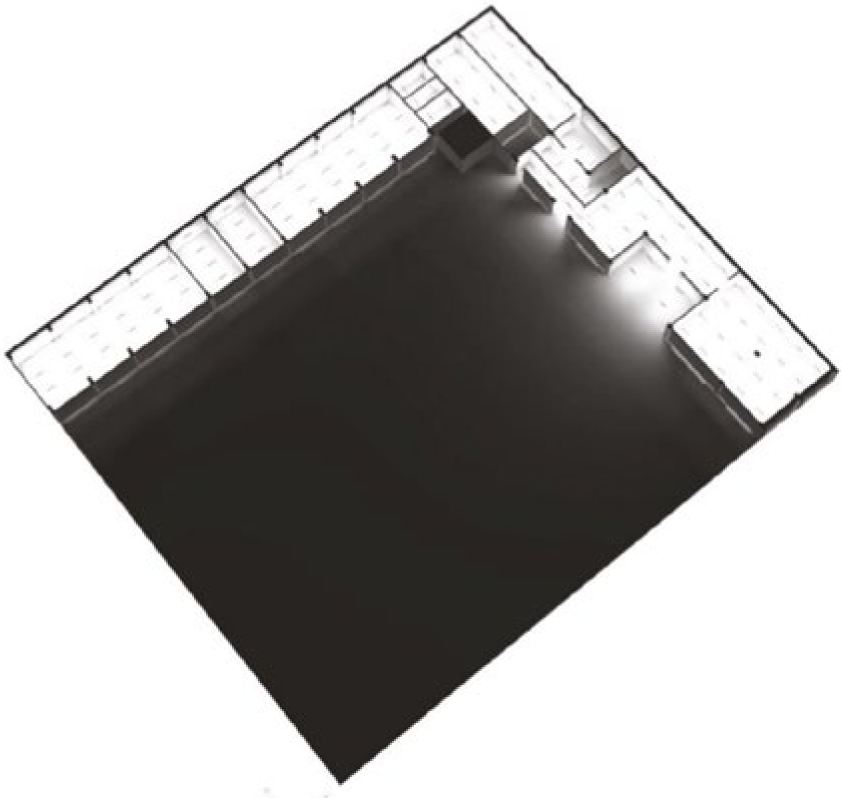
EXTERIOR SCENE 1 / FALSE COLOUR RENDERING



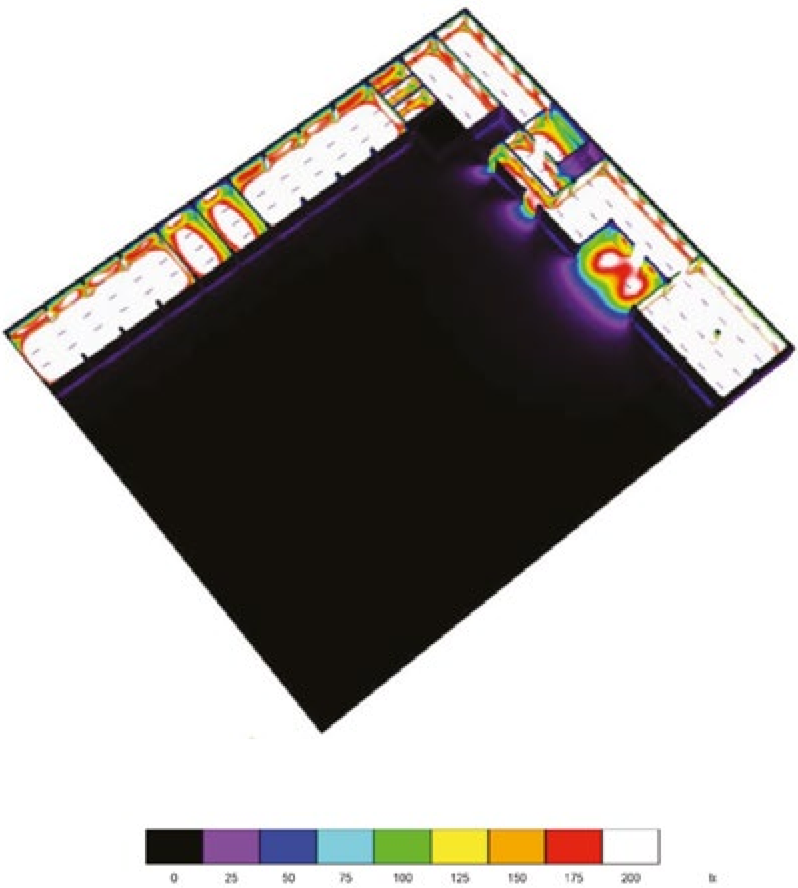
EXTERIOR SCENE 1 / 3D RENDERING

EXTERIOR SCENE 1 / FALSE COLOUR RENDERING

EXTERIOR SCENE 1 / 3D RENDERING



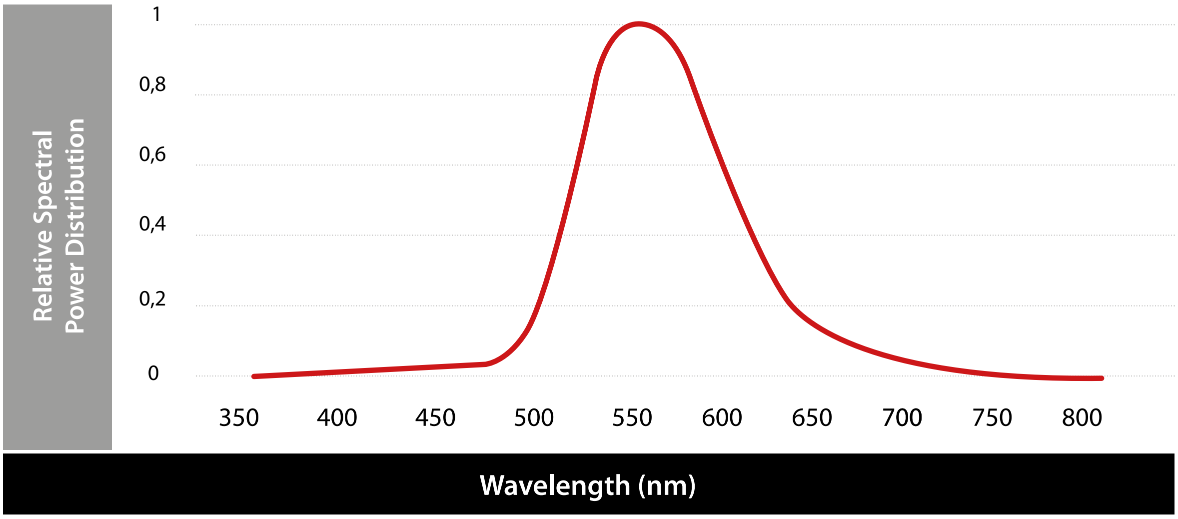
EXTERIOR SCENE 1 / FALSE COLOUR RENDERING



12.E.7.1.3_LIGHTING OUTSIDE THE BUILDING

Most animal life, fauna and insects are adapted to live in the nocturnal darkness. At night, they are able to hide from their predators, eat, hunt and reproduce. Many species are sensitive to radiation from bluish light, but in contrast amber light is almost invisible to them and, therefore, PC-Amber LED luminaries do not perturb their life cycles.

Fluidra's team of engineers has worked in partnership with the main bodies and experts on the prevention of the effects of artificial light in the environment: IAC (Astrophysics Institute of the Canaries), UM (University of Murcia), CEI (Spanish Lighting Committee), the entomologist Alfons G. Dolsa, the director of the Butterfly Museum of Catalonia, and IREC (Catalan Energy Research Institute). Together, they have pioneered the use of PC-Amber technology for street lighting.

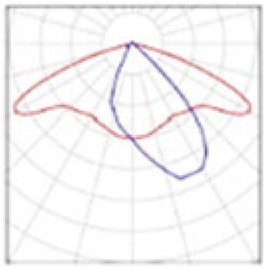


This LED technology makes the light spectrum that insects use to see disappear electronically. They are therefore not attracted to areas that are lit up, where they are easier to catch by their predators.

EXTERIOR SCENE 1 / LUMINAIRE PARTS LIST

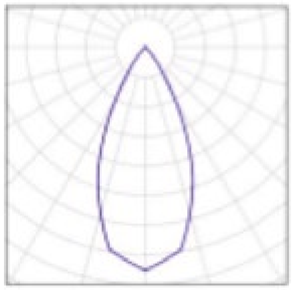
28 Pieces

IGNIALIGHT I3014ALBM X-LED
Article Nº: I3014ALBM
Luminous flux (Luminaire): 3548 lm
Luminous flux (Lamps): 3550 lm
Luminaire Wattage: 50.0 W
Luminaire classification according to CIE: 99
CIE flux code: 45 79 98 99 100
Fitting: 1 x I3014ALBM (Correction Factor 1.000)



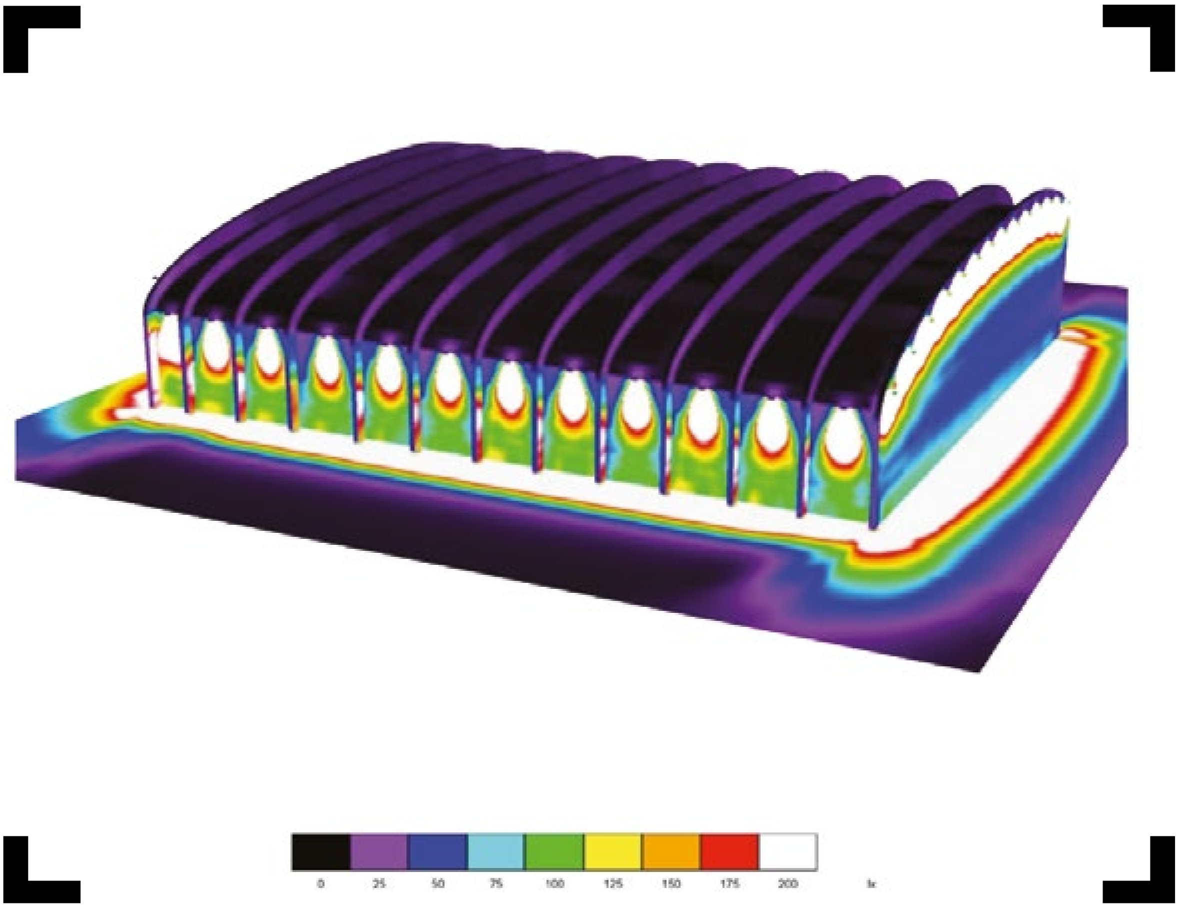
24 Pieces

IGNALIGHT I3014ALSM - PC- AMBRE X-LED
Article Nº: I3014ALSM - PC- AMBRE
Luminous flux (Luminaire): 2967 lm
Luminous flux (Lamps): 3050 lm
Luminaire Wattage: 50.0 W
Luminaire classification according to CIE: 98
CIE flux code: 93 98 100 99 98
Fitting: 1 x I3014ALSM (Correction Factor 1.000)



EXTERIOR SCENE 1 / 3D RENDERING

EXTERIOR SCENE 1 / FALSE COLOUR RENDERING



The lighting level for the safe stopping of an event is a percentage of the level for that class. This applies to the following sports in the percentages listed below:

- Swimming: 5% for at least 30 seconds
- Indoor gymnastics 5% for at least 30 seconds
- Indoor and outdoor equestrian events: 5% for at least 120 seconds
- Speed skating: 5% for at least 30 seconds
- Bobsleighing and tobogganing: 10% for at least 120 seconds
- Ski jumping and landing 10% for at least 30 seconds
- Downhill skiing: 10% for at least 30 seconds
- Cycle racing: 10% for at least 60 seconds

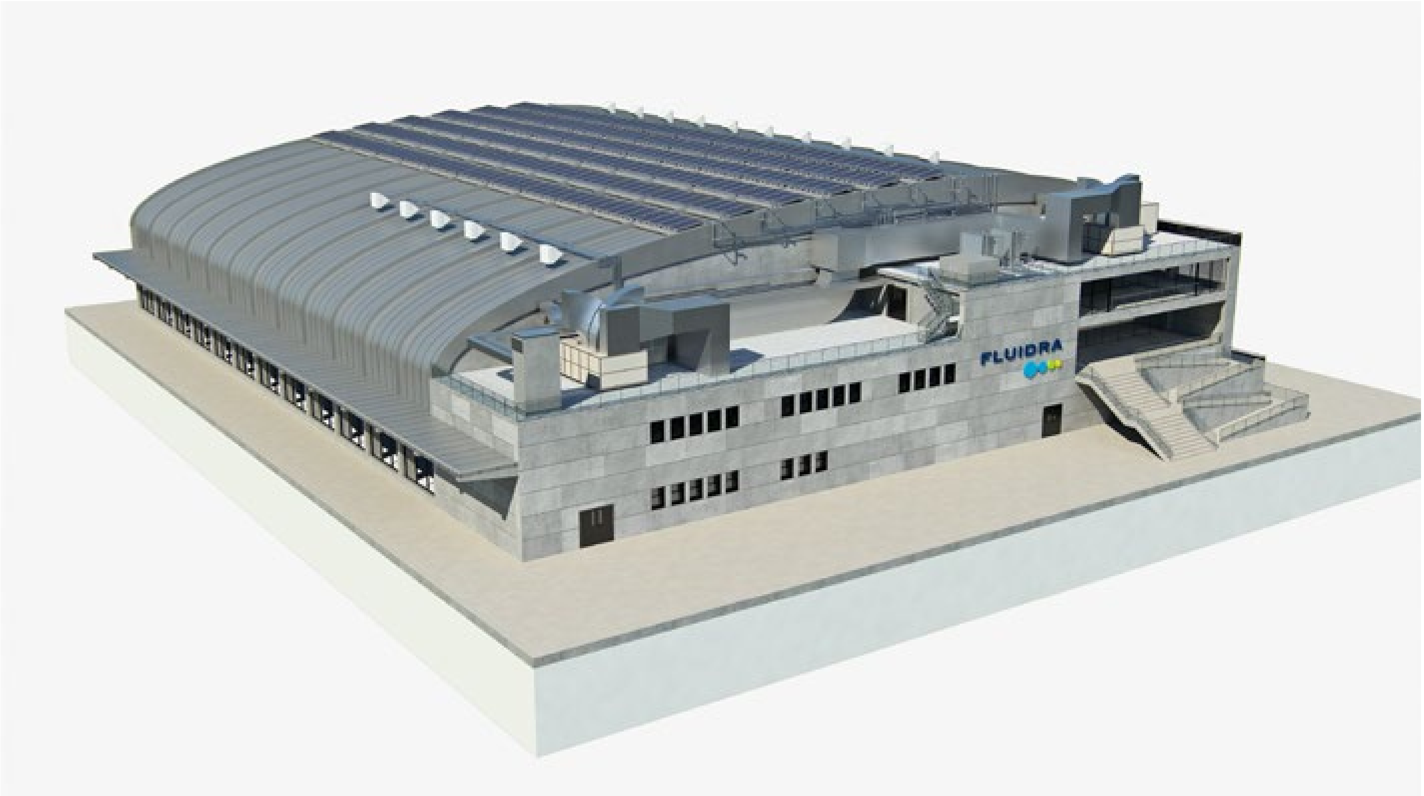
The safety lighting must come on the instant the general lighting fails and last for at least the period specified.

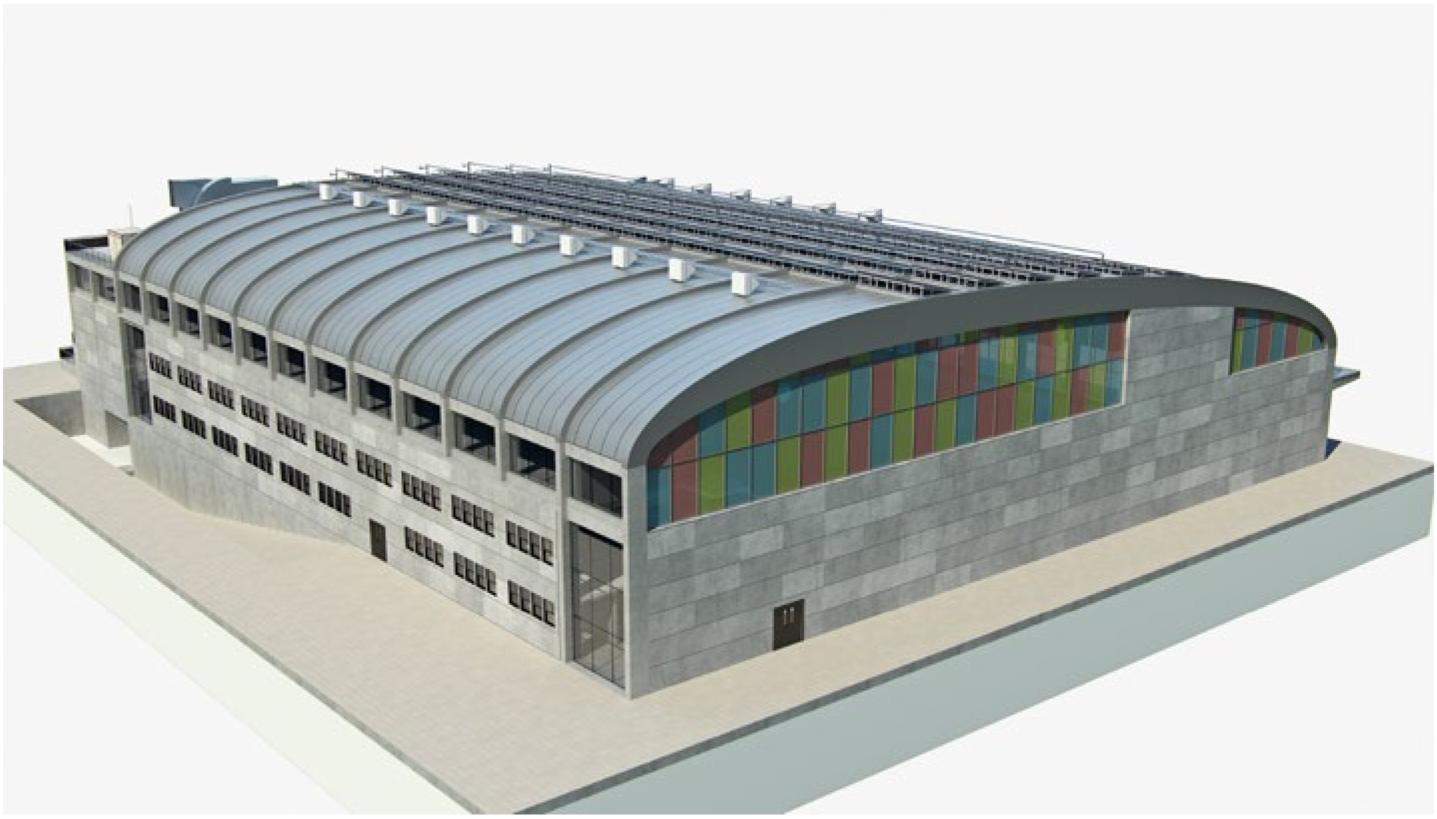
13 REFERENCES

Fluidra's remarkable Olympic pool experience is the result of many years working on sport projects. Today, Fluidra has consolidated a leading position in the water sports facilities segment worldwide.

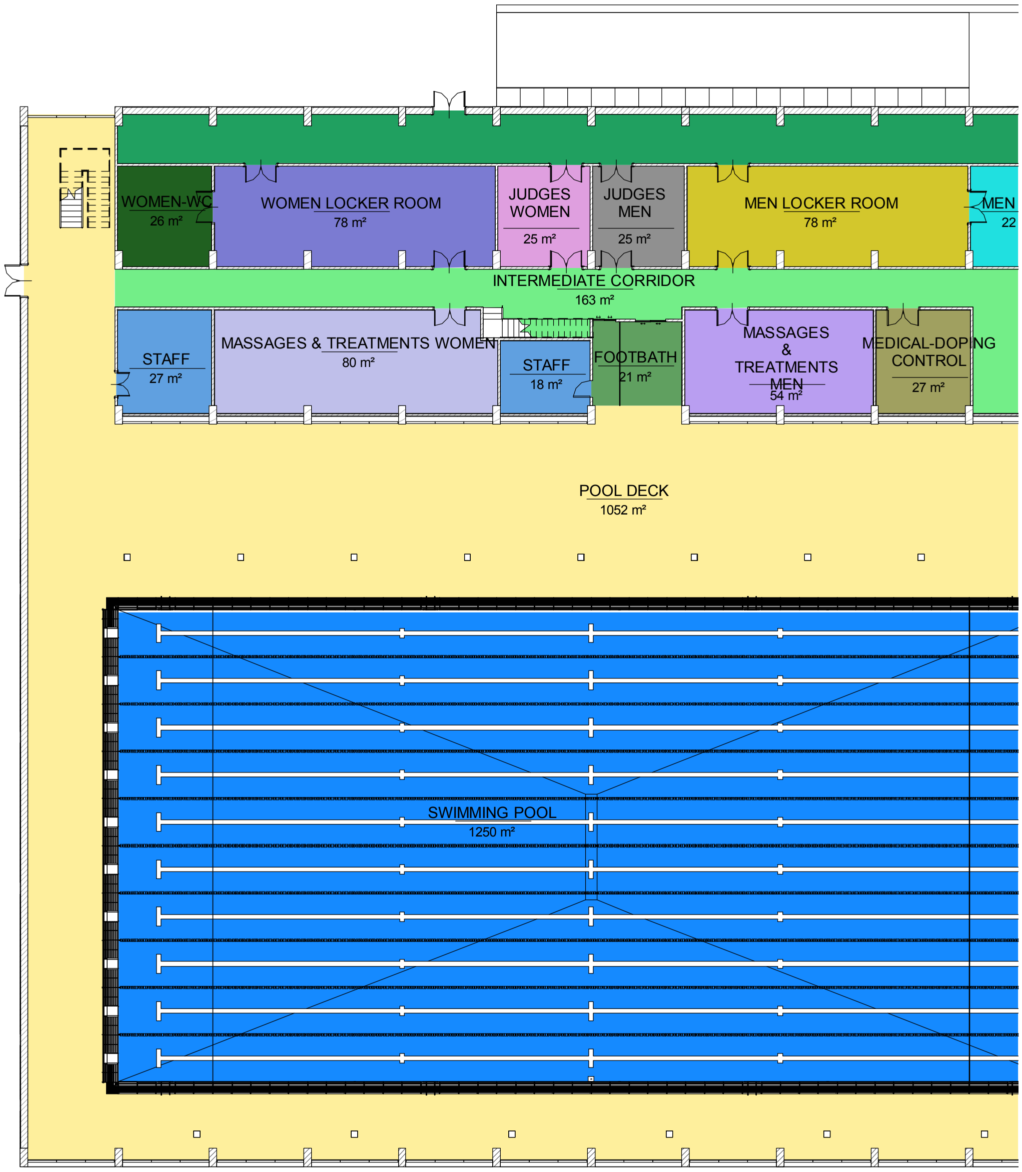
- **Atlanta 1996 Olympics**, *Atlanta. USA.* 1996
- **Sydney 2000 Olympics**. *Sydney. Australia.* 2000
- **FINA World Swimming Championships**. *Barcelona. Spain.* 2003
- **Athens Olympic**. *Athens. Greece*. 2004
- **FINA World Swimming Championships**. *Shanghai. China*. 2006
- **Austin Pool**, *Austin. USA.* 2007
- **FINA World Swimming Championships**. *Melbourne. Australia*. 2007
- **Sports Club Batumi**. *Batumi. Georgia*. 2007
- **Brown University Pool**. *Providence. USA*. 2007
- **FINA World Swimming Championships**. *Manchester. UK*. 2008
- **Thuringowa Pool**. *Thuringowa. Australia*. 2008
- **Missoula Local pool**. *Missoula. USA*. 2008
- **Beijing 2008 Olympics**. *Beijing. China*. 2008
- **Club Deportivo Palma de Mallorca**. *Mallorca. Spain*. 2009
- **Club Natació Sabadell**. *Sabadell. Spain*. 2010

- **Centro Deportivo Rio Esgueva**. *Valladolid. Spain*. 2010
- **Complejo Deportivo Mendizorroza**. *Vitoria. Spain*. 2010
- **Gorgon Construction Village**. *Barrow Island . Australia*. 2010
- **SkyPool Bicentenary**. *Mexico D.F.. México*. 2010
- **Deportivo Bobadilla**. *Puerto Vallarta . México*. 2010
- **YunNan Finance University**. *Yunnan. China*. 2010
- **Kota Kinabalu Aquatic Centre**. *Kota Kinabalu. Malaysia*. 2010
- **Bukit Panjang Sports Complex**. *Singapore. Singapore*. 2010
- **Ngee Ann Polytechnic**. *Singapore. Singapore*. 2010
- **Local Pool Torre del Mar**, *Málaga. Spain.*
- **Beaches Leisure Centre**. *Townsville. Australia.*
- **University of Oltzyn**. *Oltzyn. Poland.*
- **Olympic Stadium Doha**. *Qatar. UAE.*
- **High Performance Centre (CAR)**. *Sant Cugat. Spain*. 2011
- **XXVI Sea Games**, *Palembang. Indonesia.* 2011
- **Olympic Swimming Pool**. *Brasov. Romania*. 2012
- **London Olympic**. *London. UK*. 2012
- **Warsaw University Medical (WUM)** *Olympic SkyPool. Warsaw*. 2015
- **Virgin Active Pool**. *Bangkok. Thailand*. 2015
- **Sultan Qaboos Youth Complex**. *Salalah, Oman. UAE*. 2015
- **Saifai Stadium**. *Lucknow. India*. 2015
- **Municipal Pool Santiago de Chile**. *Chile.* 2015
- **Olympic Pool La Católica**. *Chile.* 2015
- **Midland Natatorium**. *Midland. USA*. 2016
- **Army Training Olympic Pool**. *Sharm El-Sheikh. Egypt.* 2016
- **Minery Pool**, *Rancagua, Chile*. 2016
- **Sukma Games**, *Ipoh, Malaysia*. 2017
- **Summer Universiade**, *Taipei, Taiwan*. 2017
- **Juegos Bolivarianos Centro Acuático**, *Santa Marta, Colombia*. 2017
- **Asian Games GBK Aquatic Center**, *Jakarta, Indonesia*. 2017
- **Panamerican Games - Villa Maria del Triunfo**, *Lima, Perú.* 2016
- **Mediterranean Games Aquatic Center**, *Tarragona, Spain*. 2018
- **Oruro Aquatic Centre**, *Oruro, Bolivia*. 2019
- **Ragunan Aquatic Center**, *Ragunan, Indonesia.* 2019
- **Timika Aquatic Center**, *Papua, Indonesia*. 2019
- **Summer Universiade**, *Napoli, Malaysia*. 2019


FLUIDRA

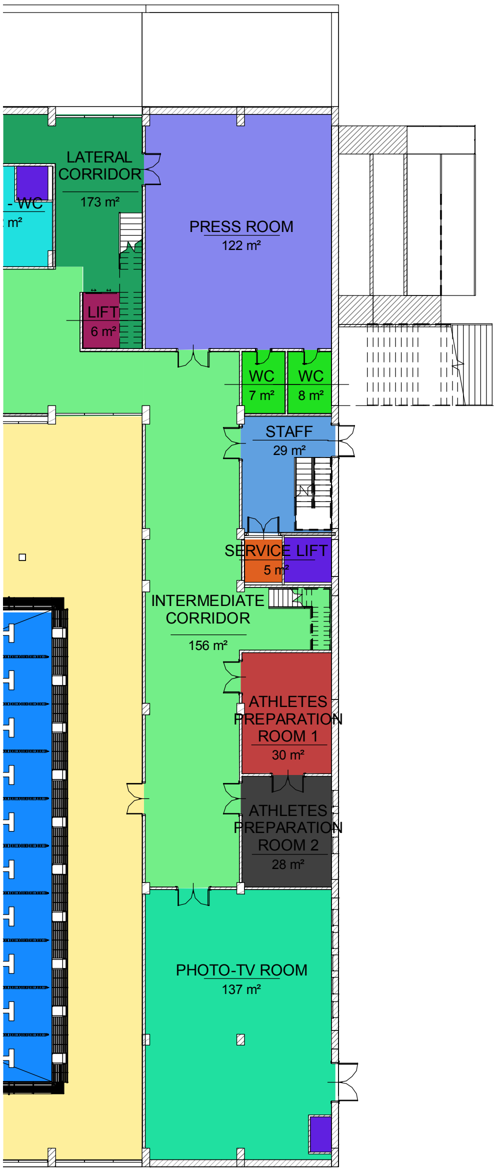


		NORTH
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN A00	PLAN ISOMETRIC	DIN/SCALE A 1: 1/50 A 3: 1/100



ROOM SCHEME

- ATHLETES PREPARATION ROOM 1
- ATHLETES PREPARATION ROOM 2
- FOOTBATH
- INSTALLATION SHAFT
- INTERMEDIATE CORRIDOR
- JUDGES MEN
- JUDGES WOMEN
- LATERAL CORRIDOR
- LIFT
- MASSAGES & TREATMENTS MEN
- MASSAGES & TREATMENTS WOMEN
- MEDICAL-DOPING CONTROL
- MEN - WC
- MEN LOCKER ROOM
- PHOTO-TV ROOM
- POOL DECK
- PRESS ROOM
- SERVICE LIFT
- STAFF
- SWIMMING POOL
- WC
- WOMEN LOCKER ROOM
- WOMEN-WC
- Calculating...



ROOM SCHEDULE P 00		
Name	Area (m2)	Volume (m3)
ATHLETES PREPARATION ROOM 1	30 m²	74 m³
ATHLETES PREPARATION ROOM 2	28 m²	67 m³
FOOTBATH	21 m²	75 m³
INSTALLATION SHAFT	6 m²	23 m³
INSTALLATION SHAFT	2 m²	7 m³
INSTALLATION SHAFT	3 m²	13 m³
INTERMEDIATE CORRIDOR	163 m²	475 m³
INTERMEDIATE CORRIDOR	156 m²	491 m³
JUDGES MEN	25 m²	71 m³
JUDGES WOMEN	25 m²	71 m³
LATERAL CORRIDOR	173 m²	484 m³
LIFT	6 m²	21 m³
MASSAGES & TREATMENTS MEN	54 m²	132 m³
MASSAGES & TREATMENTS WOMEN	80 m²	195 m³
MEDICAL-DOPING CONTROL	27 m²	101 m³
MEN - WC	22 m²	62 m³
MEN LOCKER ROOM	78 m²	218 m³
PHOTO-TV ROOM	137 m²	432 m³
POOL DECK	1052 m²	11498 m³
PRESS ROOM	122 m²	383 m³
STAFF	27 m²	85 m³
STAFF	29 m²	104 m³
STAFF	18 m²	68 m³
SWIMMING POOL	1250 m²	2744 m³
WC	8 m²	27 m³
WC	7 m²	26 m³
WOMEN LOCKER ROOM	78 m²	218 m³
WOMEN-WC	26 m²	73 m³

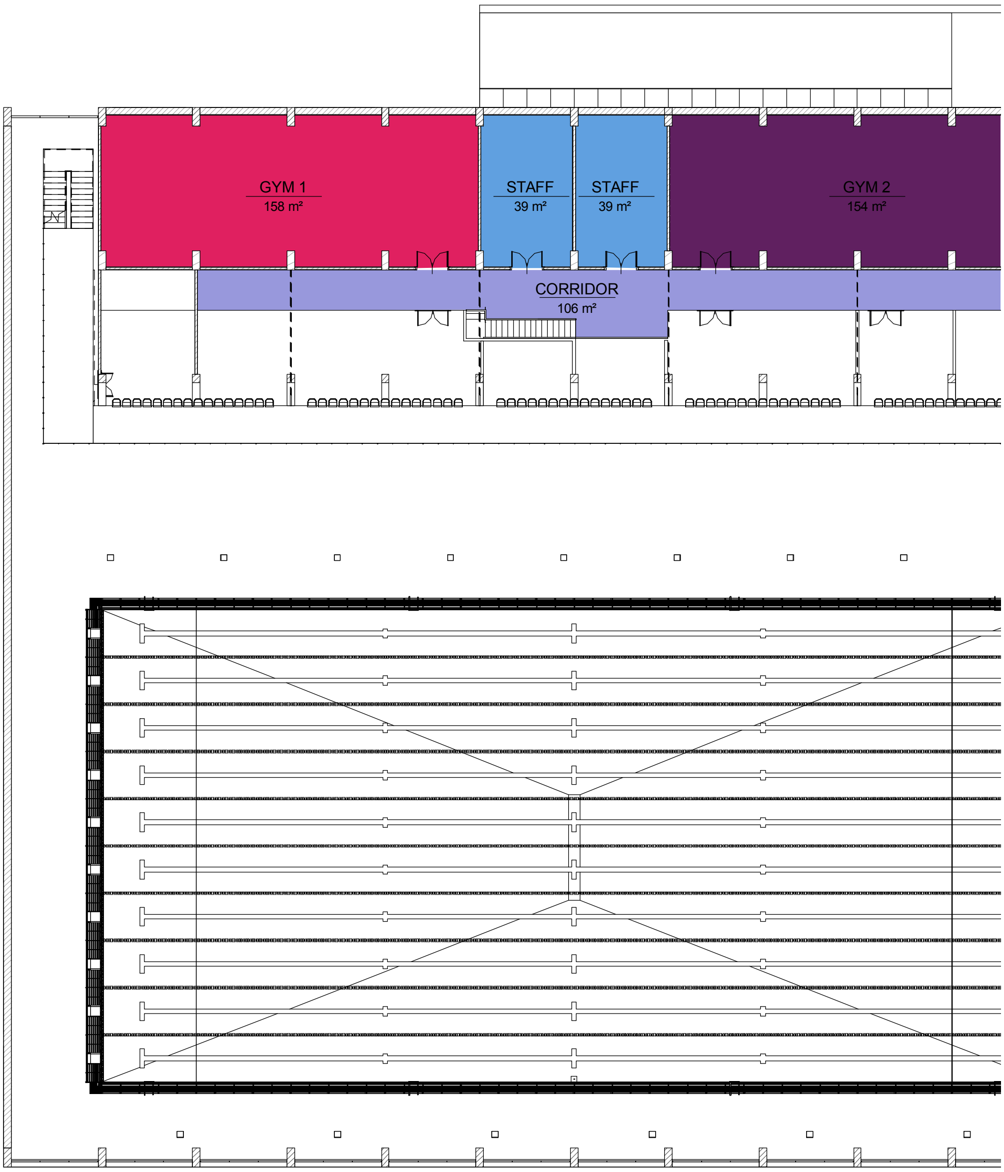
NORTH

REVISION Nº	DESCRIPTION	DATE

NOTES

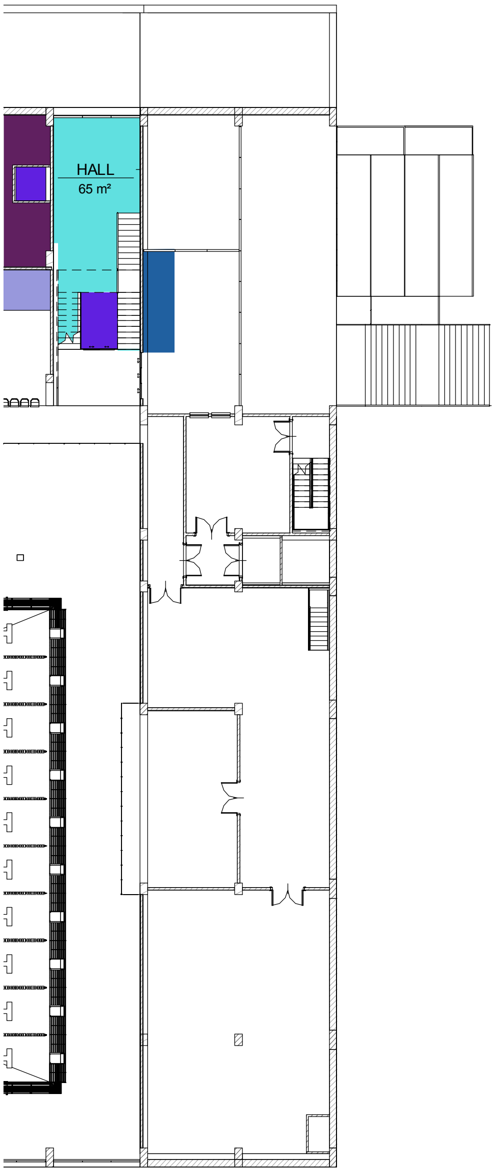
DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
A05.1	GROUND FLOOR AREAS	A 1: 1/50 A 3: 1/100

A1



ROOM SCHEME

- CORRIDOR
- GYM 1
- GYM 2
- HALL
- INSTALLATION SHAFT
- SECURITY
- STAFF
- Calculating...

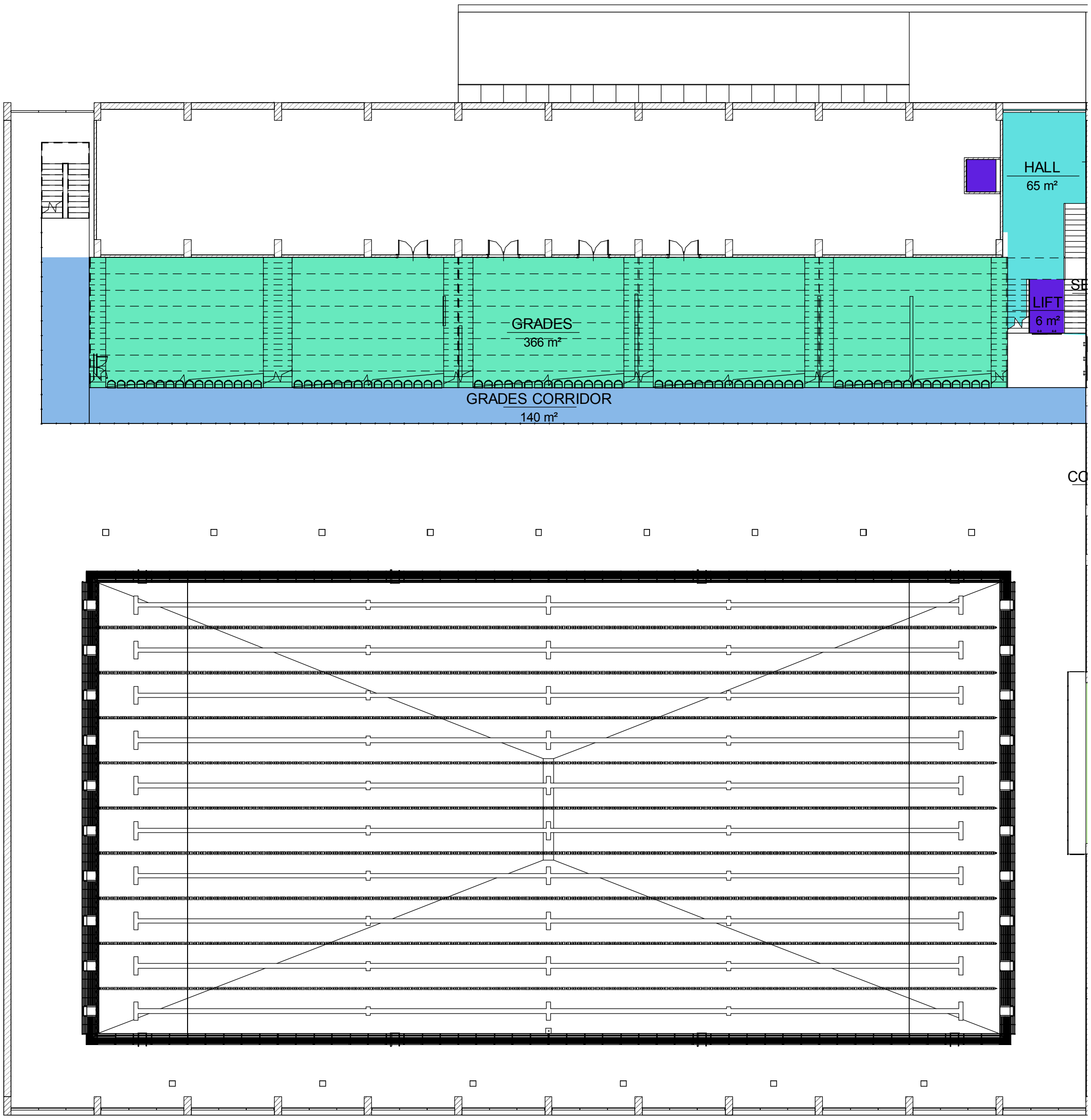


ROOM SCHEDULE P 01 A		
Name	Area (m2)	Volume (m3)
CORRIDOR	106 m²	394 m³
GYM 1	158 m²	618 m³
GYM 2	154 m²	602 m³
HALL	65 m²	195 m³
INSTALLATION SHAFT	3 m²	13 m³
INSTALLATION SHAFT	6 m²	21 m³
STAFF	39 m²	151 m³
STAFF	39 m²	151 m³

CLIENT		NORTH
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN A06.1	PLAN FIRST FLOOR AREAS-A	DIN/SCALE A 1: 1/50 A 3: 1/100

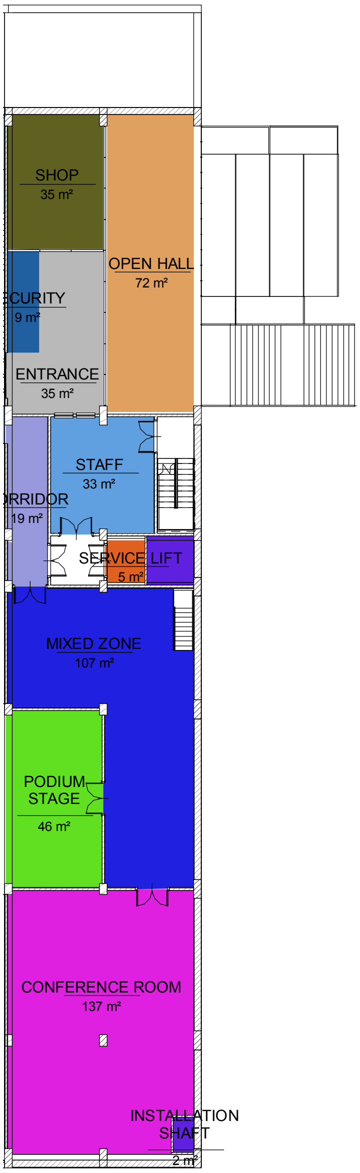
A1

UNAUTHORIZED USE FORBBIDEN



ROOM SCHEME

- CONFERENCE ROOM
- CORRIDOR
- ENTRANCE
- GRADES
- GRADES CORRIDOR
- HALL
- INSTALLATION SHAFT
- LIFT
- MIXED ZONE
- OPEN HALL
- PODIUM STAGE
- SECURITY
- SERVICE LIFT
- SHOP
- STAFF
- Calculating...

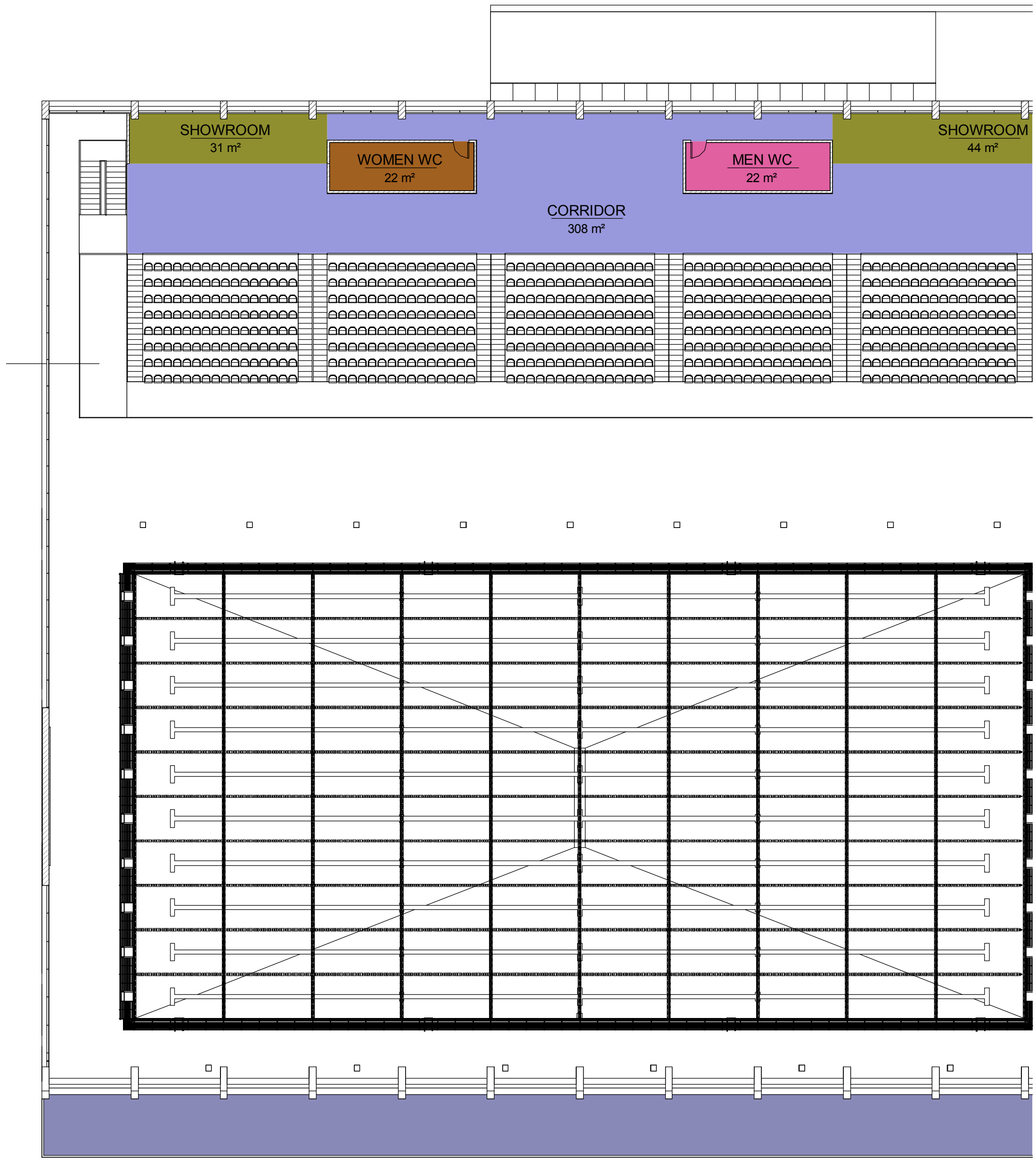


ROOM SCHEDULE P 01 B		
Name	Area (m2)	Volume (m3)
CONFERENCE ROOM	137 m²	423 m³
CORRIDOR	19 m²	66 m³
ENTRANCE	35 m²	109 m³
GRADES	366 m²	3554 m³
INSTALLATION SHAFT	6 m²	24 m³
INSTALLATION SHAFT	2 m²	6 m³
LIFT	6 m²	21 m³
MIXED ZONE	107 m²	337 m³
OPEN HALL	72 m²	227 m³
PODIUM STAGE	46 m²	164 m³
SECURITY	9 m²	31 m³
SHOP	35 m²	112 m³
STAFF	33 m²	105 m³

CLIENT		NORTH
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN A06.2	PLAN FIRST FLOOR AREAS-B	DIN/SCALE A 1: 1/50 A 3: 1/100

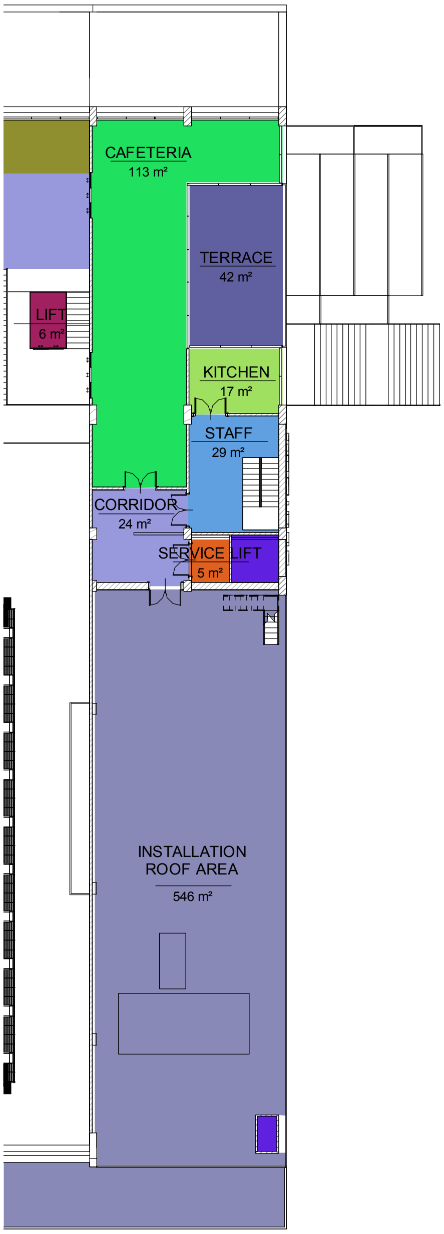
A1

UNAUTHORIZED USE FORBBIDEN



ROOM SCHEME

- CAFETERIA
- CORRIDOR
- GRADES
- INSTALLATION ROOF AREA
- INSTALLATION SHAFT
- KITCHEN
- LIFT
- MEN WC
- SERVICE LIFT
- SHOWROOM
- STAFF
- TERRACE
- WOMEN WC
- Calculating...



ROOM SCHEDULE P 02		
Name	Area (m2)	Volume (m3)
CAFETERIA	113 m²	316 m³
CORRIDOR	308 m²	1436 m³
CORRIDOR	24 m²	68 m³
GRADES	18 m²	13 m³
GRADES CORRIDOR	140 m²	1622 m³
INSTALLATION ROOF AREA	546 m²	2039 m³
INSTALLATION SHAFT	6 m²	23 m³
INSTALLATION SHAFT	2 m²	7 m³
KITCHEN	17 m²	48 m³
LIFT	6 m²	21 m³
MEN WC	22 m²	82 m³
SHOWROOM	31 m²	116 m³
SHOWROOM	44 m²	164 m³
STAFF	29 m²	72 m³
TERRACE	42 m²	117 m³
WOMEN WC	22 m²	82 m³

CLIENT

NORTH

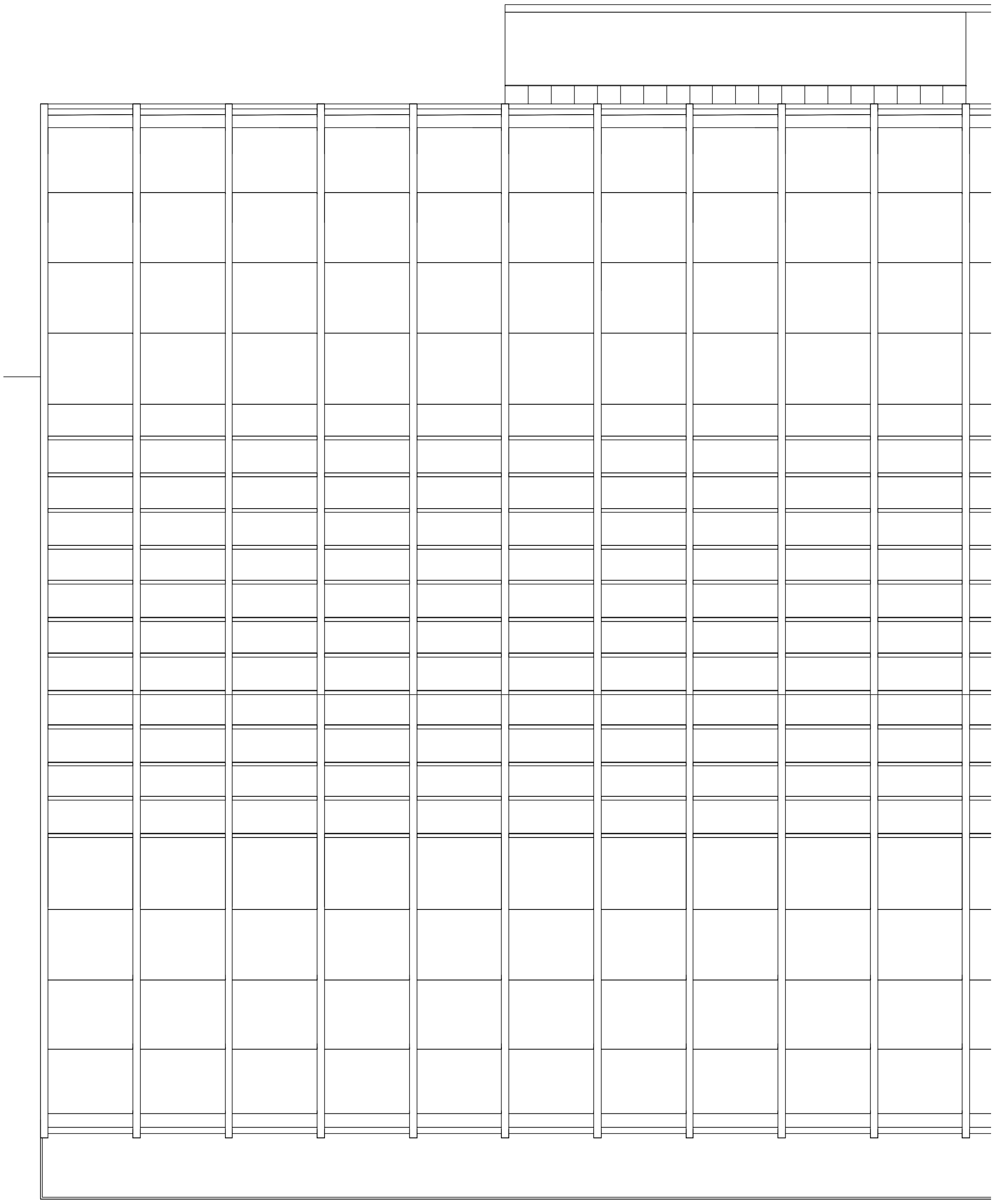
REVISION

Nº	DESCRIPTION	DATE

NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
A07.1	SECOND FLOOR AREAS	A 1: 1/50 A 3: 1/100

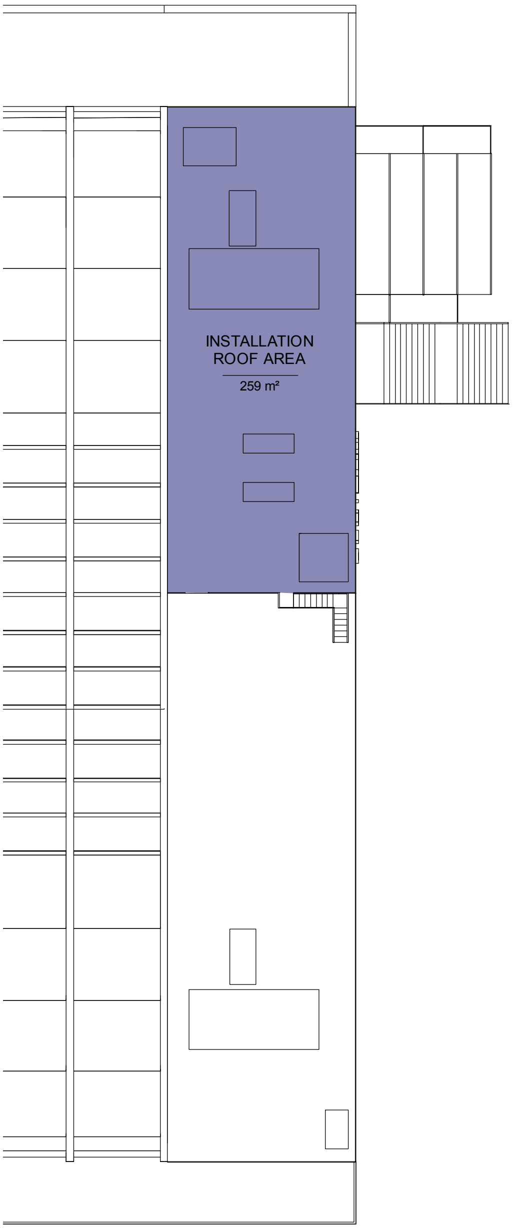
A1



ROOM SCHEME

INSTALLATION ROOF AREA

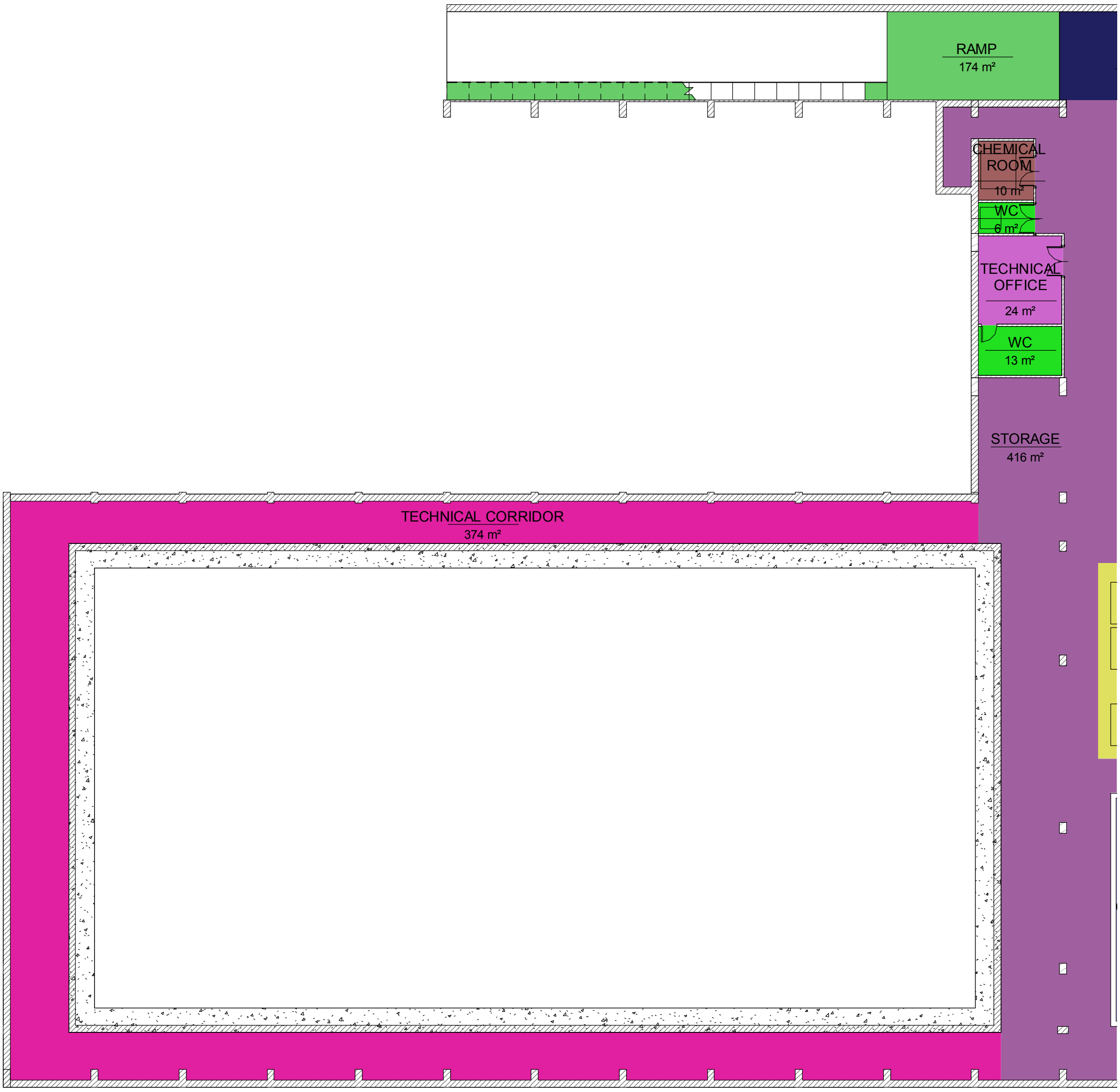
Calculating...



ROOM SCHEDULE ROOF	
Name	Area (m2)
INSTALLATION ROOF AREA	259 m²

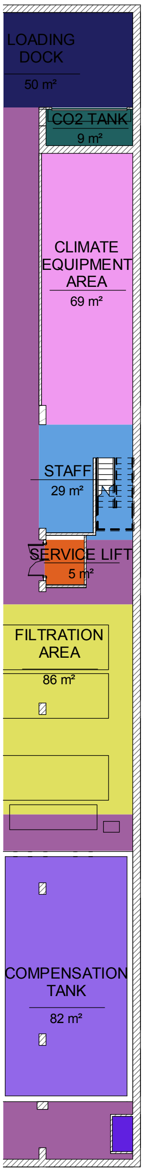
CLIENT		NORTH
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN A08.1	PLAN ROOF FLOOR AREAS	DIN/SCALE A 1: 1/50 A 3: 1/100

A1



ROOM SCHEME

- CHEMICAL ROOM
- CLIMATE EQUIPMENT AREA
- CO2 TANK
- COMPENSATION TANK
- FILTRATION AREA
- INSTALLATION SHAFT
- LOADING DOCK
- RAMP
- SERVICE LIFT
- STAFF
- STORAGE
- TECHNICAL CORRIDOR
- TECHNICAL OFFICE
- WC
- Calculating...



ROOM SCHEDULE P -01		
Name	Area (m2)	Volume (m3)
CHEMICAL ROOM	10 m²	25 m³
CLIMATE EQUIPMENT AREA	69 m²	201 m³
CO2 TANK	9 m²	30 m³
COMPENSATION TANK	82 m²	237 m³
FILTRATION AREA	86 m²	246 m³
INSTALLATION SHAFT	2 m²	7 m³
LOADING DOCK	50 m²	187 m³
RAMP	174 m²	652 m³
SERVICE LIFT	5 m²	66 m³
STAFF	29 m²	99 m³
STORAGE	416 m²	1247 m³
TECHNICAL CORRIDOR	374 m²	1235 m³
TECHNICAL OFFICE	24 m²	71 m³
WC	13 m²	32 m³
WC	6 m²	16 m³

CLIENT

NORTH

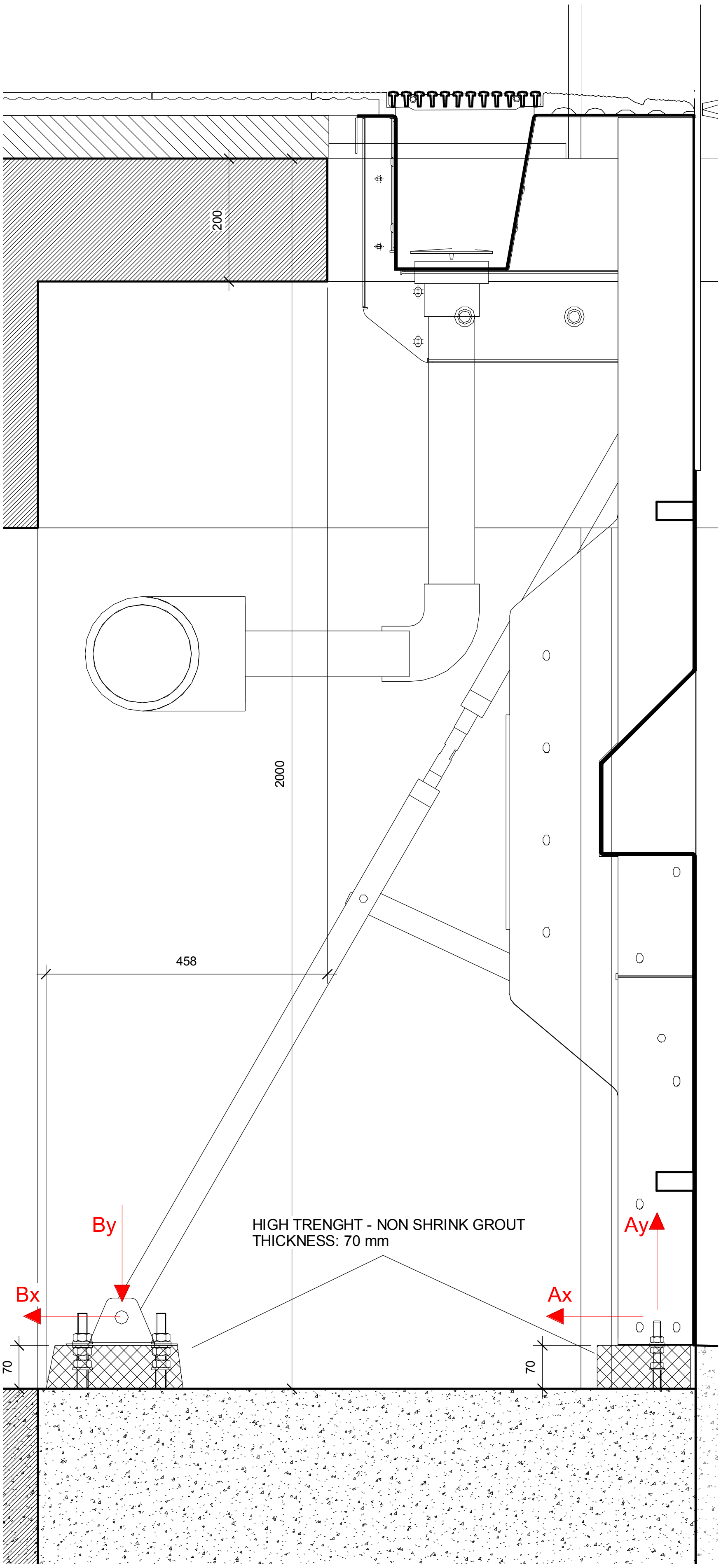
REVISION

Nº	DESCRIPTION	DATE

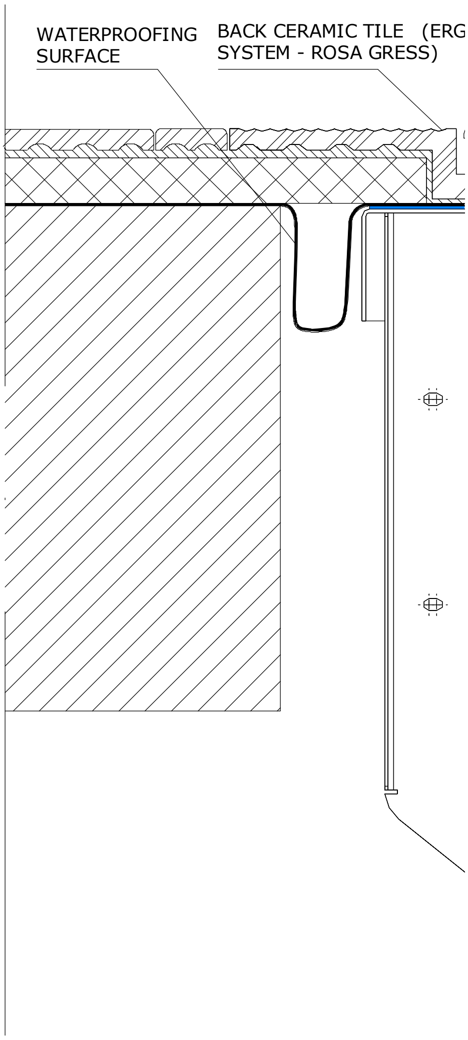
NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
A09.1	INSTALATIONS FLOOR AREAS	A 1: 1/50 A 3: 1/100

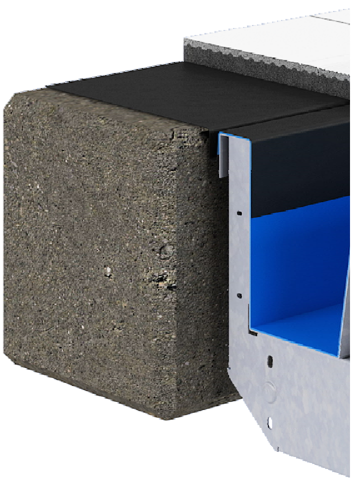
A1

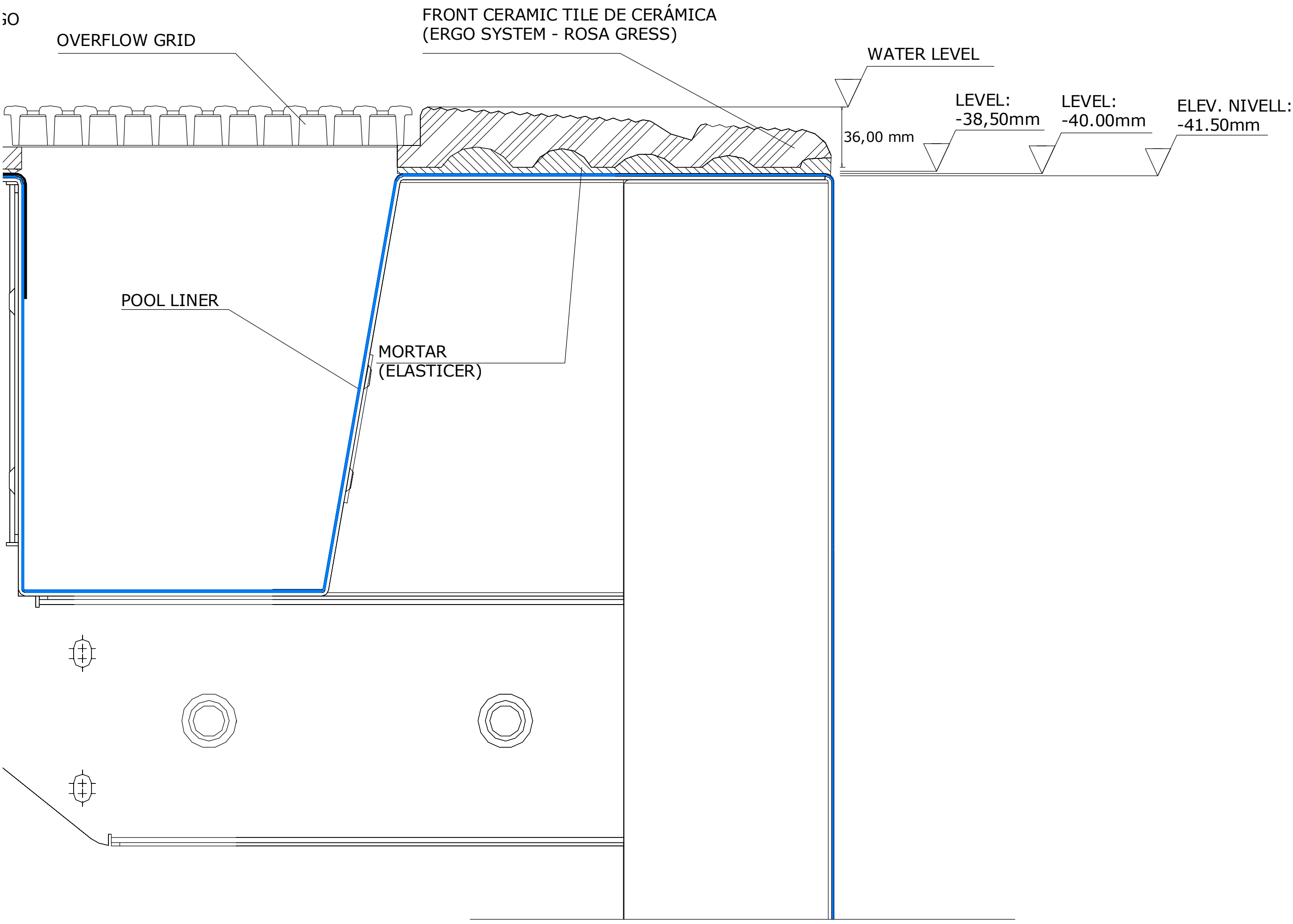


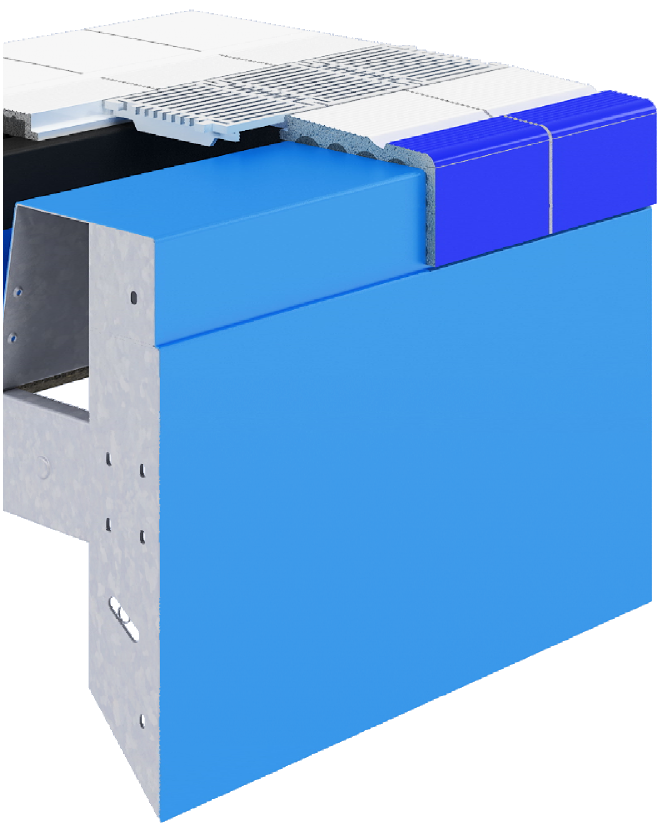
1 Section 1 - Callout 1
1 : 5



2 DECK - PANNEL DETAIL
1 : 2







FORCES IN A	Ax	Ay
Water pressure	-3.01 kN	+6.85 kN
Use	0 kN	1.73 kN

FORCES IN B	Bx	By
Water pressure	-4.02 kN	-6.97 kN
Use	-1 kN	1.73 kN

CLIENT

NORTH

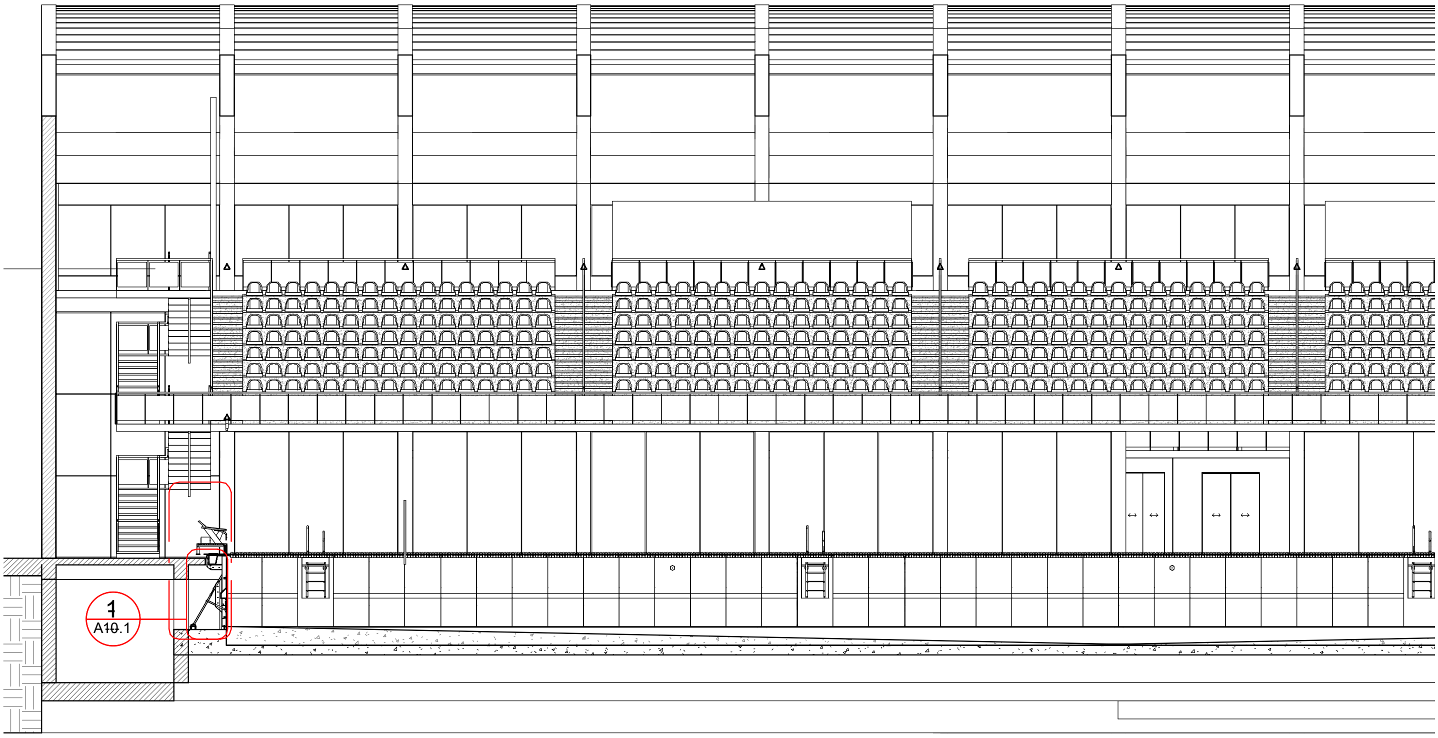
REVISION Nº | DESCRIPTION | DATE

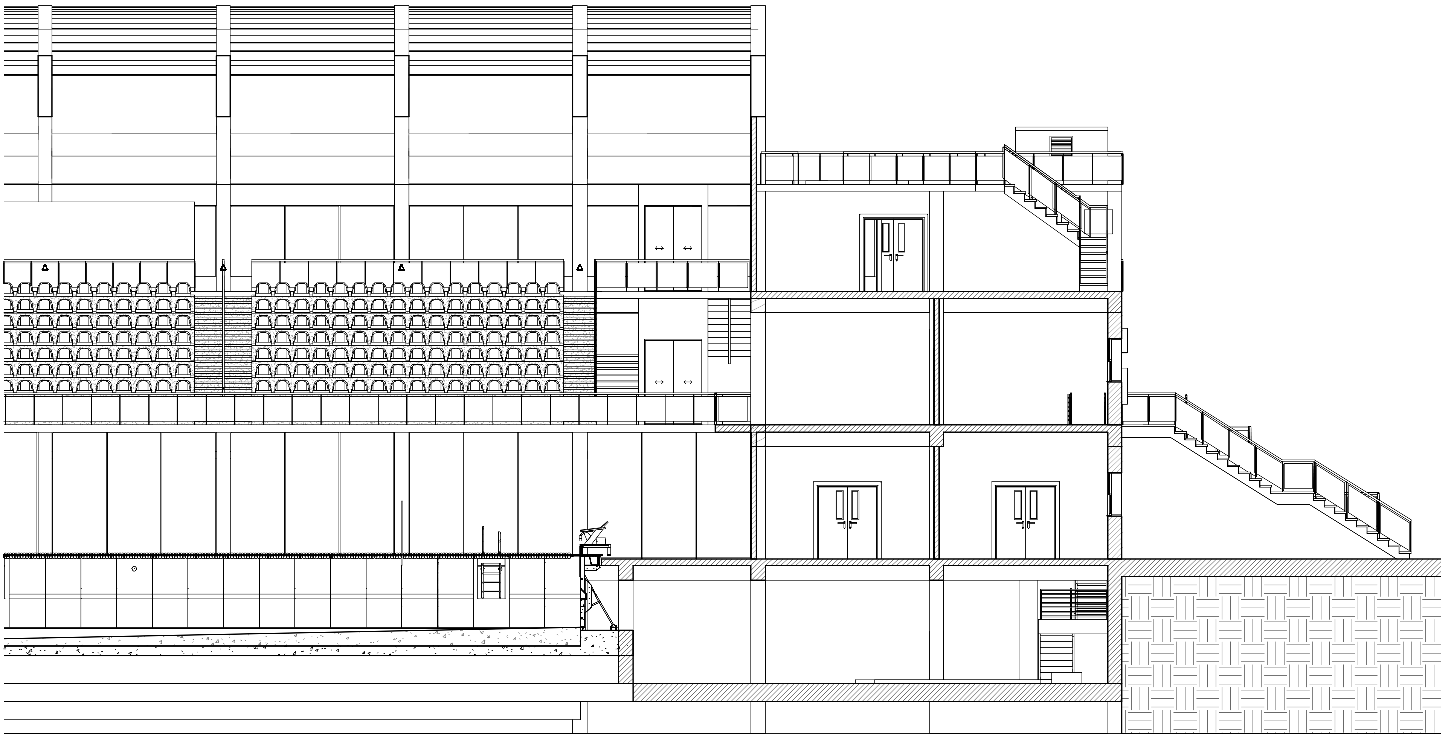
NOTES

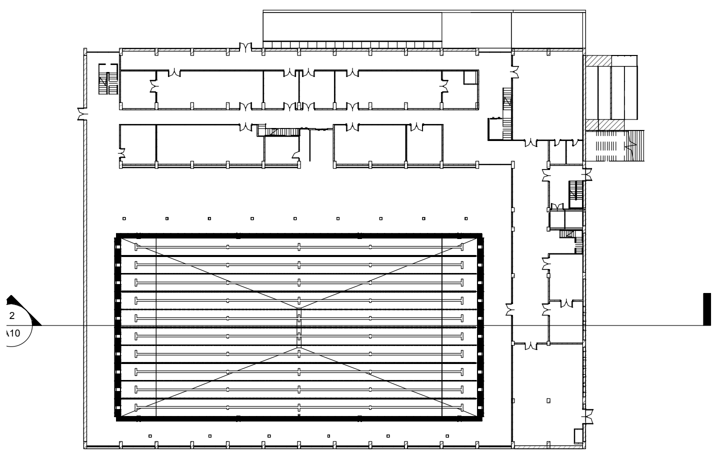
DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000

Nº PLAN	PLAN	DIN/SCALE
A10.1	SECTION1-DETAILING	A 1: 1/50 A 3: 1/100

A1


1
A10.1





CLIENT		NORTH

REVISION

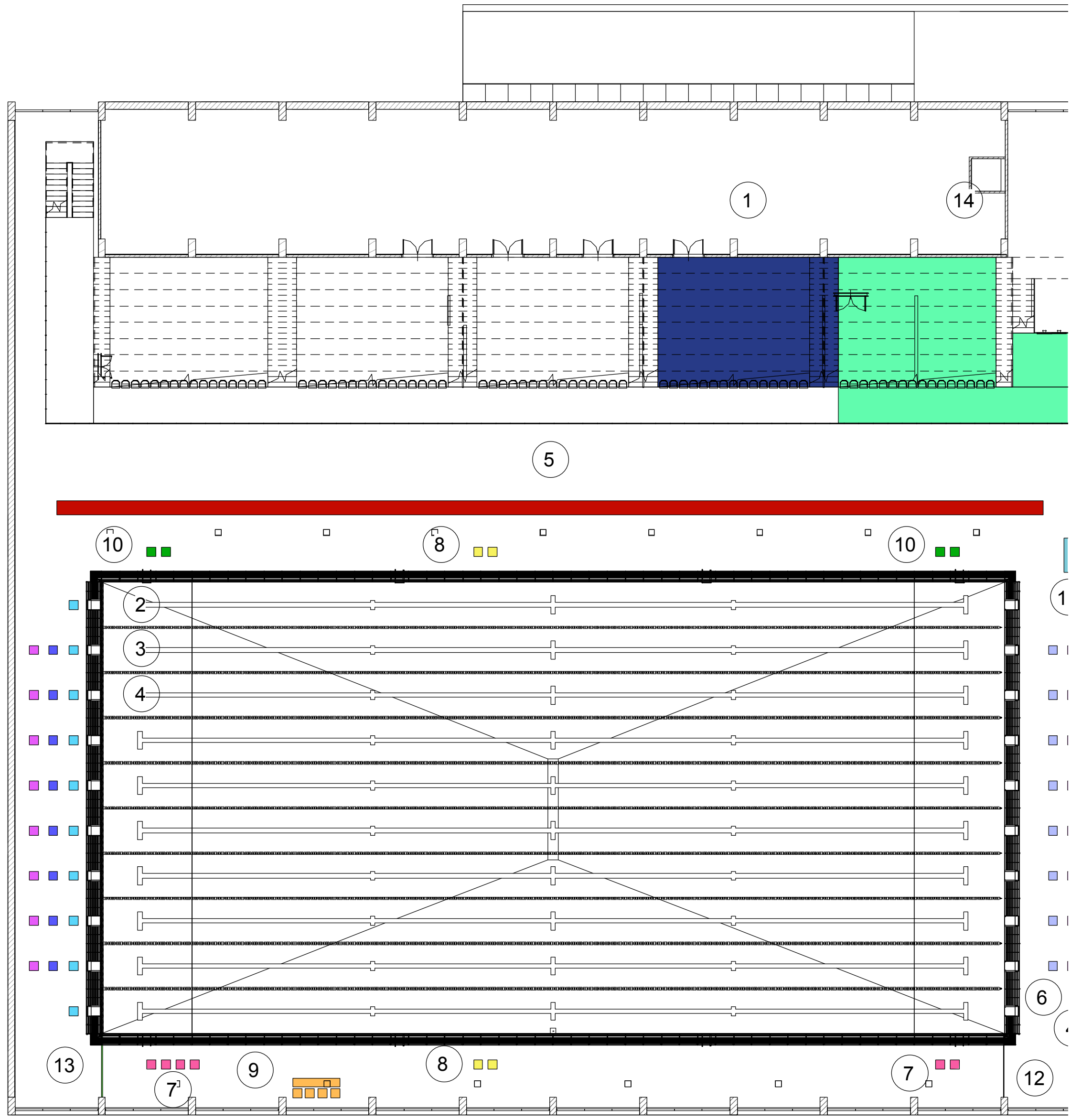
Nº	DESCRIPTION	DATE

NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
A10	SECTION 1	A 1: 1/50 A 3: 1/100

A1

UNAUTHORIZED USE FORBBIDEN


1
14
5
10
8
10
2
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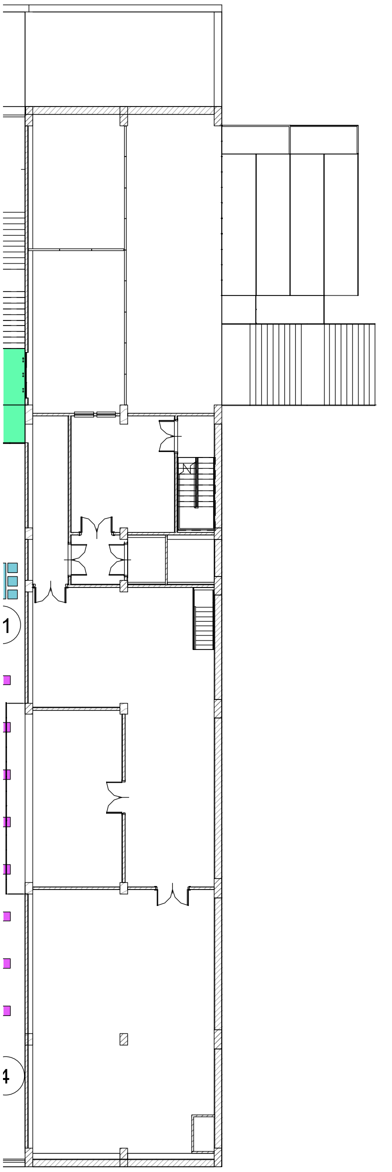
13
9
8
7
7
12



FIELD OF PLAY FOR OLYMPIC GAMES AND WORLD CHAMPIONSHIPS SWIMMI...	
SEQUENCE	ROOM
1	ATHLETES & COACH STAND
2	FINISH CAMERA
3	ATHLETE KIT CHANGE
4	INSPECTORS OF TURNS
5	CAMERA RAIL
6	ATHLETE KIT CHANGE FOR 50m EVENTS ONLY
7	REFEREE / STARTER
8	JUDGES OF STROKE
9	FINA COM X 3
10	CHIEF INSPECTOR OF TURNS
11	LIFE GUARD MEDICAL
12	START LINE FOR 50m EVENTS
13	START / FINISH LINE
14	PRESS STAND

CLIENT

NORTH

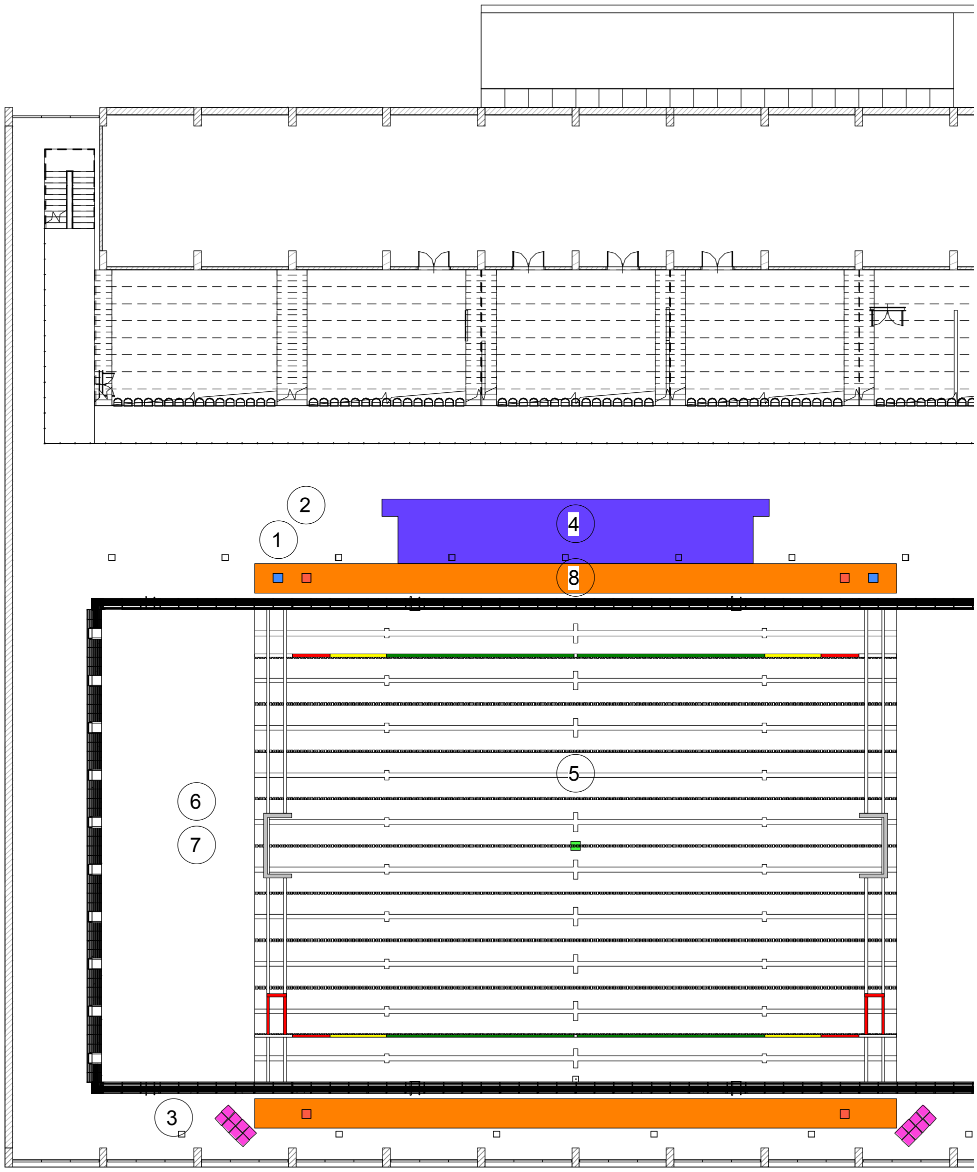
REVISION

Nº	DESCRIPTION	DATE

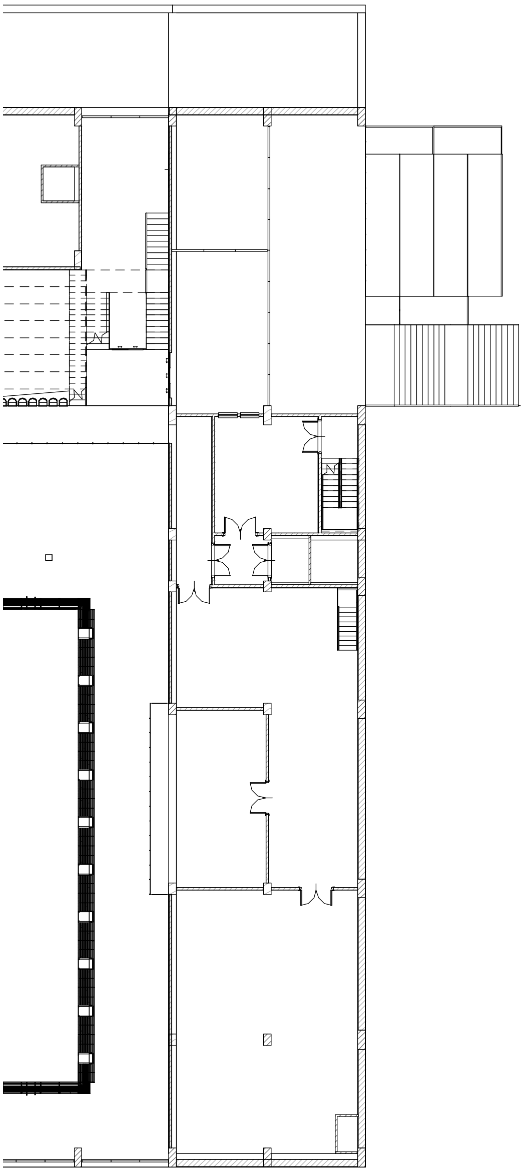
NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	PLAN	DIN/SCALE
A18	FIELD OF PLAY FOR OLYMPIC GAMES AND WORLD CHAMPIONSHIPS SWIMMING	A 1: 1/50 A 3: 1/100

A1



2
1
4
8
5
6
7
3



FIELD OF PLAY FOR PLYMPIC GAMES AND WORLD CHAMPIONSHIPS WATER...	
SEQUENCE	ROOM
1	BALLS BASKET
2	GOAL JUDGE
3	BENCH
4	OFFICIAL TABLE
5	BALL RELEASE DEVICE
6	LANE ROPE
7	GOAL
8	PLATFORM

CLIENT

.

NORTH

REVISION

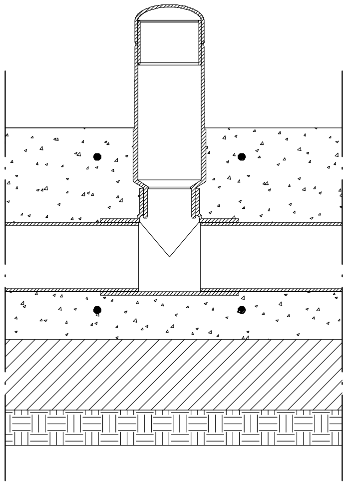
Nº	DESCRIPTION	DATE

NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	PLAN	DIN/SCALE
A19	FIELD OF PLAY FOR PLYMPIC GAMES AND WORLD CHAMPIONSHIPS WATER POLO	A 1: 1/50 A 3: 1/100

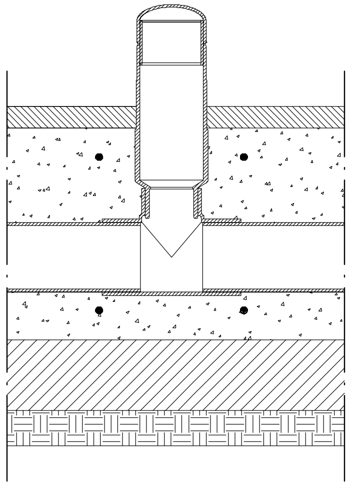
A1

UNAUTHORIZED USE FORBBIDEN



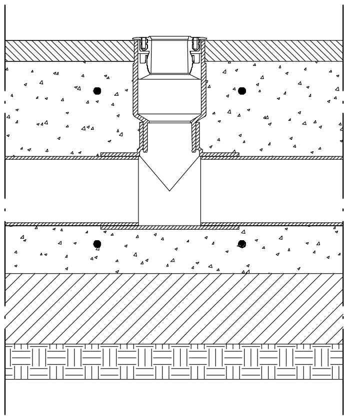
1/9

- PIPING INSTALLATION
- TEST FOR SEAL STRENGHT
- REINFORCED CONCRETE SLAB CONSTRUCTION



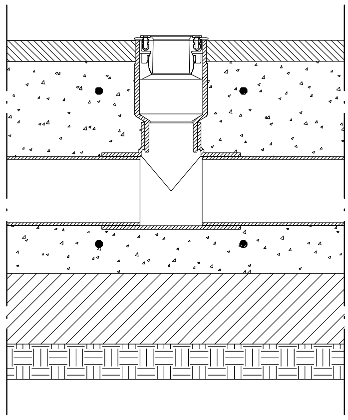
2/9

- SLOPED SLAB CONSTRUCTION
- TEST FOR SEAL STRENGHT MONITORING



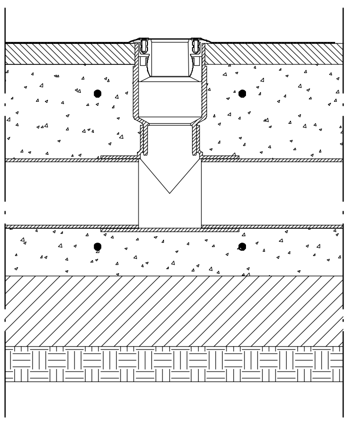
4/9

- NOZZLE (KNEE PART) INSTALLATION



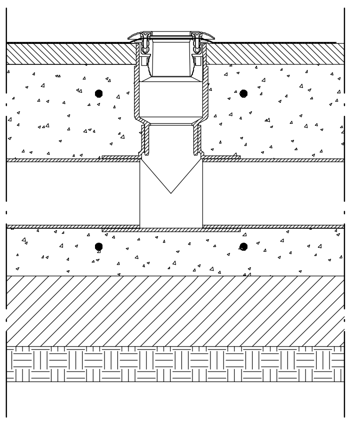
5/9

- BOTTOM SEAL INSTALLATION



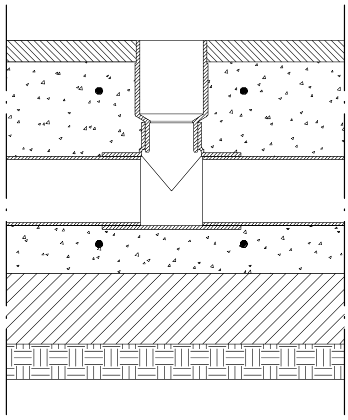
7/9

- UPPER SEAL INSTALLATION



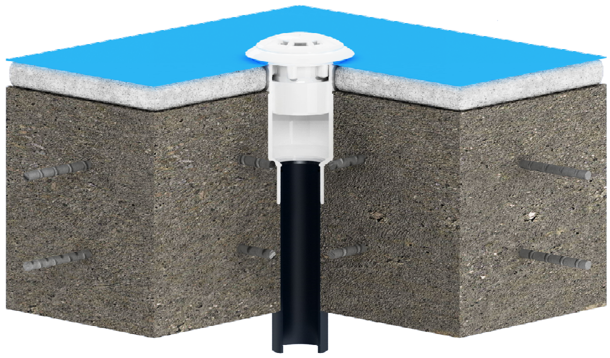
8/9

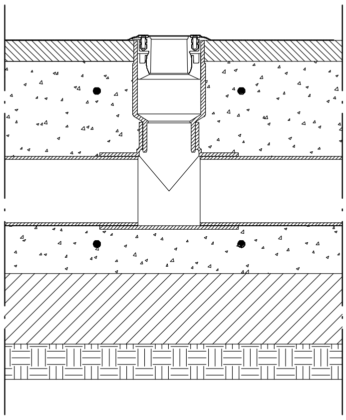
UPPER RING INSTALLATION



3/9

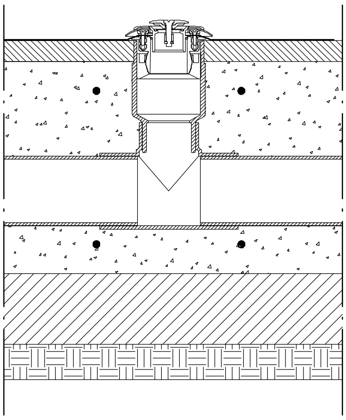
- WALL BUSHING CUT





6/9

- LINER INSTALLATION



9/9

- JET INSTALLATION

REINFORCED CONCRETE SLAB

SLOPED SLAB

OVERSITE CONCRETE

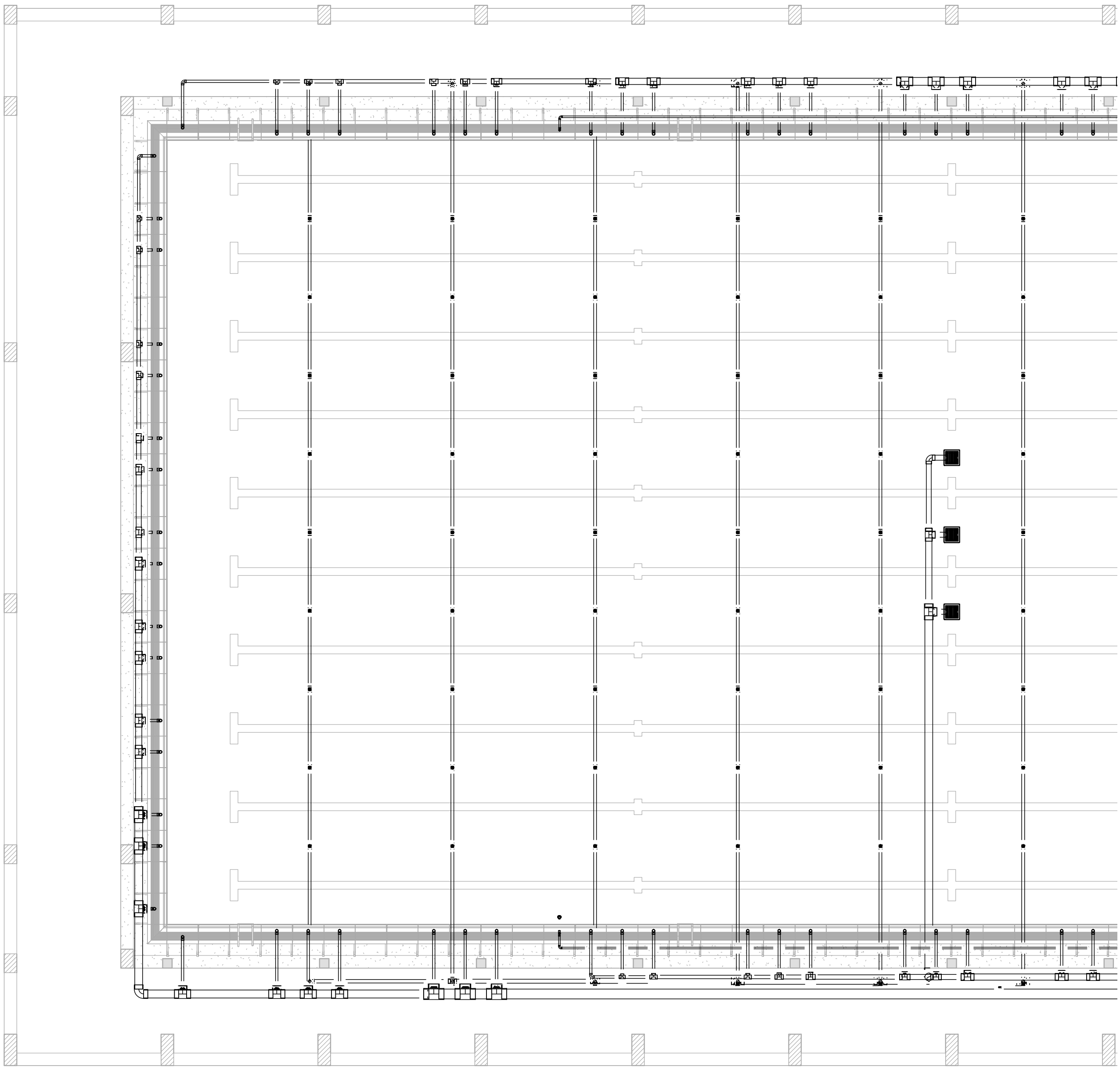
SOIL

LINER + GEOTEXTIL

CLIENT		NORTH
.		
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN A20	PLAN NOZZLES INSTALLATION DETAILS	DIN/SCALE A 1: 1/50 A 3: 1/100

A1

UNAUTHORIZED USE FORBBIDEN

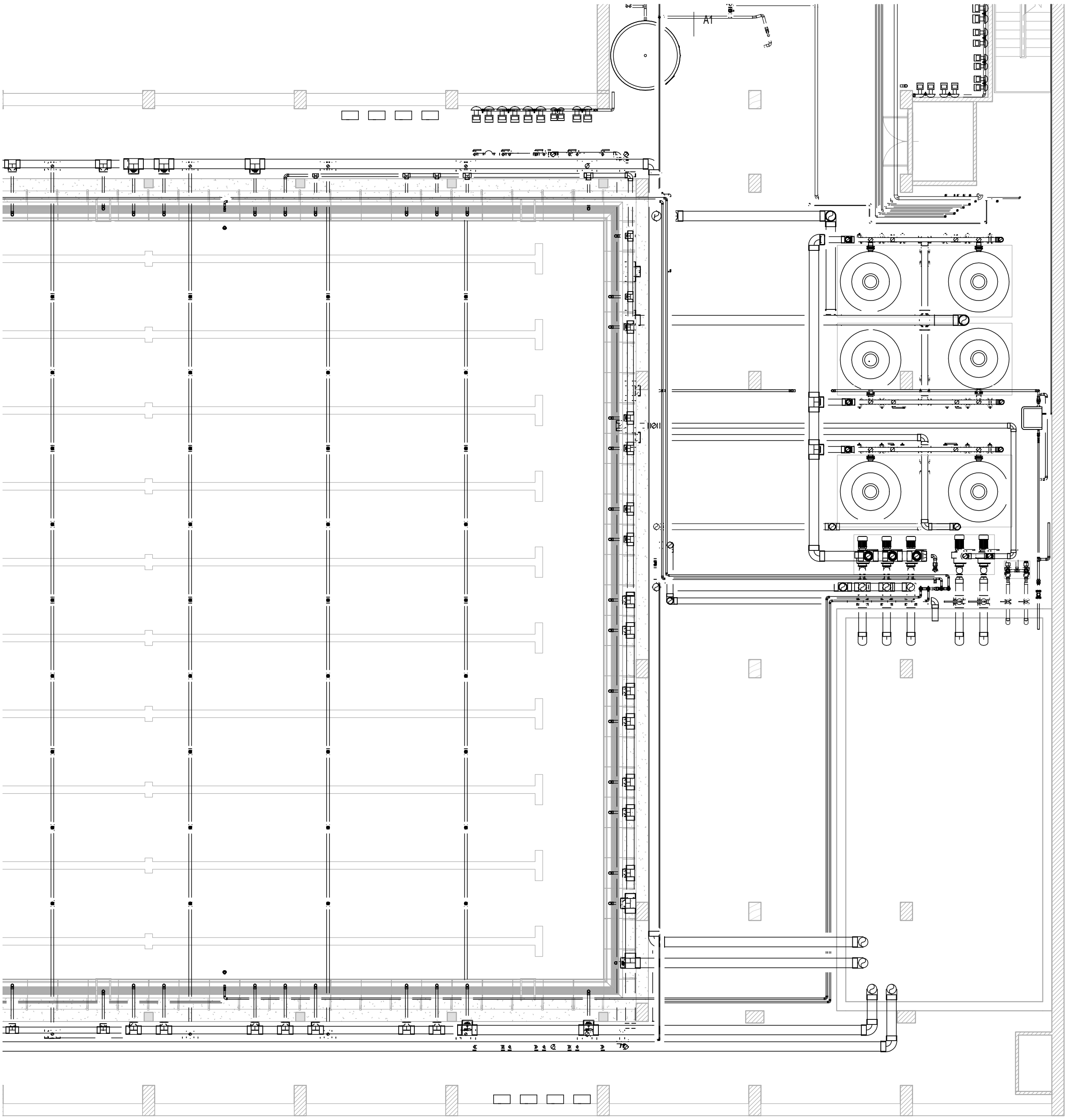


GENERAL MECHANICAL EQUIPMENT		
Description	FES_CODE	Count
25Kg GLASS BAG 0.5mm-1.0mm	57011	606
25Kg GLASS BAG 1.0mm-3.0mm	57012	198
25Kg GLASS BAG 3.0mm-7.0mm	57013	222
APQ TANK 3000L	09387	1
AUTOMATIC REGULATION AND CONTROL EQUIPMENT PR-207	60361	1
BDP140-EXTERNAL CONDENSER	41103	2
BUFFER CYLINDER SPU-2 5000L	SPU-2-5000-023	4
CO2 PACK FOR SWIMMING POOL EQUIPMENT	NO CODE	2
CONTINUOUS FLOCULANT SYSTEM	54528	6
DEHUMIDIFY HEAT PUMP BDP-160+F	26513	2
EXPANSION TANK 50L	24.00.458-023	1
EXPANSION TANK 1000L	24.83.715-023	1
FAN COIL TDA-HP4 12-825X500X260-680m³/h	TDA-HP4 12-007	3
FAN COIL TDA-HP4 16-1000X550X315-1020m³/h	TDA-HP4 16-007	6
FAN COIL TDA-HP4 25-1200X620X315-1360m³/h	TDA-HP4 25-007	2
FAN COIL TDA-HP4 43-1400X620X350-2380m³/h	TDA-HP4 43-007	4
FAN COIL TDA-HP4 54-1400X670X400-3060m³/h	TDA-HP4 54-007	5
FAN COIL TDA-HP4 68-1400X670X450-4080m³/h	TDA-HP4 68-007	4
GEOTHERMAL ENERGY PUMP THHEBY 275 LT P1-029	THHEBY 275 LT P1-029	1
GVG INYECTOR	62862	1
HEAT SINK LH100/2 STEEL 230V 3PHASE 51 PANELS	65.23.590S-023	6
HEAT SINK LH100/3 STEEL 230V 3PHASE 86 PANELS	65.23.591S-023	10
HEAT TITANIUM EXCHANGER BASIC MODEL ETNA-90	43236	8
HEAT TITANIUM EXCHANGER BASIC MODEL ETNA-500	33143	2
HEAT TITANIUM EXCHANGER BASIC MODEL ETNA-580	33144	1
KIVU PUMP WITH PREFILTER 7.5CV 50Hz 1500rpm 690V	56634	2
KIVU PUMP WITH PREFILTER 10CV 50Hz 1500rpm 690V	56637	3

DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300



GENERAL MECHANICAL EQUIPMENT		
Description	FES_CODE	Count
NEOLISIS AP 120Gr/h + UV 2 X 90 W + pH/ORP (EXT-2)	57768	8
POLYETHILENE CYLINDRICAL TANK 1000L	28831	1
PRAGA FILTER D.2000 mm OUTLET DN125 mm - 2.5 Bar - GLASS	00706	6
PUMP TPED 32-40/4 Dn32 0.25kW	TPED 32-40/4-024	2
PUMP TPED 32-100/4 Dn32 0.37kW	TPED 32-100/4-024	2
PUMP TPED 32-120/4 Dn32 0.55kW	TPED 32-120/4-024	3
PUMP TPED 40-90/4 Dn40 0.25kW	TPED 40-90/4-024	1
PUMP TPED 40-130/4 Dn40 0.75kW	TPED 40-130/4-024	3
PUMP TPED 40-160/4 Dn40 0.75kW	TPED 40-160/4-024	7
PUMP TPED 50-130/4 Dn50 1.1kW	TPED 50-130/4-024	5
PUMP TPED 65-60/4 Dn65 0.55kW	TPED 65-60/4-024	1
PUMP TPED 65-130/4 Dn65 1.5kW	TPED 65-130/4-024	4
PUMP TPED 80-90/4 Dn50 1.5kW	TPED 80-90/4-024	1
PUMP TPED 80-150/4 Dn50 3kW	TPED 80-150/4-024	1
PUMP UPA 15-120-024	UPA 15-120-024	1
SHELL & TUBE HEAT EXCHANGER	65541	3
SOLAR COLLECTOS TOPSON CFK-1	CFK-1-023	72
SOLAR COOLING-BDH8X95/100-45/40-10/15-20-R1-028	BDH8X95/100-45/4 0-10/15-20-R1-028	2
STORAGE EXCHANGER TANK 2500L	MVV-2500-SB-025	2
STORAGE EXCHANGER TANK 4000L	MVV-4000-SB-025	2
UTC R600 TOPTWIN 1100KW (2X550KW)	UTC02030603-023	1
VICTORIA PLUS PUMP 0,71KW 1PHASE	38780	3
WATERHEAT 20KW	41426	1
WATERHEAT 20KW	65539	1

CLIENT

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NORTH

REVISION

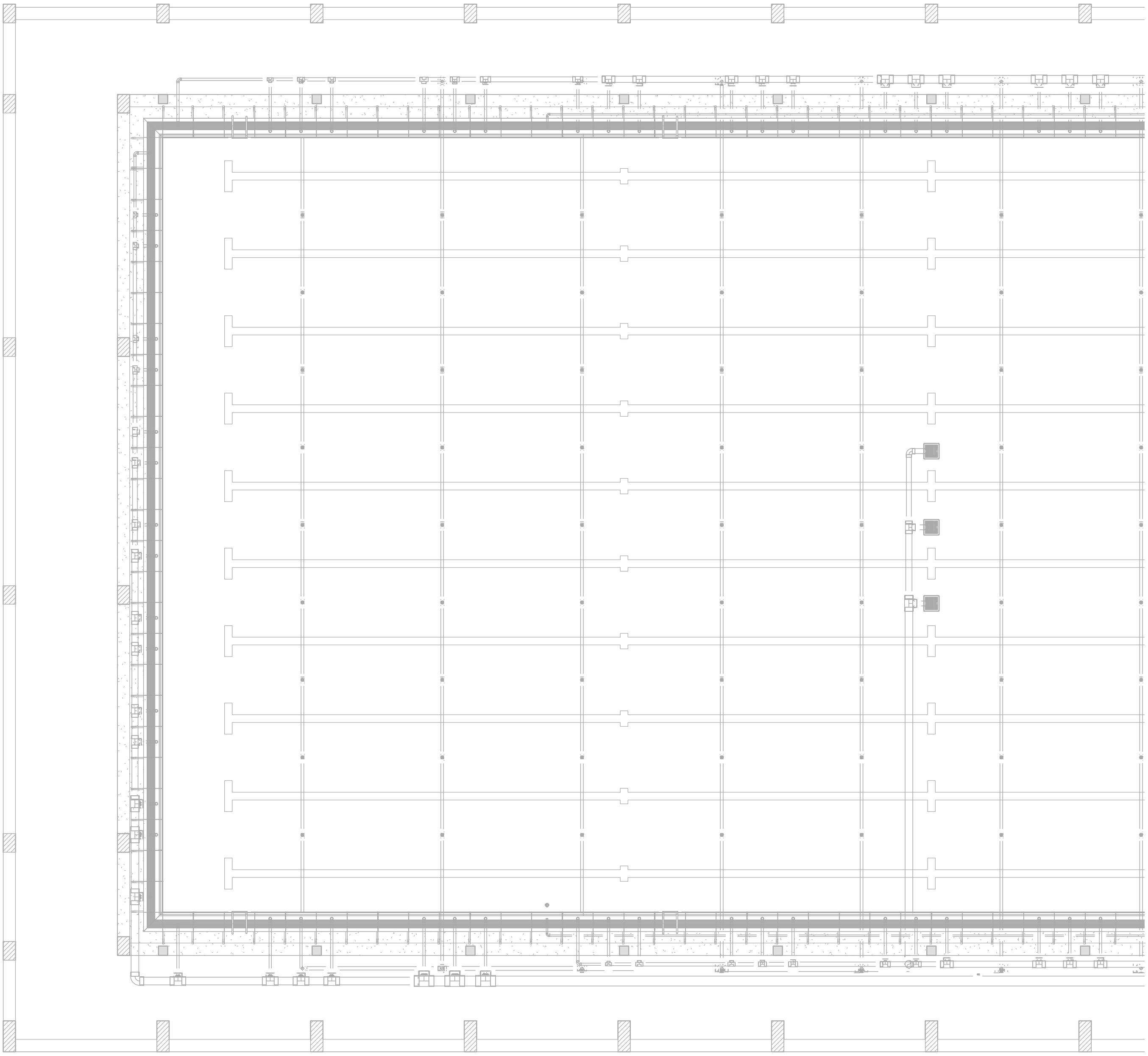
Nº	DESCRIPTION	DATE
V01		12/04/2016

NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000

Nº PLAN	PLAN	DIN/SCALE
M01-DE	GENERAL HYDRAULIC CIRCUIT	A 1: 1/50 A 3: 1/100

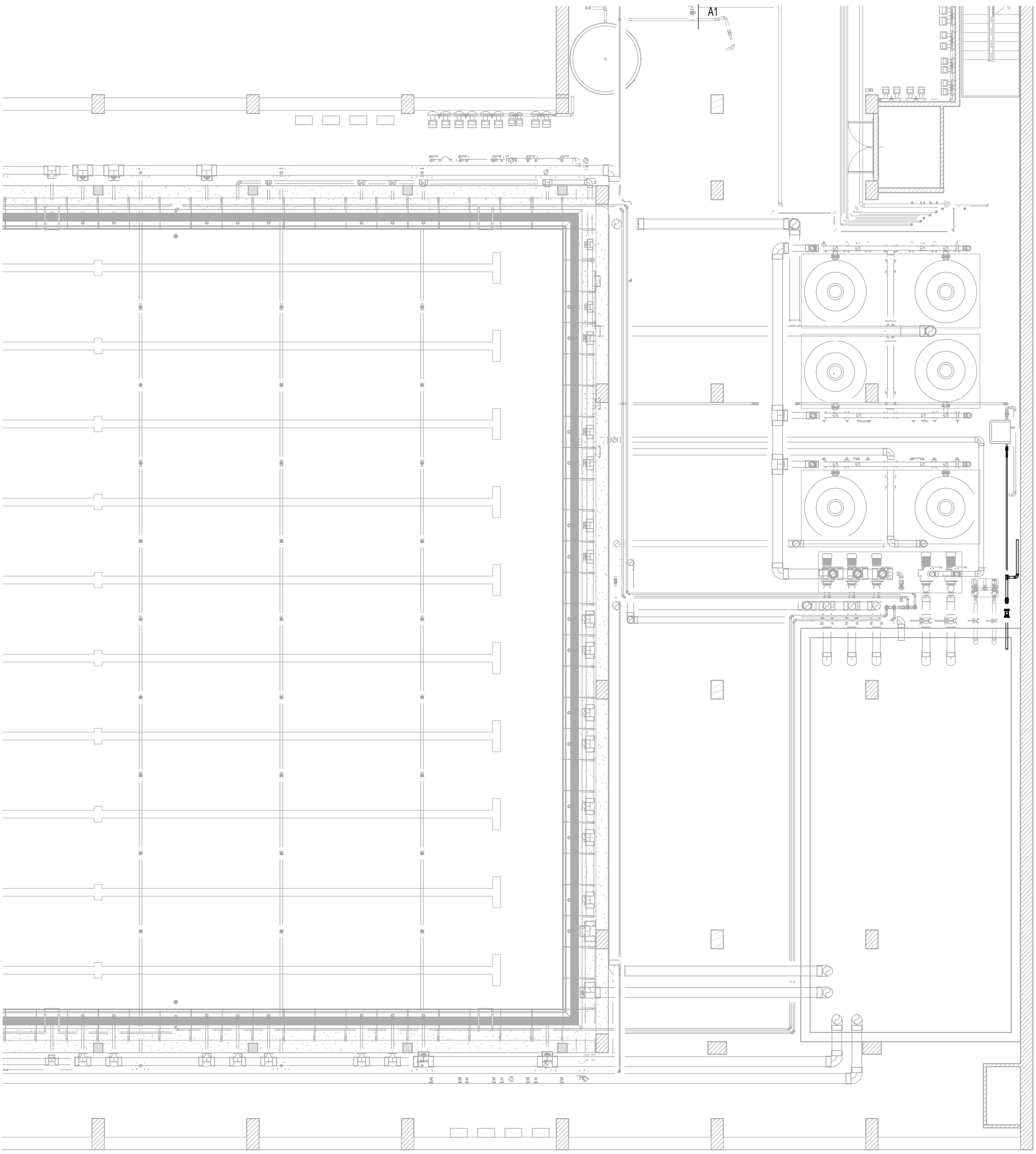
A1



DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300



PIPE - PHWS-AP-01-PO			
Description	Nominal Diameter	Length (m)	FES_CODE
PIPE PVC - PN10 SOLVENT SOCKET	32	6	02708
PIPE PVC - PN10 SOLVENT SOCKET	50	3	02710

PIPE ACCESSORIES - PHWS-AP-01-PO			
Description	Nominal Diameter	FES_CODE	Count
BALL VALVE Dn 32 SOLVENT SOCKET	32-32	36504	1
BALL VALVE Dn 50 SOLVENT SOCKET	50-50	36506	1
WALTMAN Dn100	50-50	20430	1

PIPE FITTING - PHWS-AP-01-PO			
Description	Nominal Diameter	FES_CODE	Count
90º ELBOW PVCC-U solvent soket	32-32	01715	2
90º ELBOW PVCC-U solvent soket	50-50	01717	1
90º TEE PVCC-U solvent soket	50-50-50	01785	1
REDUCING BUSH PVC-U solvent socket	50-32	01926	1

CLIENT
.

NORTH

REVISION

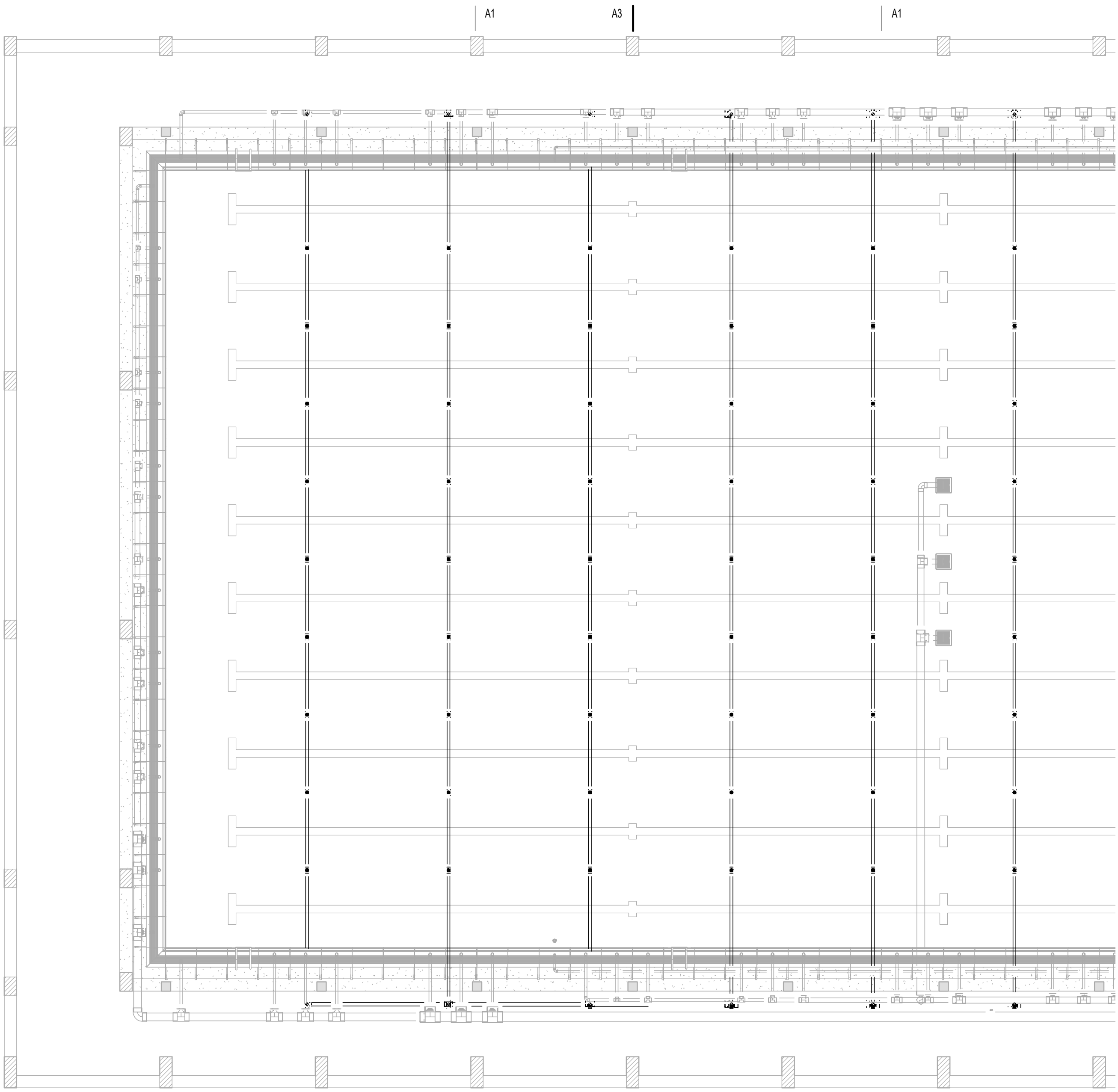
Nº	DESCRIPTION	DATE
V01		12/04/2016

NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
M02-DE	CONTRIBUTION HYDRAULIC CIRCUIT	A 1: 1/50 A 3: 1/100

A1

A1

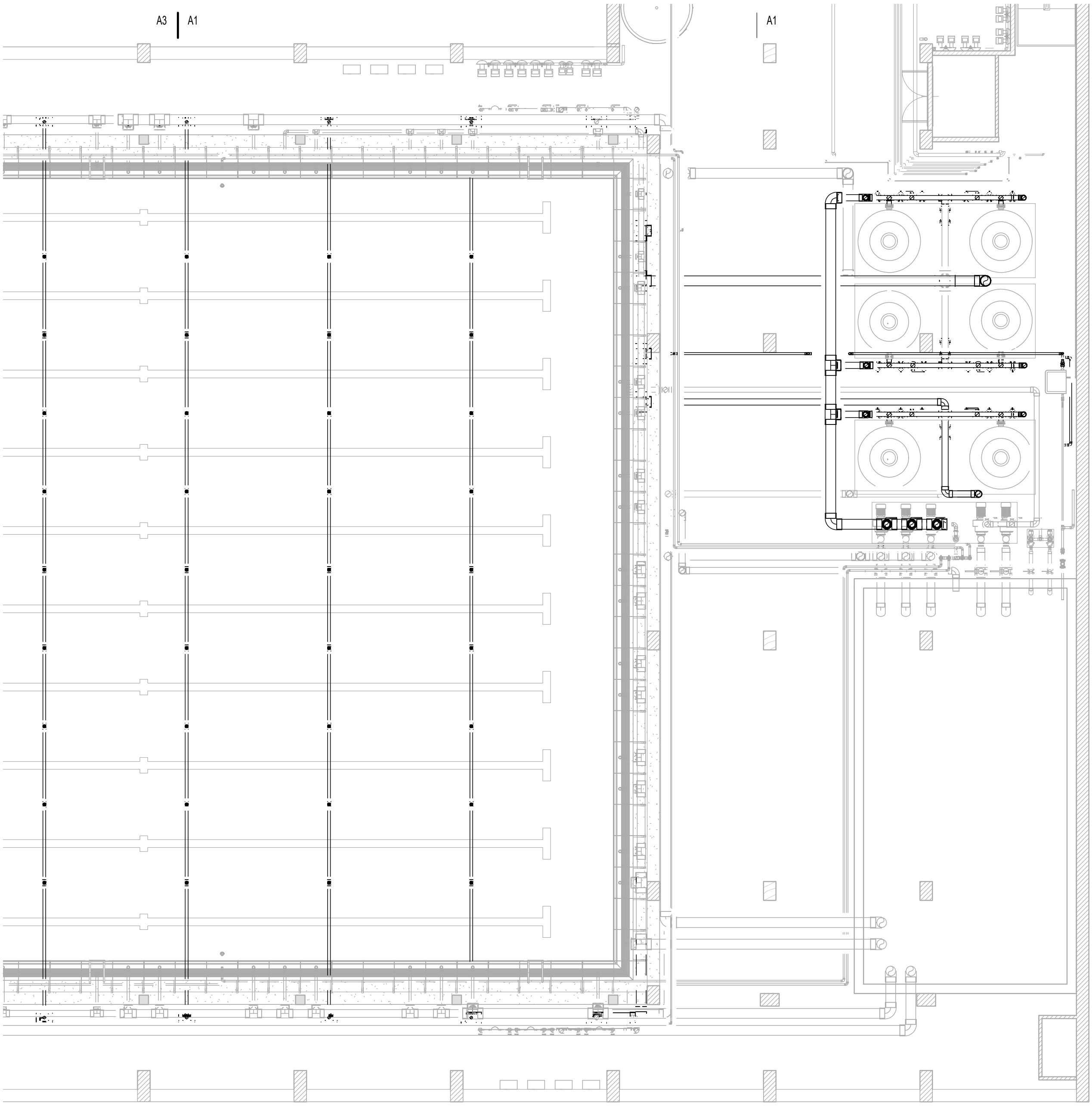


PIPE FITTING - PHWR-PO-01-IC			
Description	Nominal Diameter	FES_CODE	Count
90º ELBOW PVCC-U solvent soket	50-50	01717	12
90º ELBOW PVCC-U solvent soket	80-80	01719	20
90º ELBOW PVCC-U solvent soket	100-100	01720	2
90º ELBOW PVCC-U solvent soket	125-125	01722	15
90º ELBOW PVCC-U solvent soket	175-175	01724	5
90º ELBOW PVCC-U solvent soket	300-300	01727	6
90º TEE PVCC-U solvent soket	110-110-110	01789	2
90º TEE PVCC-U solvent soket	125-125-125	01790	32
90º TEE PVCC-U solvent soket	175-175-175	01792	15
90º TEE PVCC-U solvent soket	225-225-225	01794	6
90º TEE PVCC-U solvent soket	300-300-300	01795	14
90º TEE REDUCTION PVCC-U solvent soket	80-80-50	01787	89
90º TEE REDUCTION PVCC-U solvent soket	80-80-80	01787	1
CONICAL REDUCER PVC-U solvent socket	175-125	02013	2
REDUCING BUSH PVC-U solvent socket	50-25	01927	1
REDUCING BUSH PVC-U solvent socket	100-50	18690	2
REDUCING BUSH PVC-U solvent socket	100-80	01930	18
REDUCING BUSH PVC-U solvent socket	110-80	18691	2
REDUCING BUSH PVC-U solvent socket	110-100	01931	2
REDUCING BUSH PVC-U solvent socket	125-100	18692	2
REDUCING BUSH PVC-U solvent socket	125-110	01932	2
REDUCING BUSH PVC-U solvent socket	150-100	18693	17
REDUCING BUSH PVC-U solvent socket	150-125	01933	22
REDUCING BUSH PVC-U solvent socket	175-150	01934	36
REDUCING BUSH PVC-U solvent socket	200-150	01936	3
REDUCING BUSH PVC-U solvent socket	200-175	01935	19
REDUCING BUSH PVC-U solvent socket	225-175	01938	20
REDUCING BUSH PVC-U solvent socket	300-200	01940	4
REDUCING BUSH PVC-U solvent socket	300-225	01939	14
WALL CONDUIT DN80-DN50	90-65	43590	90

DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300



PLUMBING FIXTURES - PHWR-PO-01-IC		
Description	FES_CODE	Count
RETURN INLET Ø90	43588	90

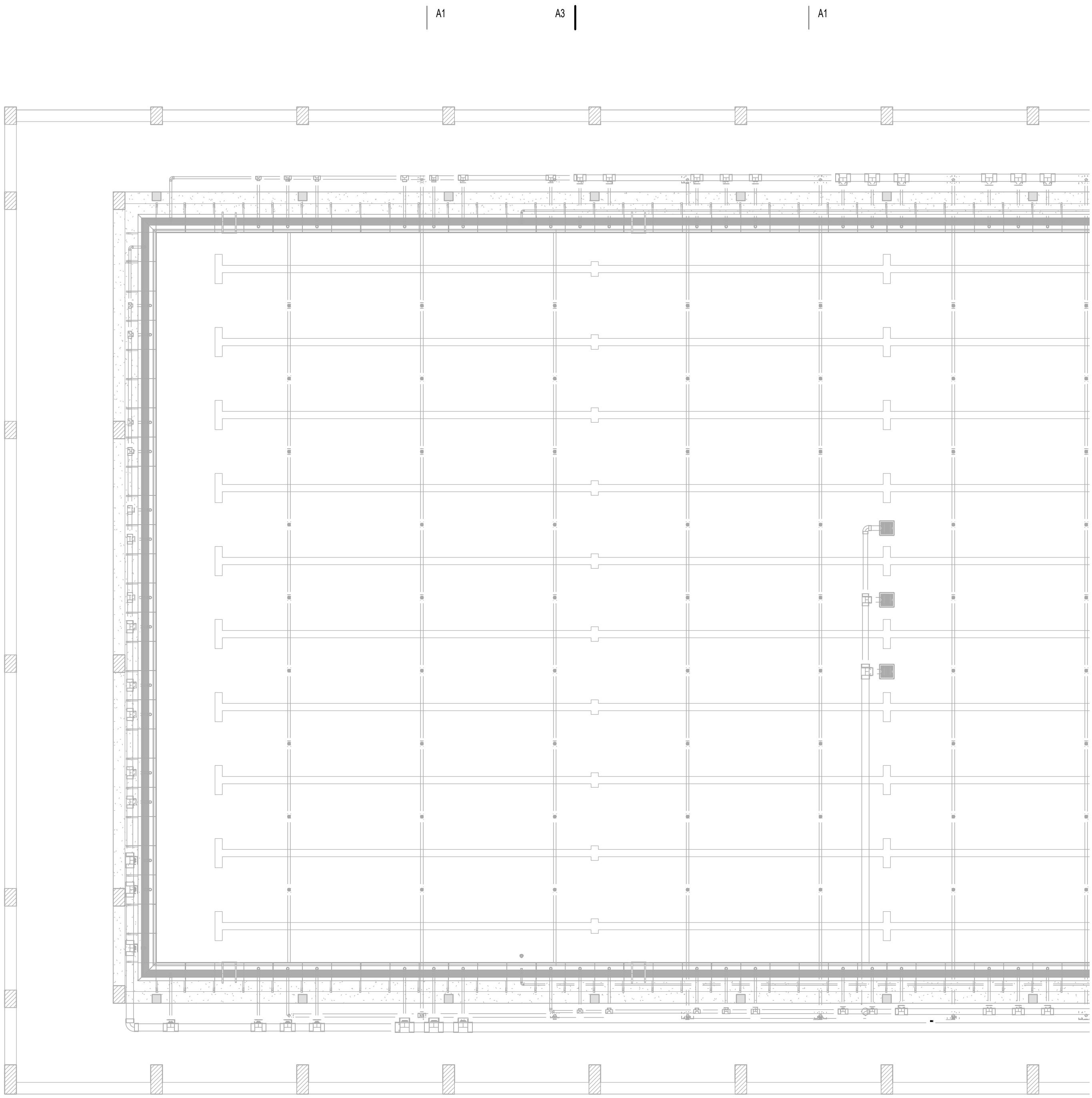
PIPE - PHWR-PO-01-IC			
Description	Nominal Diameter	Length (m)	FES_CODE
PIPE PVC - PN10 SOLVENT SOCKET	50	64	02710
PIPE PVC - PN10 SOLVENT SOCKET	80	305	02712
PIPE PVC - PN10 SOLVENT SOCKET	100	9	02713
PIPE PVC - PN10 SOLVENT SOCKET	110	9	02714
PIPE PVC - PN10 SOLVENT SOCKET	125	62	02715
PIPE PVC - PN10 SOLVENT SOCKET	150	0	02716
PIPE PVC - PN10 SOLVENT SOCKET	175	53	02718
PIPE PVC - PN10 SOLVENT SOCKET	225	26	02719
PIPE PVC - PN10 SOLVENT SOCKET	300	61	02720

PIPE ACCESSORIES - PHWR-PO-01-IC			
Description	Nominal Diameter	FES_CODE	Count
ANTIVIBRATION FLANGE Dn 200	200-200	20237	3
BALL VALVE Dn 50 SOLVENT SOCKET	50-50	36506	2
BUTTERFLY VALVE SERIE PVC-U Dn80	80-80	32615	20
BUTTERFLY VALVE SERIE PVC-U Dn125	125-125	32617	30
BUTTERFLY VALVE SERIE PVC-U Dn175	175-175	32619	3
RUBER CHECK Dn200	200-200	20245	3
WALTMAN Dn100	200-200	20436	3

A3 | A1

CLIENT		NORTH
.		
REVISION Nº	DESCRIPTION	DATE
V01		12/04/2016
NOTES		
DATE: 26.10.2016	PROJECT: SWIMMING POOL 50X25X2	Nº PROJECT: 16.000
Nº PLAN: M03-DE	PLAN: IMPULSION HYDRAULIC CIRCUIT	DIN/SCALE: A 1: 1/50 A 3: 1/100

A1

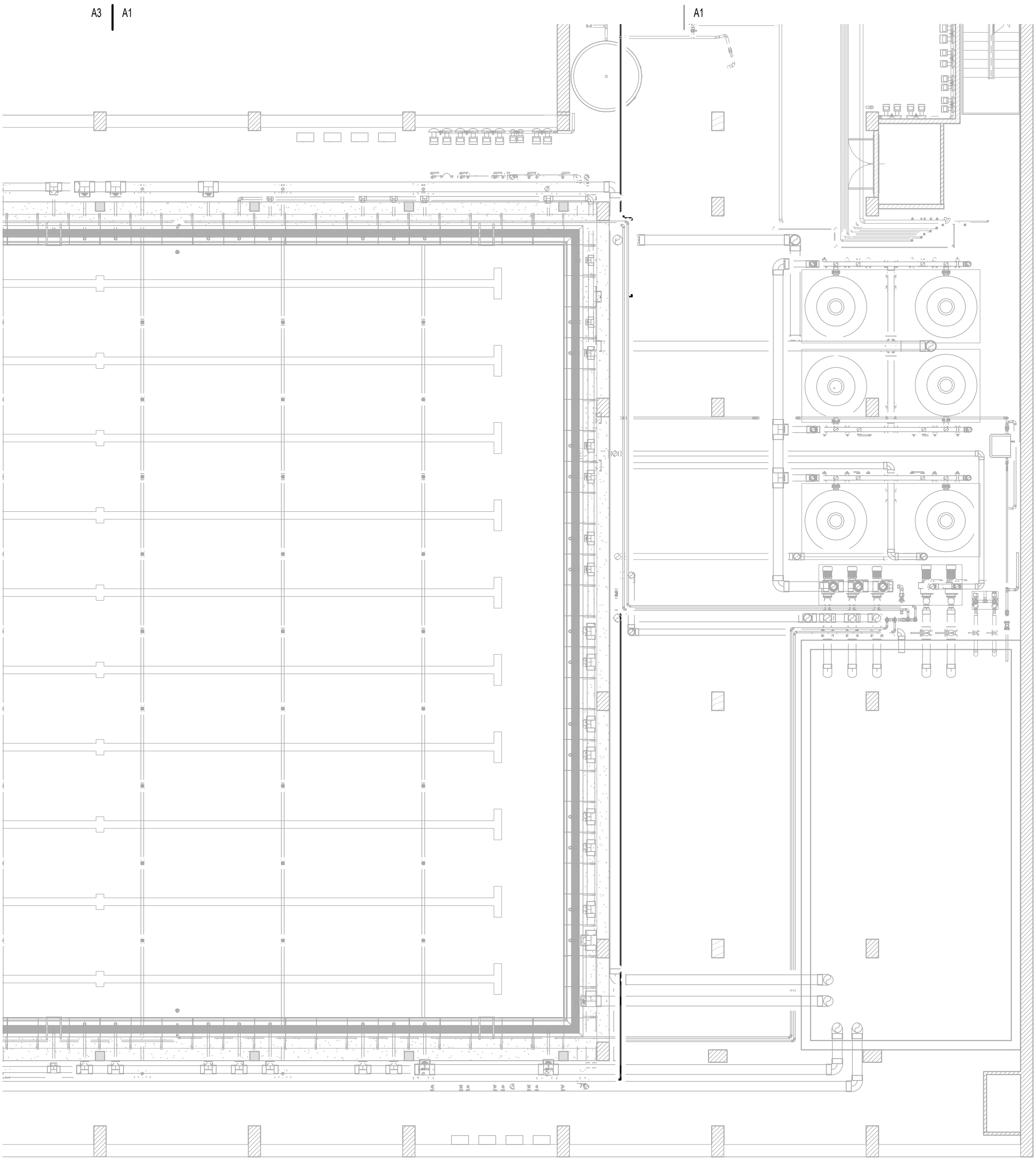


DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300

PLUMBING FIXTURES - PHWR-PO-01-AN		
Description	FES_CODE	Count
RETURN INLET FOR PANEL POOL	41518	1



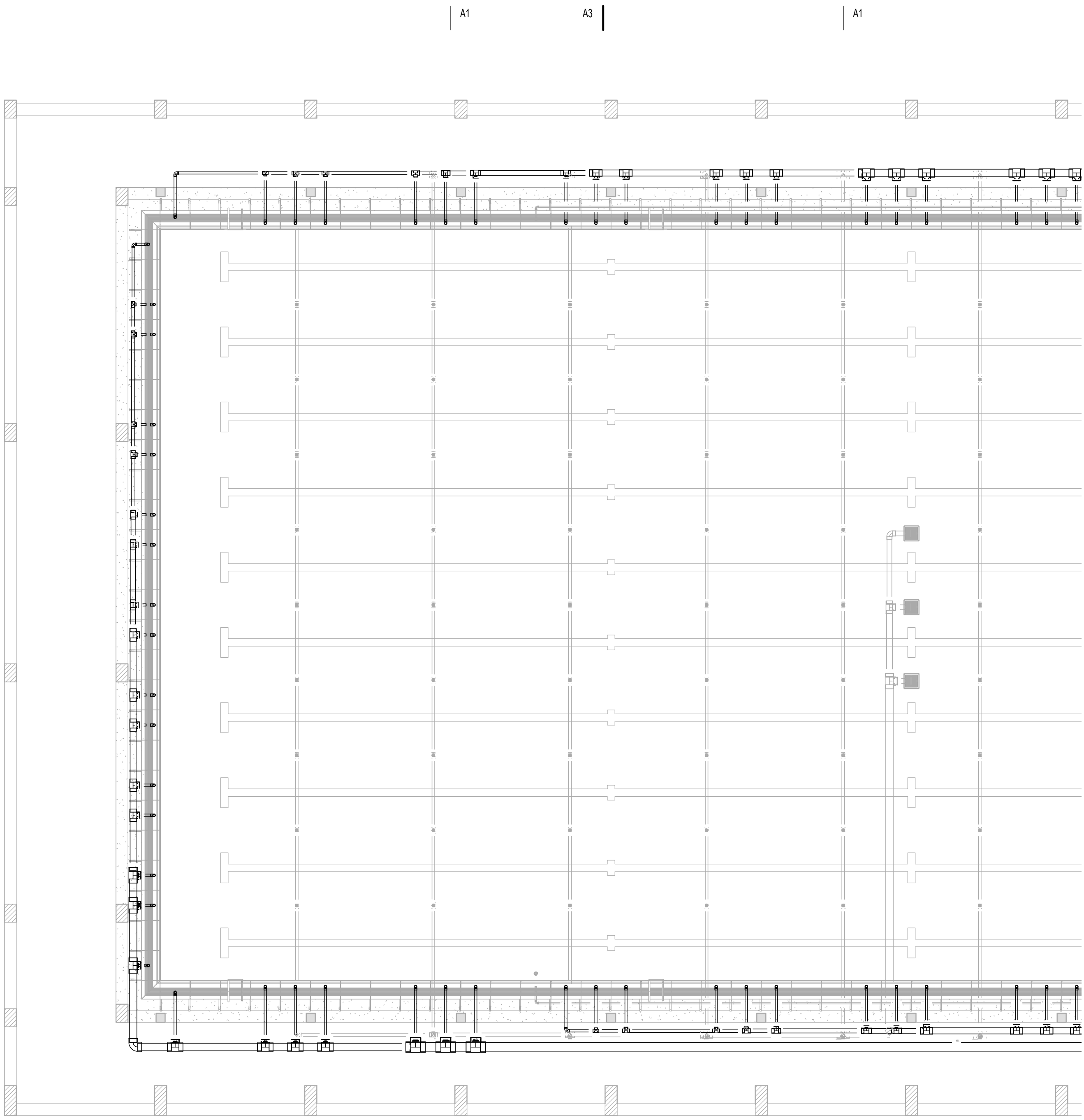
PIPE FITTING - PHWR-PO-01-AN			
Description	Nominal Diameter	FES_CODE	Count
90º ELBOW PVCC-U solvent soket	15-15	01712	3
90º ELBOW PVCC-U solvent soket	25-25	01714	11
90º ELBOW PVCC-U solvent soket	65-65	01718	1
90º TEE PVCC-U solvent soket	25-25-25	01782	2
REDUCING BUSH PVC-U solvent socket	25-15	01917	2
REDUCING BUSH PVC-U solvent socket	40-25	01922	1
REDUCING BUSH PVC-U solvent socket	65-40	18685	1

PIPE - PHWR-PO-01-AN			
Description	Nominal Diameter	Length (m)	FES_CODE
PIPE PVC - PN10 SOLVENT SOCKET	15	2	24128-PN16
PIPE PVC - PN10 SOLVENT SOCKET	25	95	02724
PIPE PVC - PN10 SOLVENT SOCKET	65	2	02711

PIPE ACCESSORIES - PHWR-PO-01-AN			
Description	Nominal Diameter	FES_CODE	Count
BALL VALVE Dn 25 SOLVENT SOCKET	25-25	36503	1
Ball valves D.110mm (STD) series PVC-U solvent socket PE-EPDM	15-15	36501	2

CLIENT .		NORTH
REVISION Nº V01	DESCRIPTION	DATE 12/04/2016
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN M04-DE	PLAN DOSAGE & CONTROL HYDRAULIC CIRCUIT	DIN/SCALE A 1: 1/50 A 3: 1/100

A1



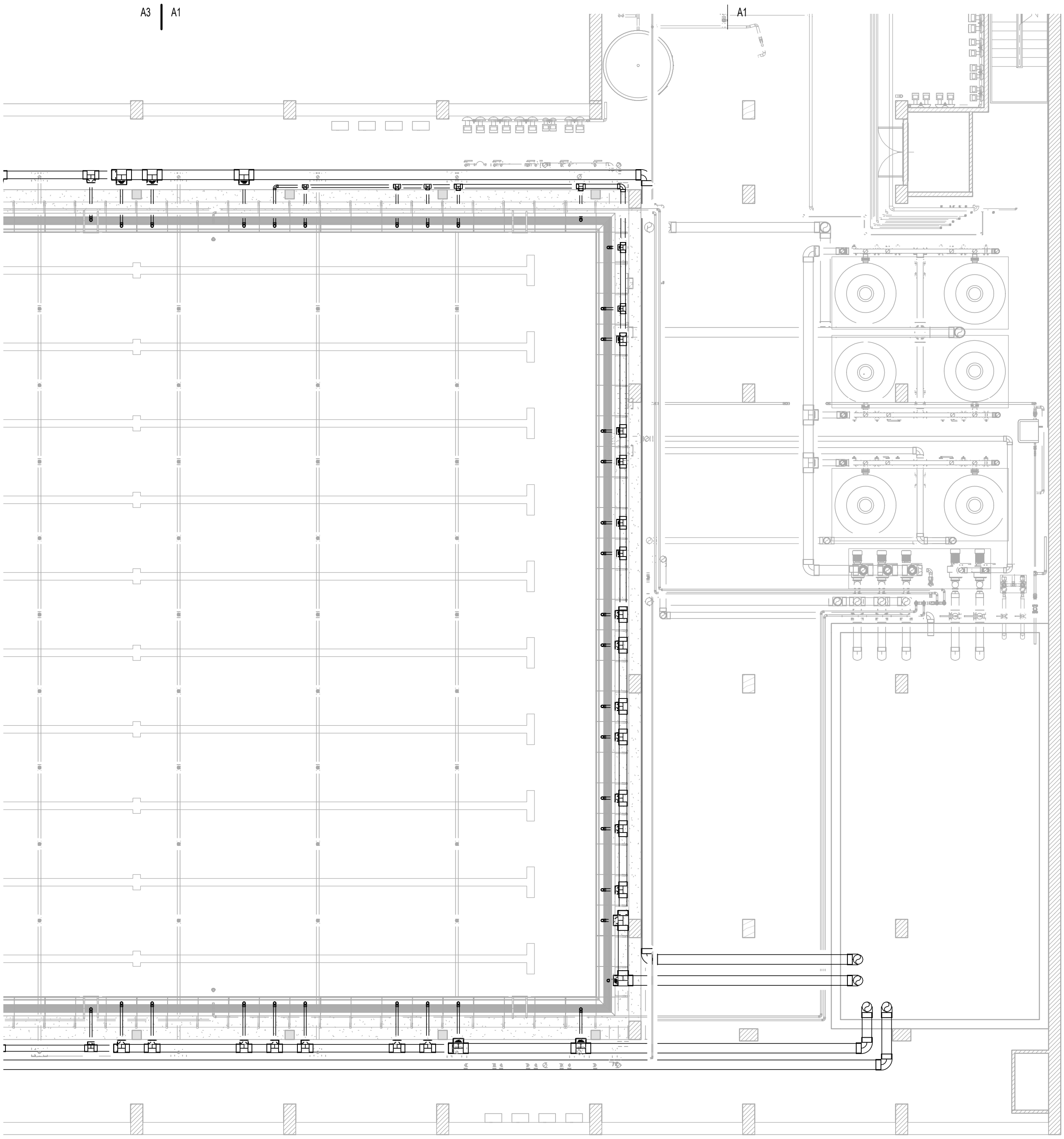
DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300

PIPE - PHWR-PO-01-OC			
Description	Nominal Diameter	Length (mm)	FES_CODE
PIPE PVC - PN10 SOLVENT SOCKET	65	166	
PIPE PVC - PN10 SOLVENT SOCKET	80	6	02712
PIPE PVC - PN10 SOLVENT SOCKET	100	13	02713
PIPE PVC - PN10 SOLVENT SOCKET	110	7	02714
PIPE PVC - PN10 SOLVENT SOCKET	125	8	02715
PIPE PVC - PN10 SOLVENT SOCKET	150	11	02716
PIPE PVC - PN10 SOLVENT SOCKET	175	31	
PIPE PVC - PN10 SOLVENT SOCKET	225	40	02719
PIPE PVC - PN10 SOLVENT SOCKET	300	131	

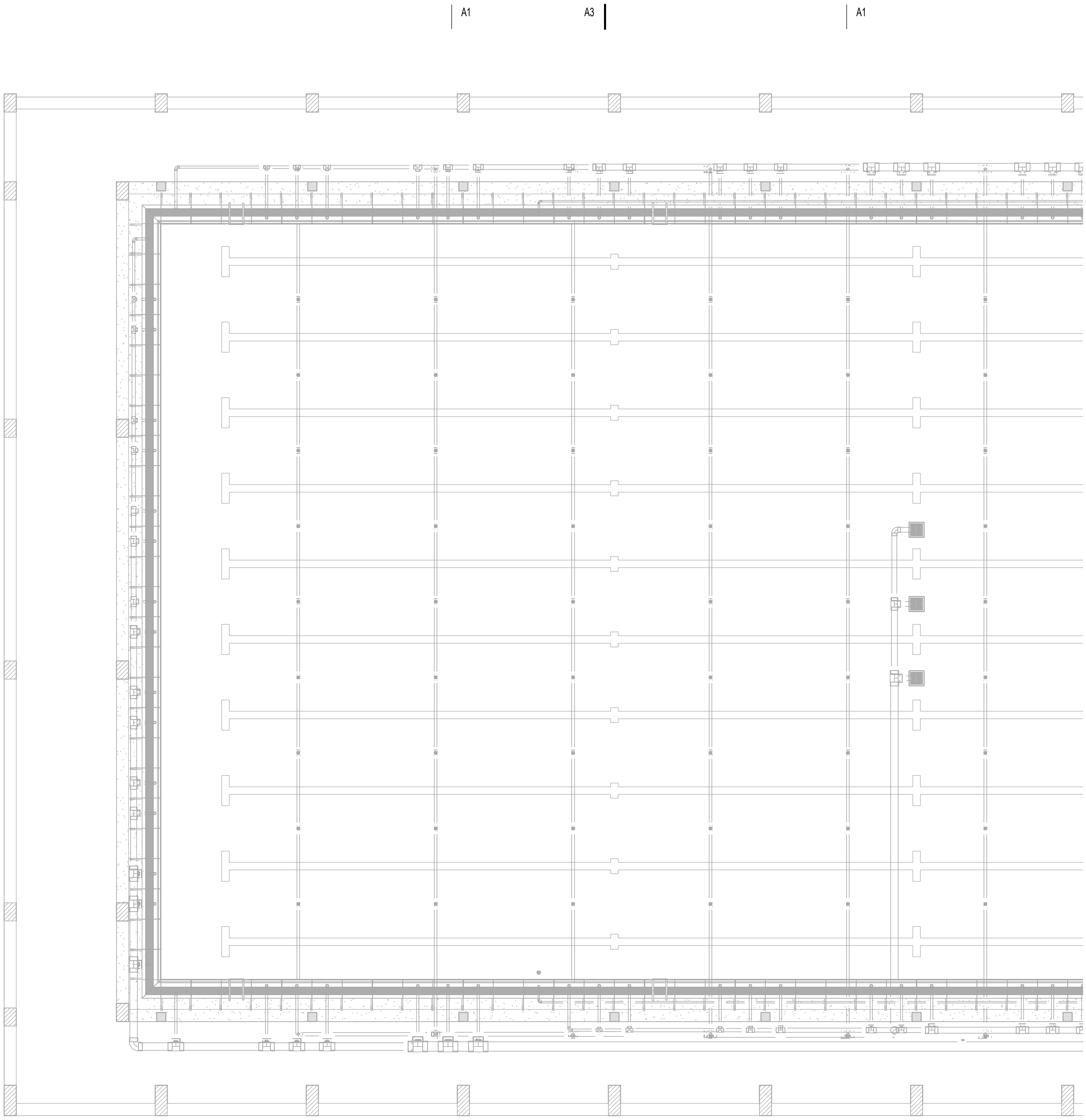
PLUMBING FIXTURES - PHWR-PO-01-OC		
Description	FES_CODE	Count
SUCTION INLET FOR OVERFLOW WITH LYNER Dn65	41519	90



PIPE FITTING - PHWR-PO-01-OC			
Description	Nominal Diameter	FES_CODE	Count
90º ELBOW PVCC-U solvent soket	65-65	01718	94
90º ELBOW PVCC-U solvent soket	125-125	01722	1
90º ELBOW PVCC-U solvent soket	225-225	01726	1
90º ELBOW PVCC-U solvent soket	300-300	01727	8
90º TEE PVCC-U solvent soket	80-80-80	01787	4
90º TEE PVCC-U solvent soket	100-100-100	01788	8
90º TEE PVCC-U solvent soket	110-110-110	01789	4
90º TEE PVCC-U solvent soket	125-125-125	01790	4
90º TEE PVCC-U solvent soket	150-150-150	01791	8
90º TEE PVCC-U solvent soket	175-175-175	01792	20
90º TEE PVCC-U solvent soket	225-225-225	01794	28
90º TEE PVCC-U solvent soket	300-300-300	01795	10
REDUCING BUSH PVC-U solvent socket	80-65	01929	8
REDUCING BUSH PVC-U solvent socket	100-65	18689	78
REDUCING BUSH PVC-U solvent socket	100-80	01930	4
REDUCING BUSH PVC-U solvent socket	110-65	20142	4
REDUCING BUSH PVC-U solvent socket	110-100	01931	4
REDUCING BUSH PVC-U solvent socket	125-100	18692	70
REDUCING BUSH PVC-U solvent socket	125-110	01932	4
REDUCING BUSH PVC-U solvent socket	150-125	01933	70
REDUCING BUSH PVC-U solvent socket	175-150	01934	62
REDUCING BUSH PVC-U solvent socket	225-175	01938	42
REDUCING BUSH PVC-U solvent socket	300-225	01939	14

CLIENT		NORTH
REVISION Nº	DESCRIPTION	DATE
V01		12/04/2016
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN M05-DE	PLAN OVERFLOW HYDRAULIC CIRCUIT	DIN/SCALE A 1: 1/50 A 3: 1/100

A1



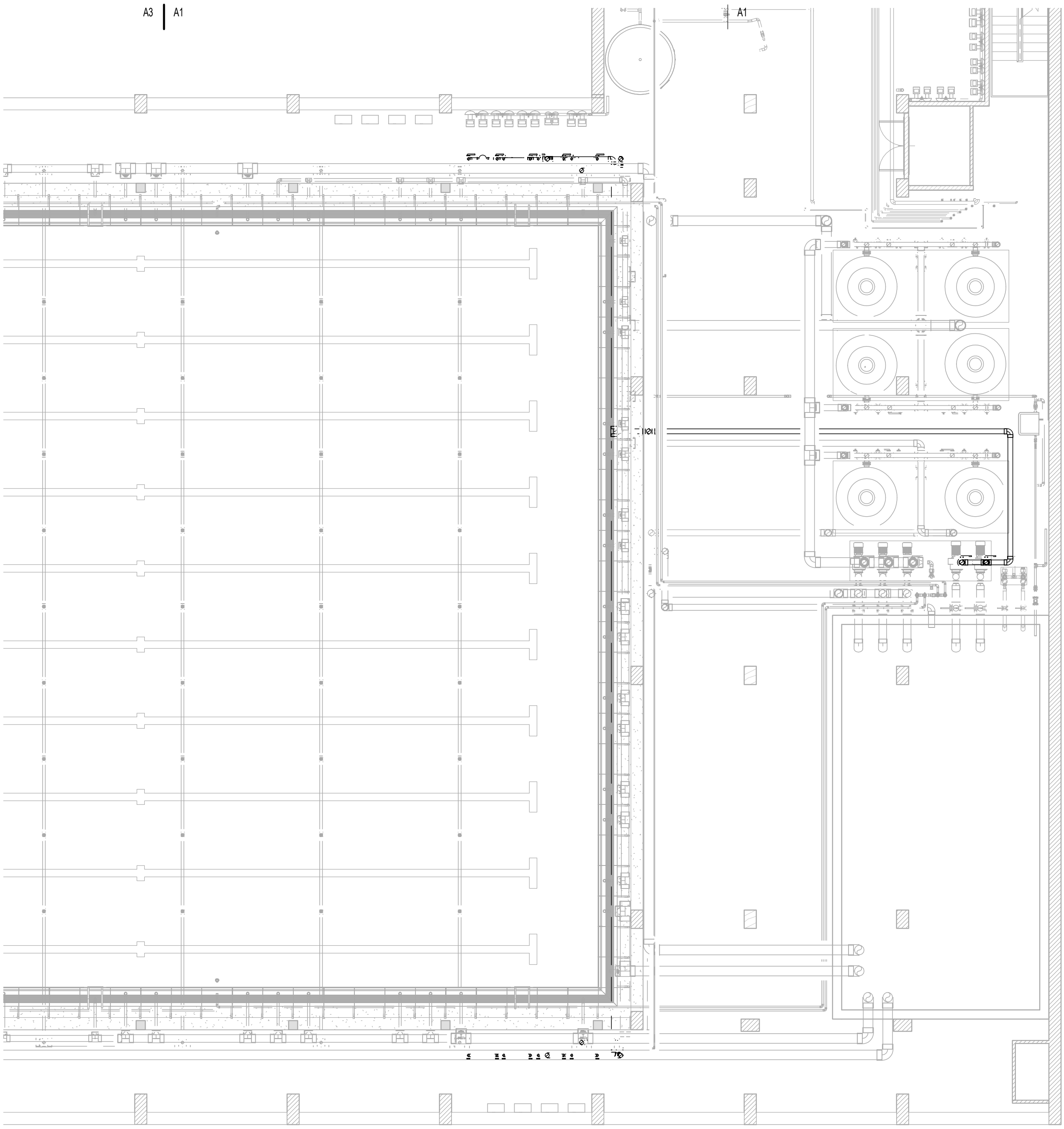
DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300

PIPE - PHWR-PO-01-CC			
Description	Nominal Diameter	Length (m)	FES_CODE
PIPE PVC - PN10 SOLVENT SOCKET	65	21	02711
PIPE PVC - PN10 SOLVENT SOCKET	80	4	02712
PIPE PVC - PN10 SOLVENT SOCKET	125	42	02715
PIPE PVC - PN10 SOLVENT SOCKET	150	20	02716

A3 | A1



PIPE FITTING - PHWR-PO-01-CC			
Description	Nominal Diameter	FES_CODE	Count
90º ELBOW PVCC-U solvent soket	65-65	01718	22
90º ELBOW PVCC-U solvent soket	125-125	01722	12
90º ELBOW PVCC-U solvent soket	150-150	01723	5
90º TEE PVCC-U solvent soket	80-80-80	01787	6
90º TEE PVCC-U solvent soket	100-100-100	01788	2
90º TEE PVCC-U solvent soket	125-125-125	01790	4
90º TEE PVCC-U solvent soket	150-150-150	01791	2
CONICAL REDUCER PVC-U solvent socket	175-125	02013	2
REDUCING BUSH PVC-U solvent socket	80-65	01929	14
REDUCING BUSH PVC-U solvent socket	100-65	18689	6
REDUCING BUSH PVC-U solvent socket	100-80	01930	6
REDUCING BUSH PVC-U solvent socket	125-100	18692	8
REDUCING BUSH PVC-U solvent socket	150-125	01933	2
REDUCING BUSH PVC-U solvent socket	175-150	01934	2

PIPE ACCESSORIES - PHWR-PO-01-CC			
Description	Nominal Diameter	FES_CODE	Count
ANTIVIBRATION FLANGE Dn 150	150-150	20236	2
BUTTERFLY VALVE SERIE PVC-U Dn65	65-65	32614	16
BUTTERFLY VALVE SERIE PVC-U Dn150	150-150	32618	2
NEOLISYS CELL 120	65-65		8
RUBER CHECK Dn150	150-150	20244	2

CLIENT
.

NORTH

REVISION

Nº	DESCRIPTION	DATE
V01		12/04/2016

NOTES

DATE
26.10.2016

PROJECT
SWIMMING POOL 50X25X2

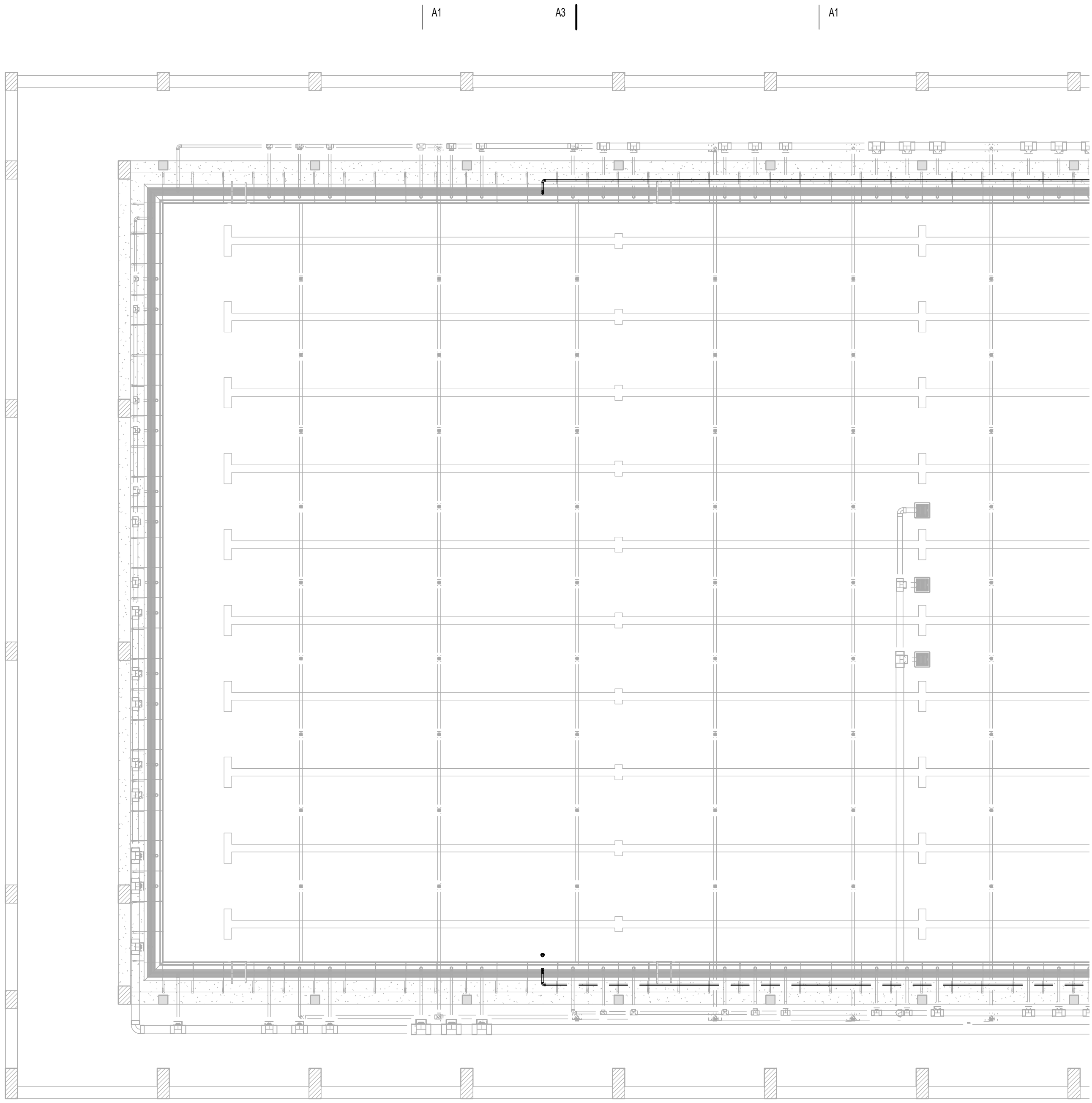
Nº PROJECT
16.000

Nº PLAN
M06-DE

PLAN
CHEMICAL HYDRAULIC CIRCUIT

DIN/SCALE
A 1: 1/50
A 3: 1/100

A1



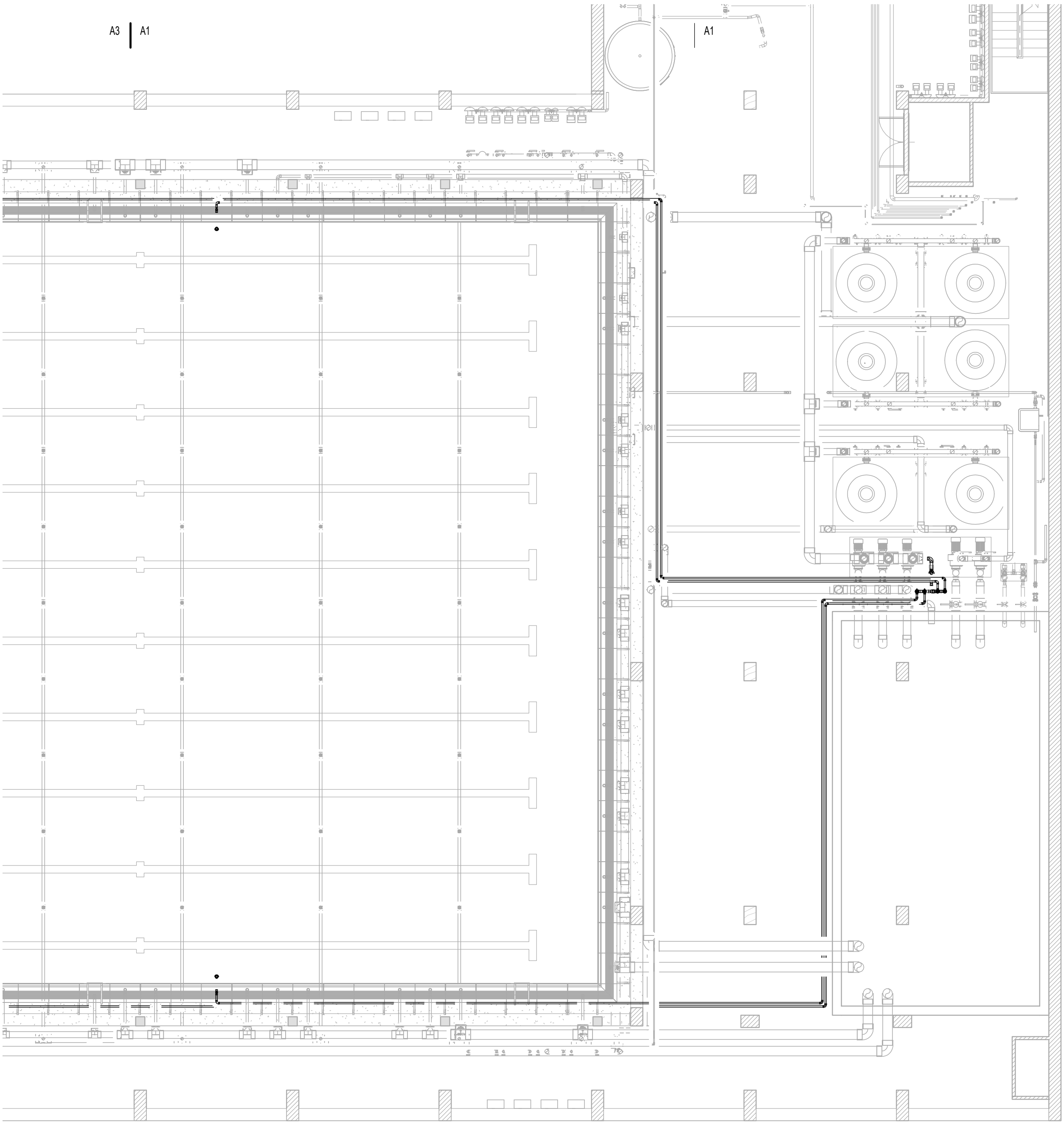
DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300

PIPE ACCESSORIES - PHWR-PO-01-CS			
Description	Nominal Diameter	FES_CODE	Count
BALL VALVE Dn 50 SOLVENT SOCKET	50-50	36506	4
BALL VALVE Dn 80 SOLVENT SOCKET	80-80	36508	1
RUBER CHECK Dn80	80-80	20241	1

A3 | A1 | A1



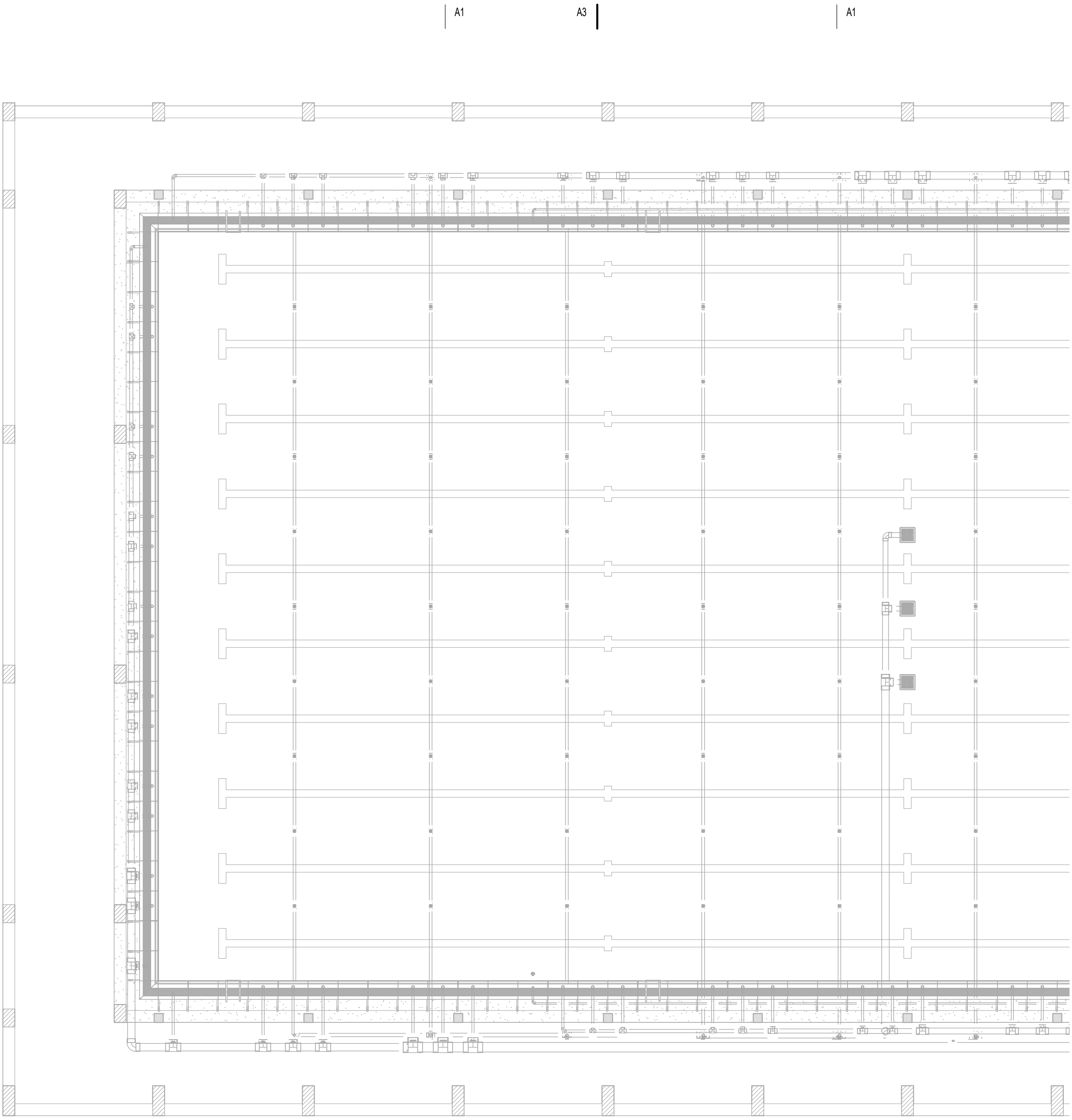
PIPE FITTING - PHWR-PO-01-CS			
Description	Nominal Diameter	FES_CODE	Count
90º ELBOW PVCC-U solvent soket	40-40	01716	28
90º ELBOW PVCC-U solvent soket	65-65	01718	2
90º ELBOW PVCC-U solvent soket	80-80	01719	3
90º TEE PVCC-U solvent soket	65-65-65	01786	2
90º TEE PVCC-U solvent soket	80-80-80	01787	1
CONICAL REDUCER PVC-U solvent socket	80-65	01997	2
REDUCING BUSH PVC-U solvent socket	50-40	01925	8
REDUCING BUSH PVC-U solvent socket	65-40	18685	4
REDUCING BUSH PVC-U solvent socket	80-65	01929	2

PIPE - PHWR-PO-01-CS			
Description	Nominal Diameter	Length (m)	FES_CODE
PIPE PVC - PN10 SOLVENT SOCKET	40	203	02709
PIPE PVC - PN10 SOLVENT SOCKET	65	1	02711
PIPE PVC - PN10 SOLVENT SOCKET	80	3	02712

PLUMBING FIXTURES - PHWR-PO-01-CS		
Description	FES_CODE	Count
SUCTION NOZZLE FOR LINER Dn40	00332	4

CLIENT			NORTH
.			
REVISION			
Nº	DESCRIPTION		DATE
V01			12/04/2016
NOTES			
DATE	PROJECT		Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2		16.000
Nº PLAN	PLAN		DIN/SCALE
M07-DE	CLEANING HYDRAULIC CIRCUIT		A 1: 1/50 A 3: 1/100

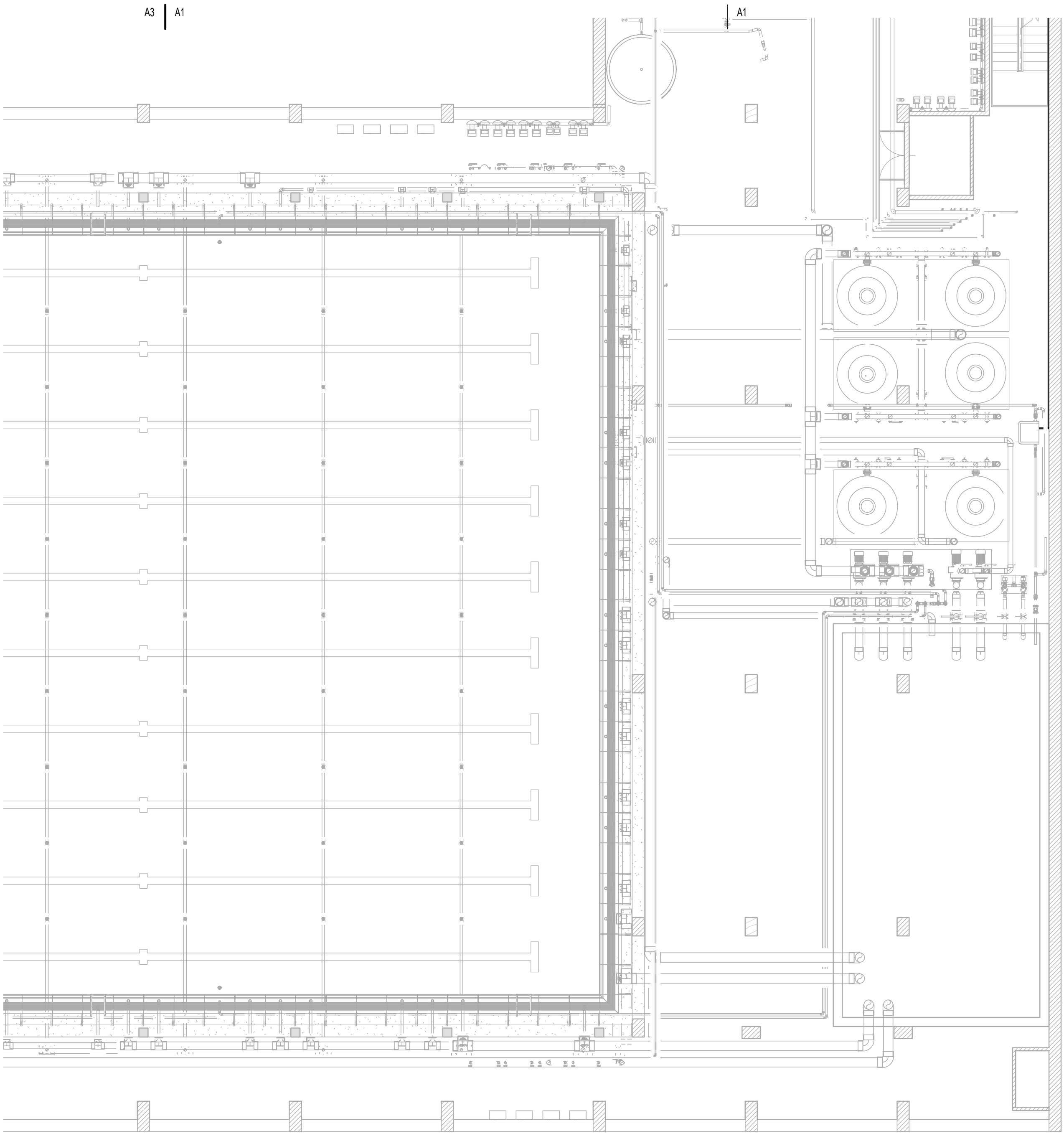
A1



DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300



PIPE - CO2			
Description	Nominal Diameter	Length (mm)	FES_CODE
INOX PIPE	10	73	INOX

PIPE FITTING - CO2			
Description	Nominal Diameter	FES_CODE	Count
INOX ELBOW	10-10		10

CLIENT
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NORTH

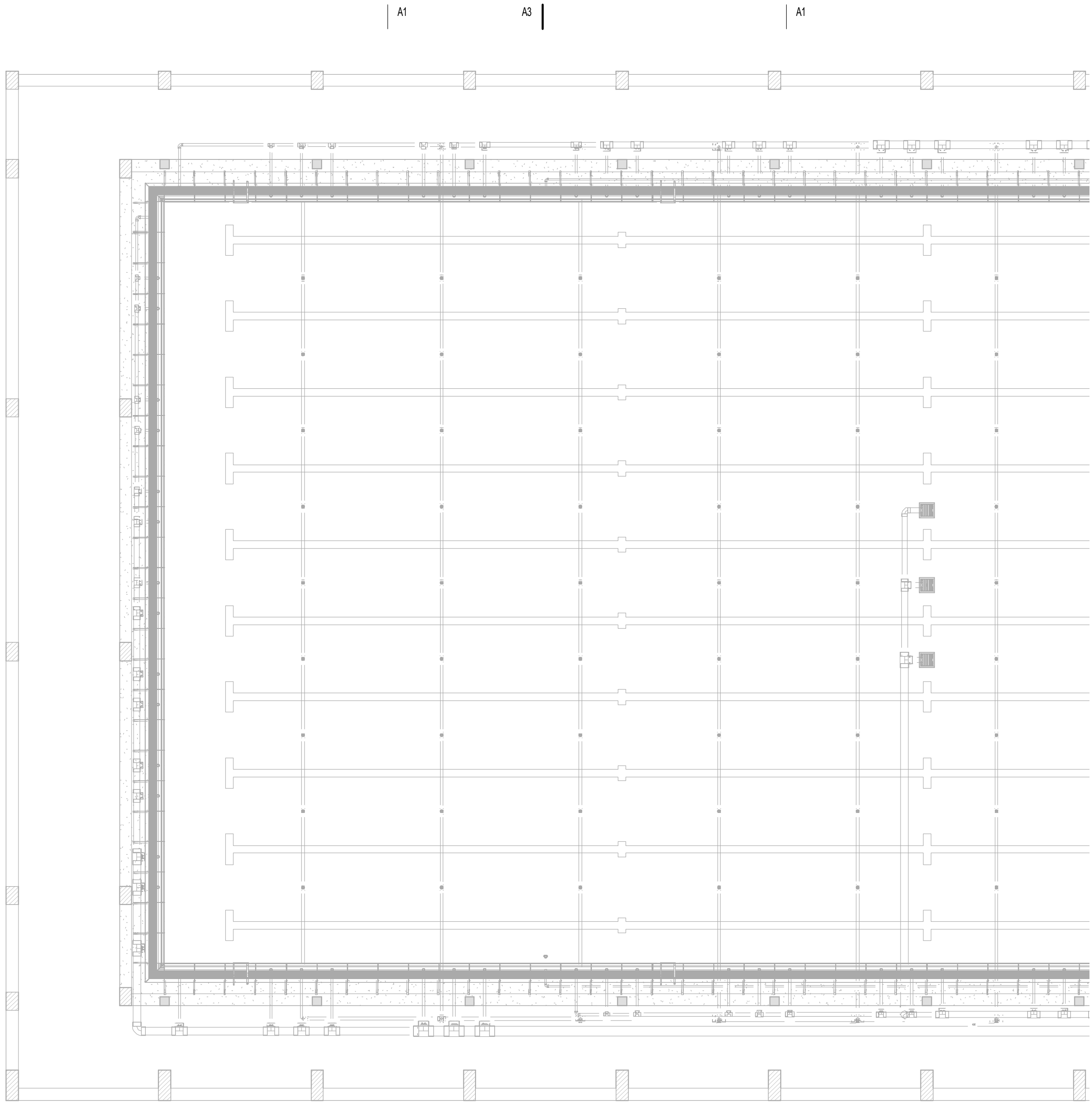
REVISION

Nº	DESCRIPTION	DATE
V01		12/04/2016

NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
M08-DE	C02 HYDRAULIC CIRCUIT	A 1: 1/50 A 3: 1/100

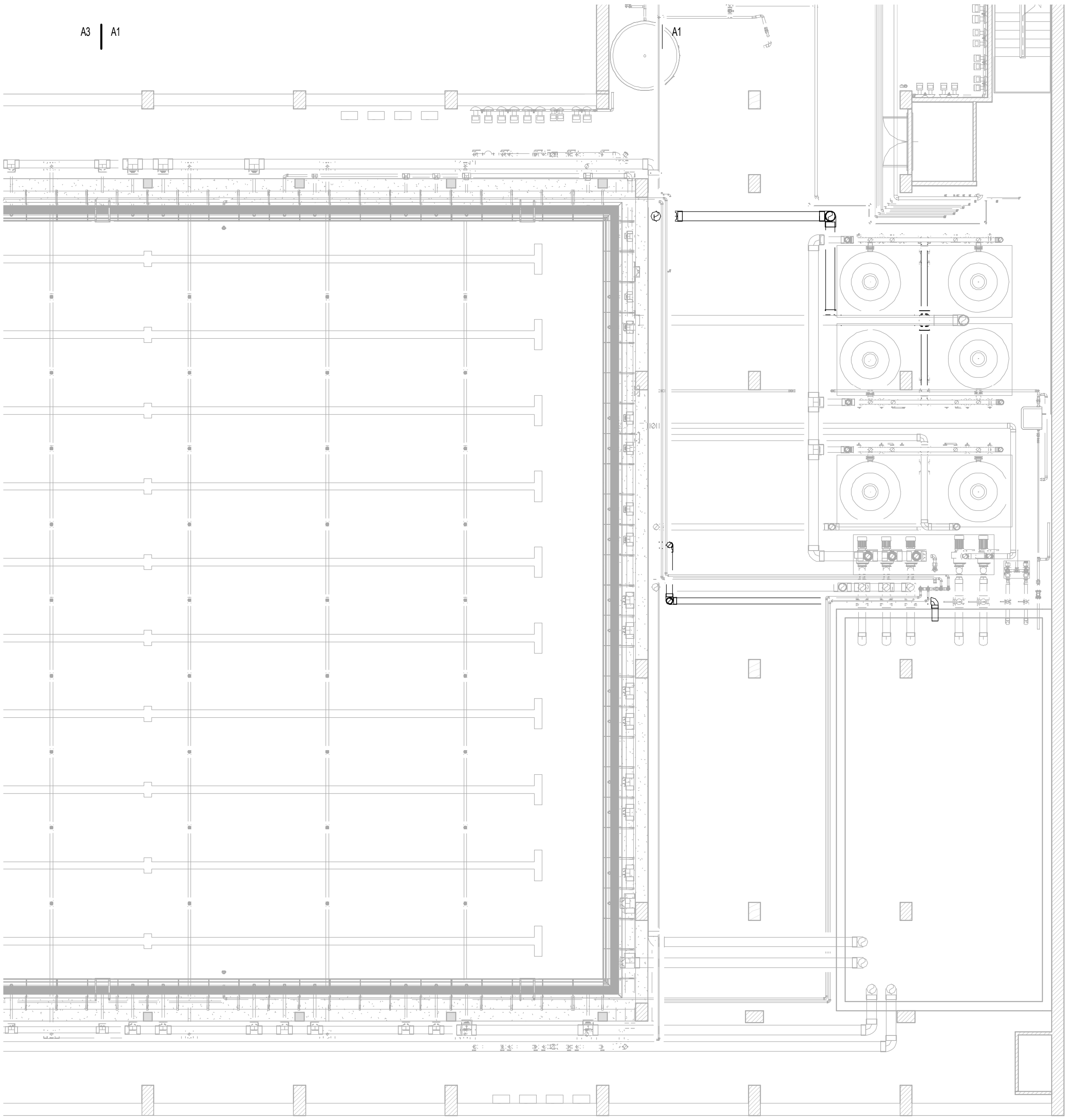
A1



DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300



PIPE - PHWR-PO-01-DC			
Description	Nominal Diameter	Length (mm)	FES_CODE
CARBON STEEL	100	22	
PIPE PVC - PN10 SOLVENT SOCKET	175	28	02718
PIPE PVC - PN10 SOLVENT SOCKET	300	14	

PIPE ACCESSORIES - PHWR-PO-01-DC			
Description	Nominal Diameter	FES_CODE	Count
BUTTERFLY VALVE SERIE PVC-U Dn175	175-175	32619	1

PIPE FITTING - PHWR-PO-01-DC			
Description	Nominal Diameter	FES_CODE	Count
45º ELBOW SOLVENT SOCKET PVC-U	300-300	01761	2
90º ELBOW PVCC-U solvent soket	175-175	01724	5
90º ELBOW PVCC-U solvent soket	300-300	01727	4
90º TEE PVCC-U solvent soket	175-175-175	01792	2
90º TEE PVCC-U solvent soket	300-300-300	01795	2
INOX ELBOW	100-100		2
REDUCING BUSH PVC-U solvent socket	225-175	01938	3
REDUCING BUSH PVC-U solvent socket	300-225	01939	3

CLIENT

NORTH

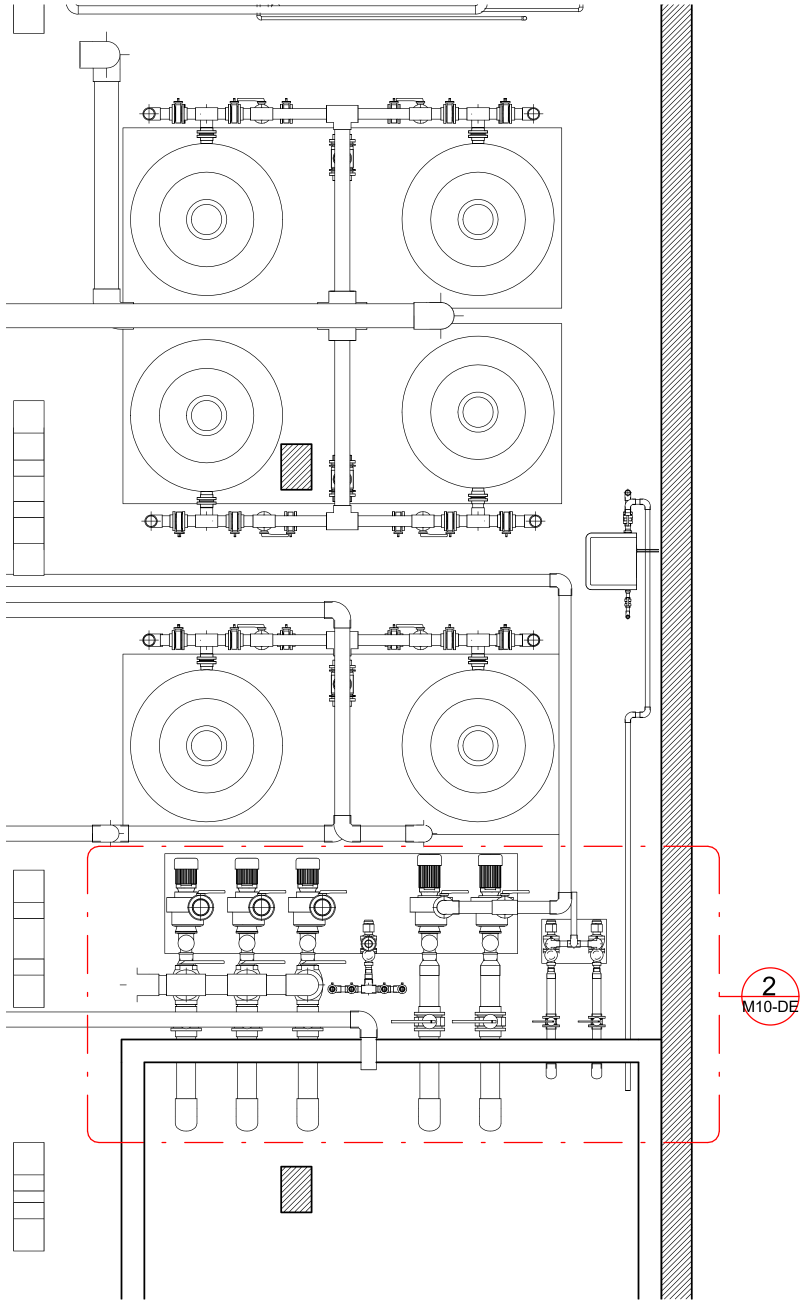
REVISION

Nº	DESCRIPTION	DATE

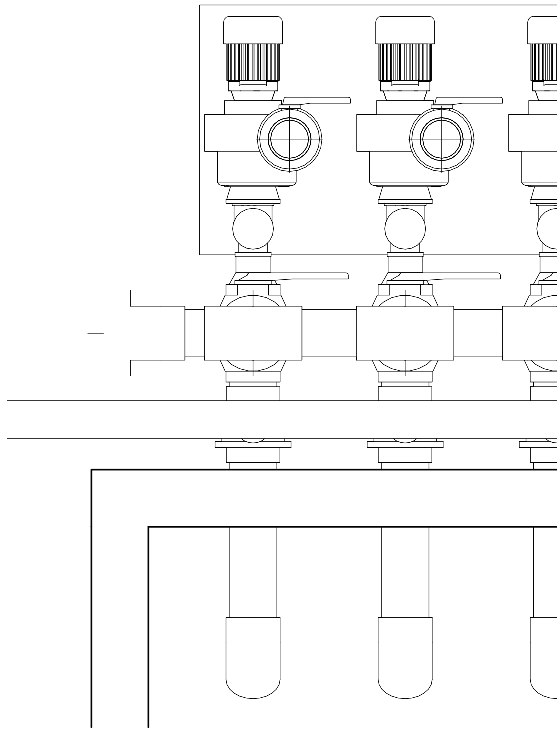
NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
M09-DE	SCRAPPING HYDRAULIC SYSTEM	A 1: 1/50 A 3: 1/100

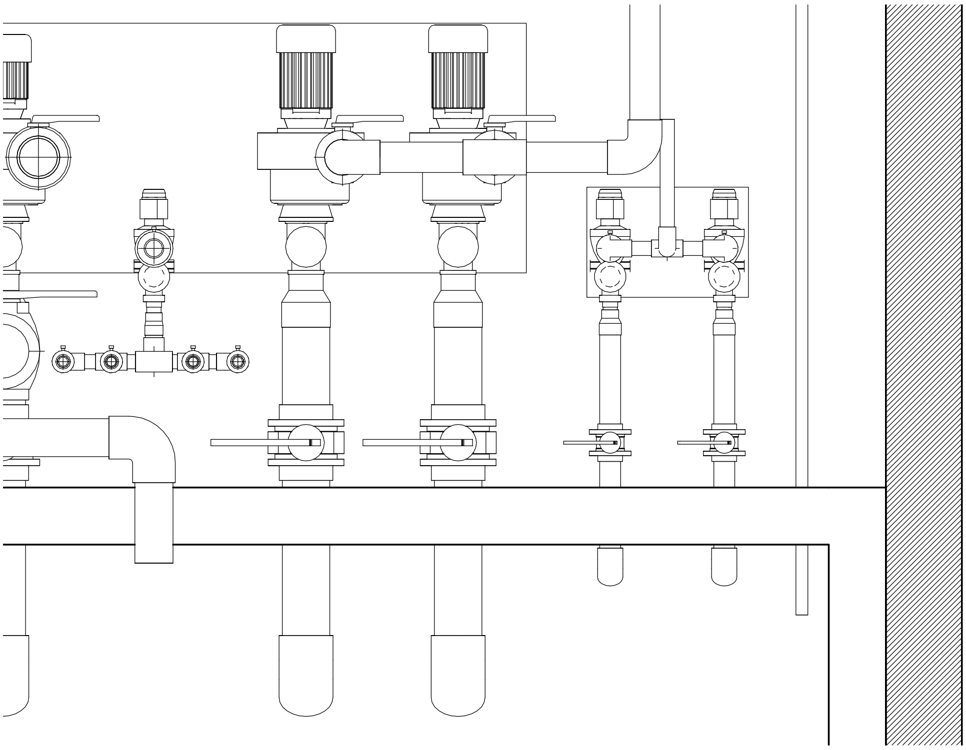
A1



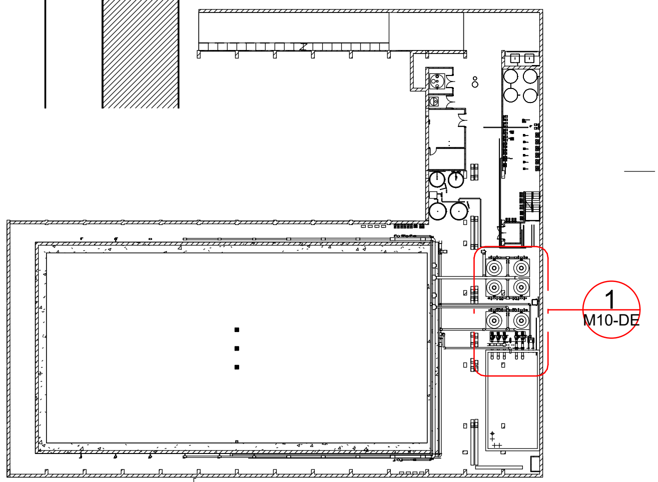
1 INSTALATION FLOOR - FILTRATION AREA
1 : 50



2 INSTALATION FLOOR - FILTRATIC
1 : 20



ꞏN AREA - PUMPS



CLIENT

NORTH

REVISION

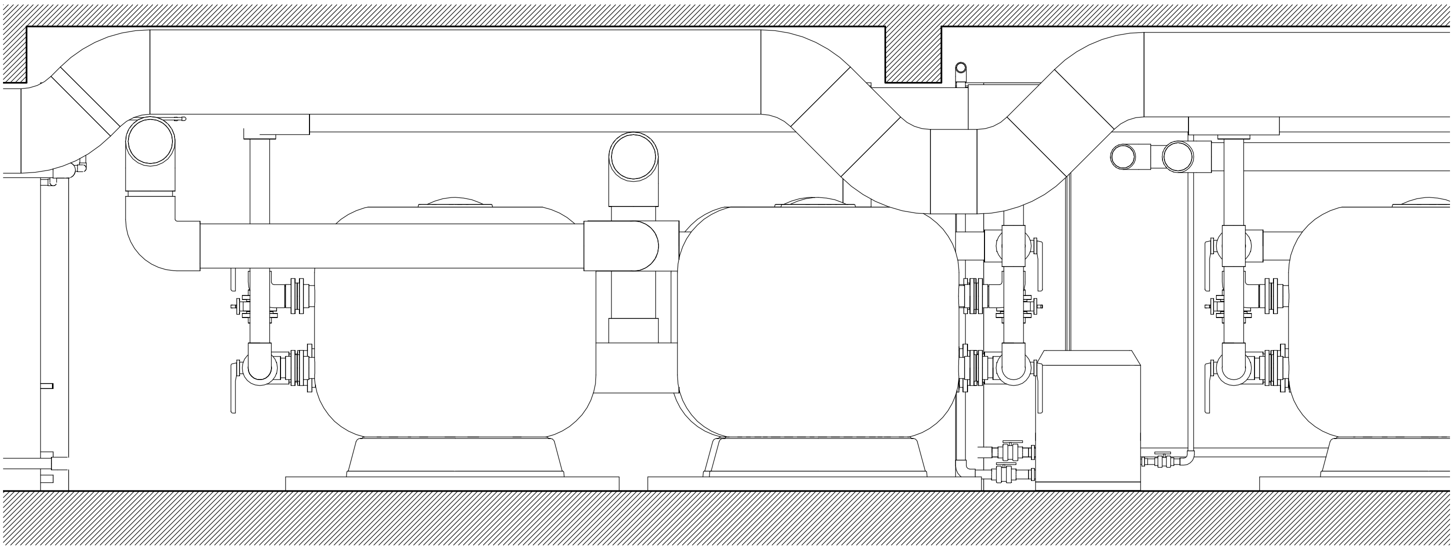
Nº	DESCRIPTION	DATE

NOTES

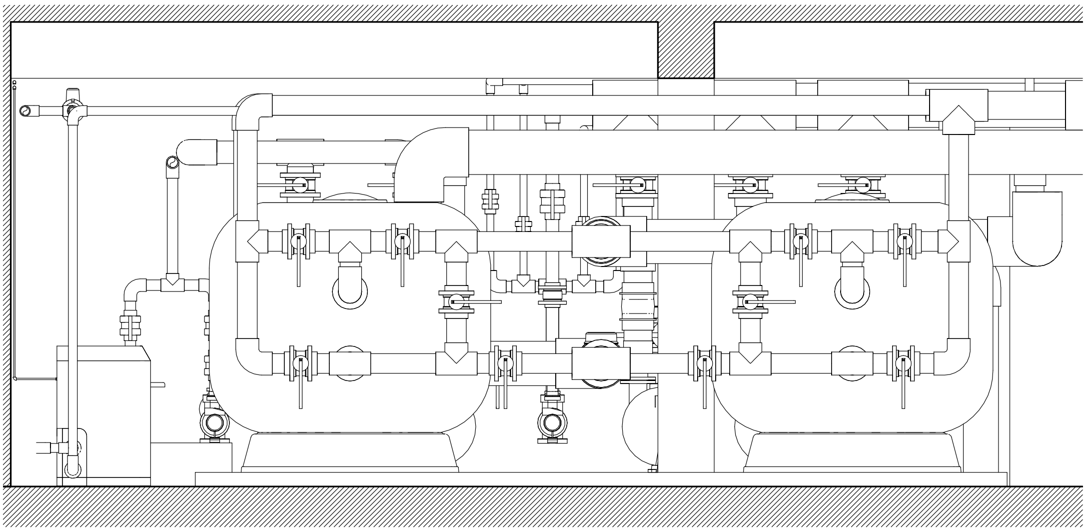
DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000

Nº PLAN	PLAN	DIN/SCALE
M10-DE	FILTRATION	A 1: 1/50 A 3: 1/100

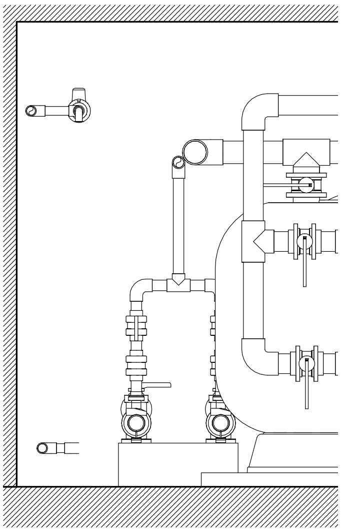
A1



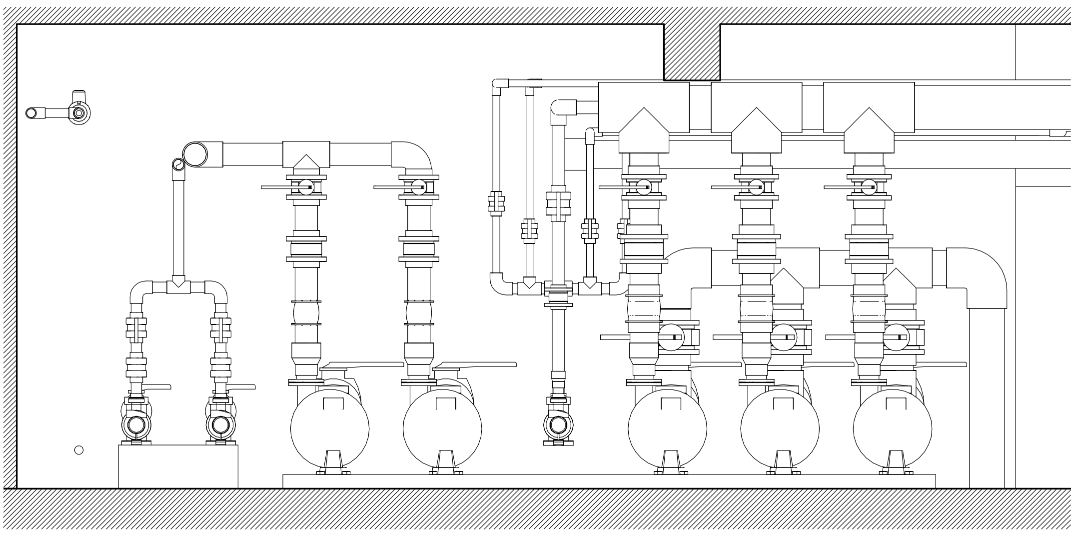
1 FILTRATION
1 : 25



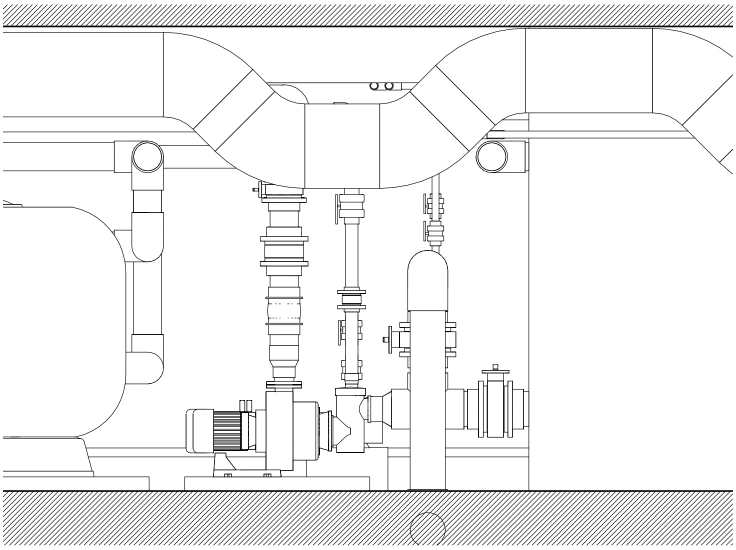
2 FILTRATION 2
1 : 25

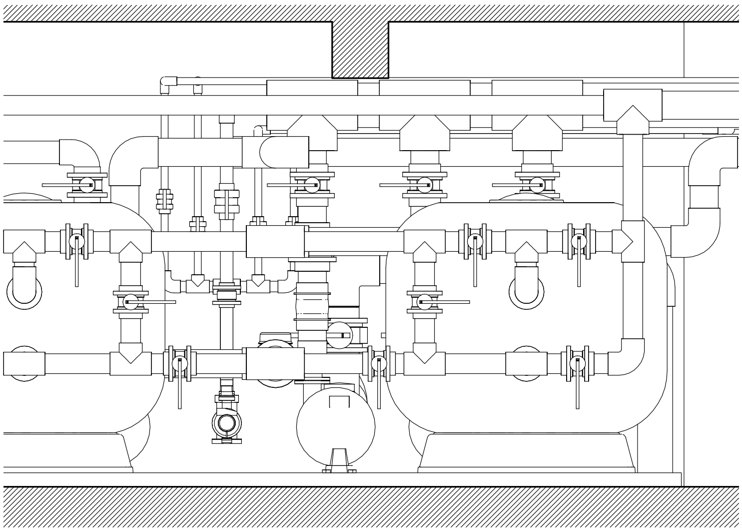


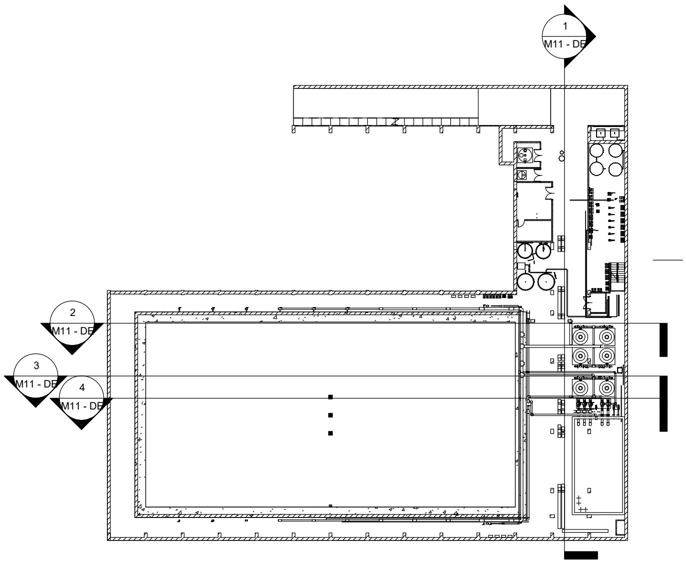
3 FILTRATION 3
1 : 25



4 FILTRATION 1
1 : 25

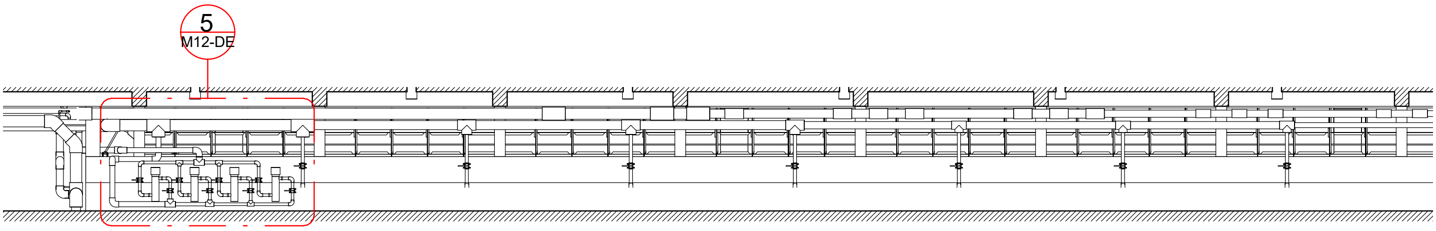






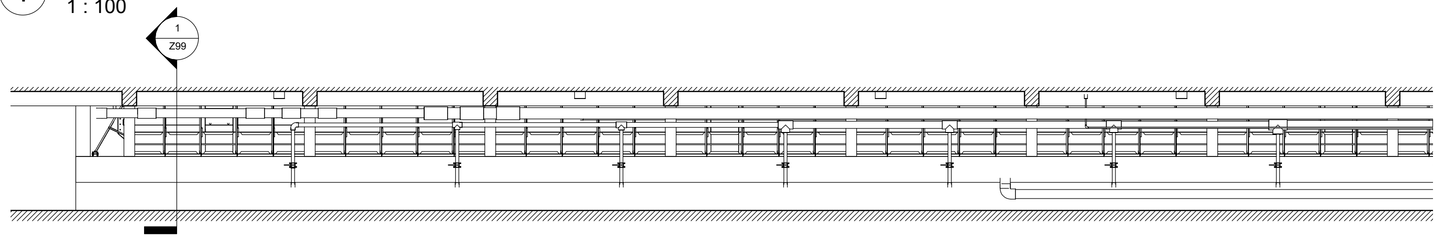
CLIENT			NORTH
REVISION			
Nº	DESCRIPTION		DATE
NOTES			
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2		Nº PROJECT 16.000
Nº PLAN M11 - DE	PLAN FILTRATION		DIN/SCALE A 1: 1/50 A 3: 1/100

A1



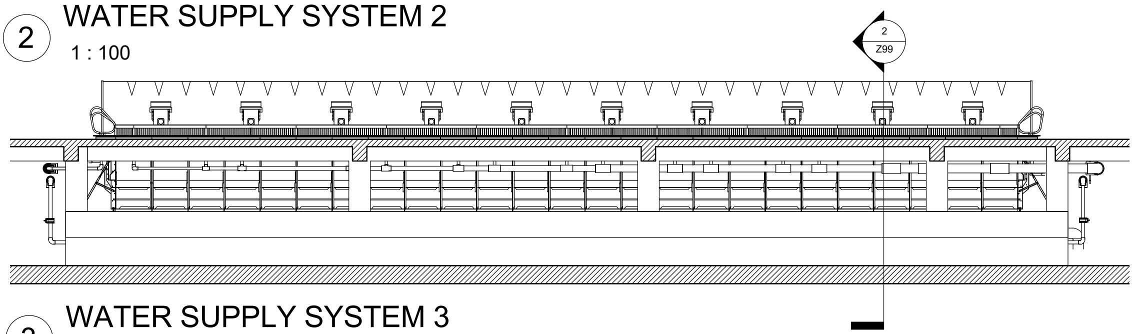
1 WATER SUPPLY SYSTEM

1 : 100



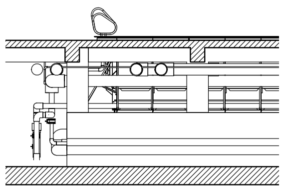
2 WATER SUPPLY SYSTEM 2

1 : 100



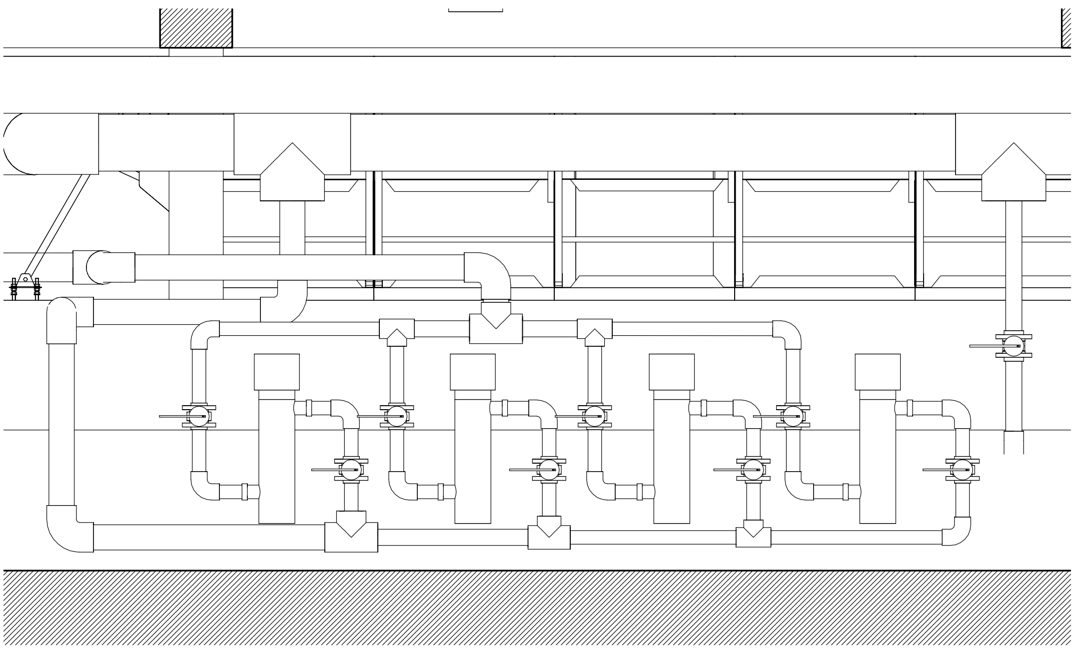
3 WATER SUPPLY SYSTEM 3

1 : 100



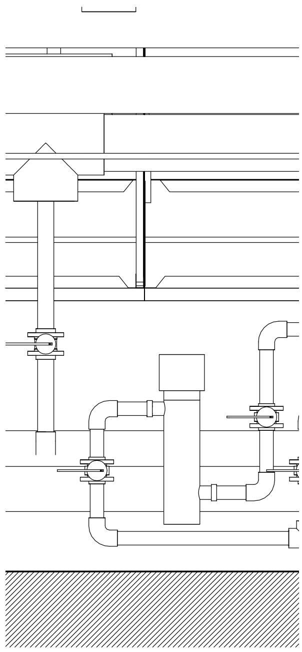
4 WATER SUPPLY

1 : 100



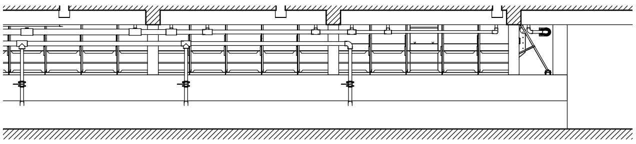
5 WATER SUPPLY SYSTEM - DETAIL 1

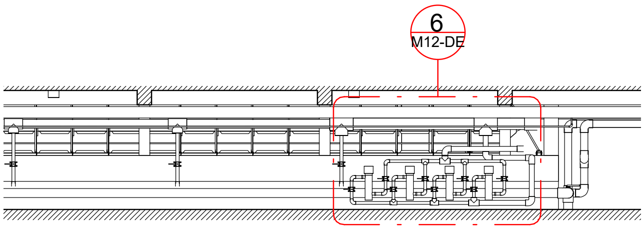
1 : 20

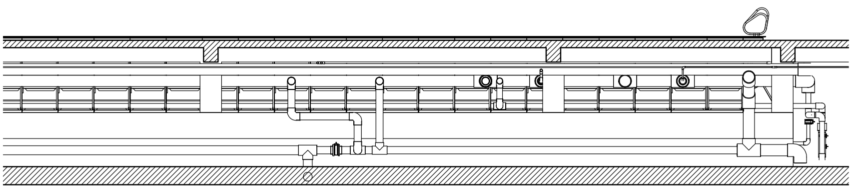


6 WATER SUPPLY

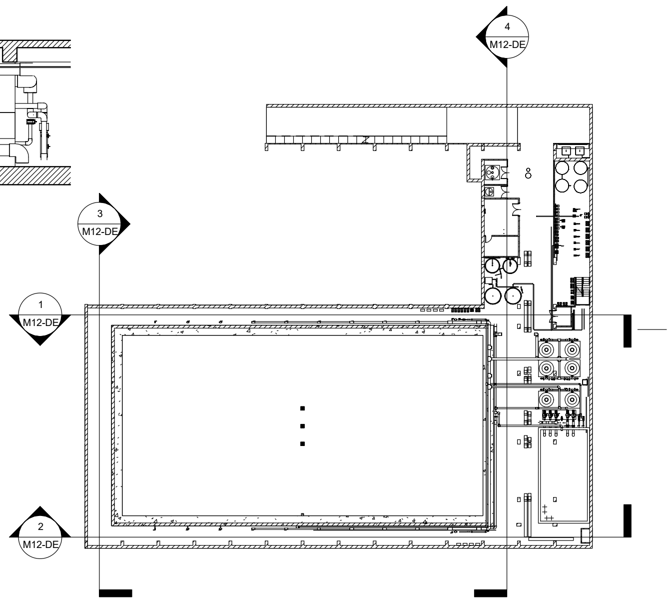
1 : 20

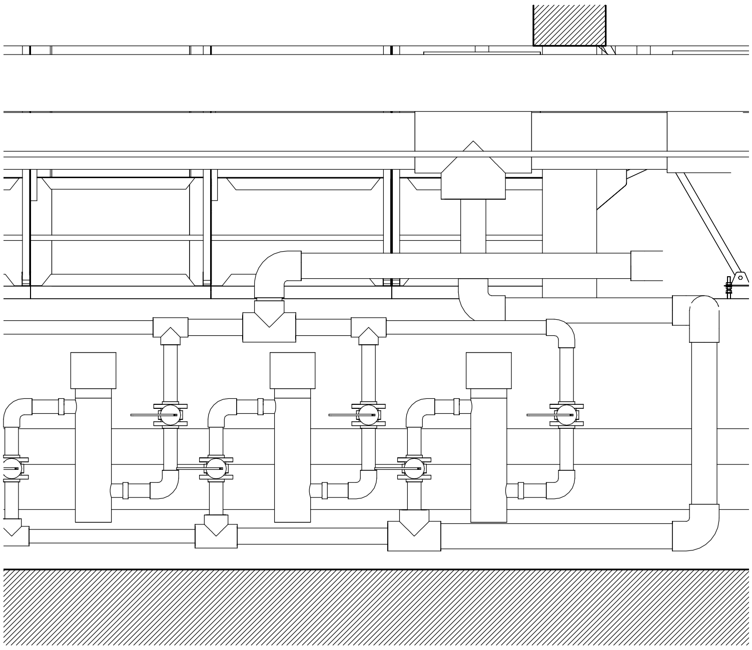






Y SYSTEM 1



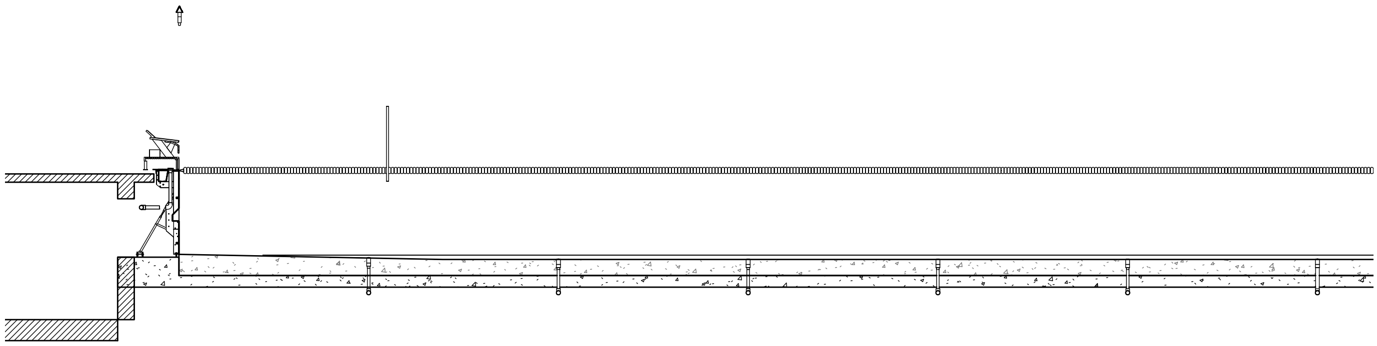


SYSTEM - DETAIL 2

CLIENT		NORTH
.		
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN M12-DE	PLAN POOL WATER 1	DIN/SCALE A 1: 1/50 A 3: 1/100

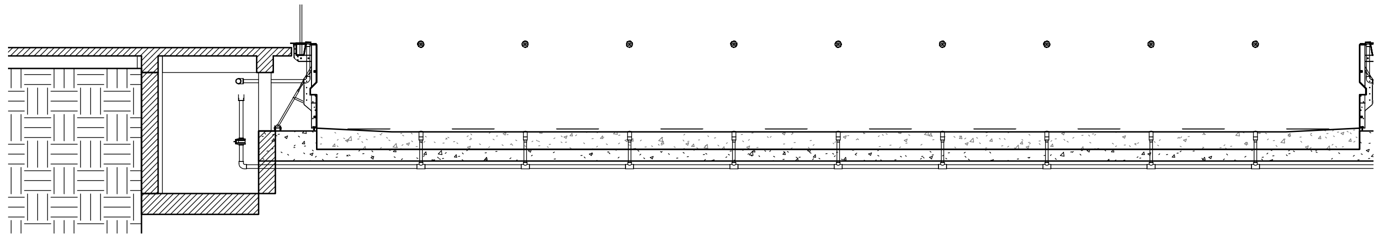
A1

UNAUTHORIZED USE FORBBIDEN



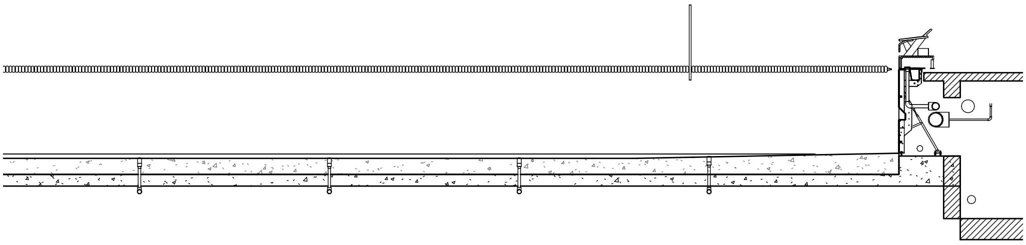
3 INLET SEC 1

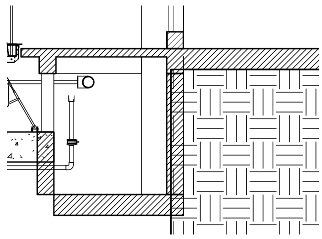
1 : 100

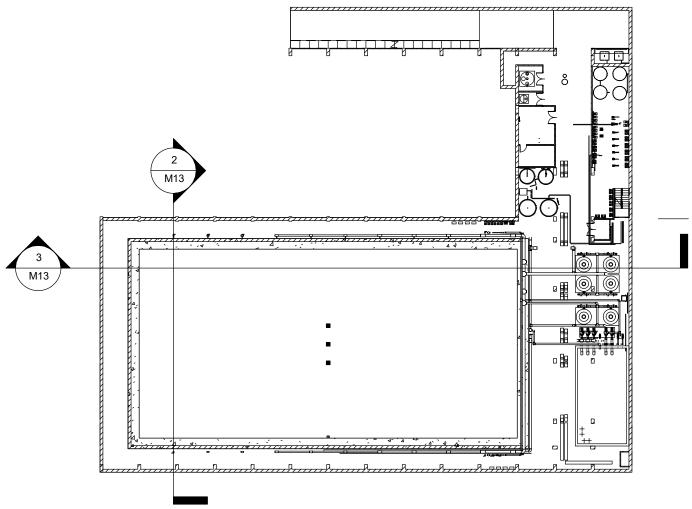


2 INLET SEC 2

1 : 100







CLIENT

NORTH

REVISION

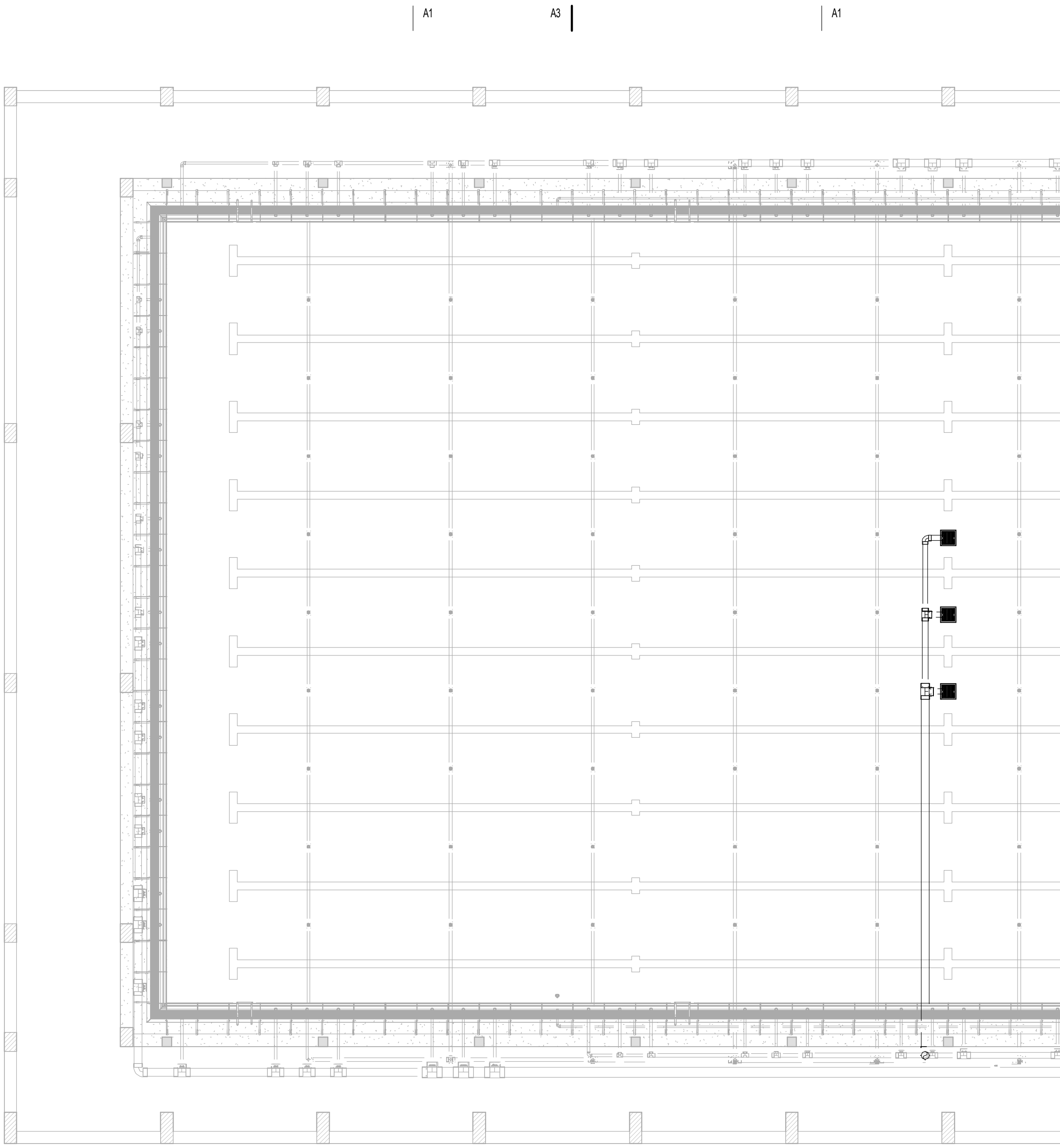
Nº	DESCRIPTION	DATE

NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
M13	INLETS	A 1: 1/50 A 3: 1/100

A1

UNAUTHORIZED USE FORBBIDEN

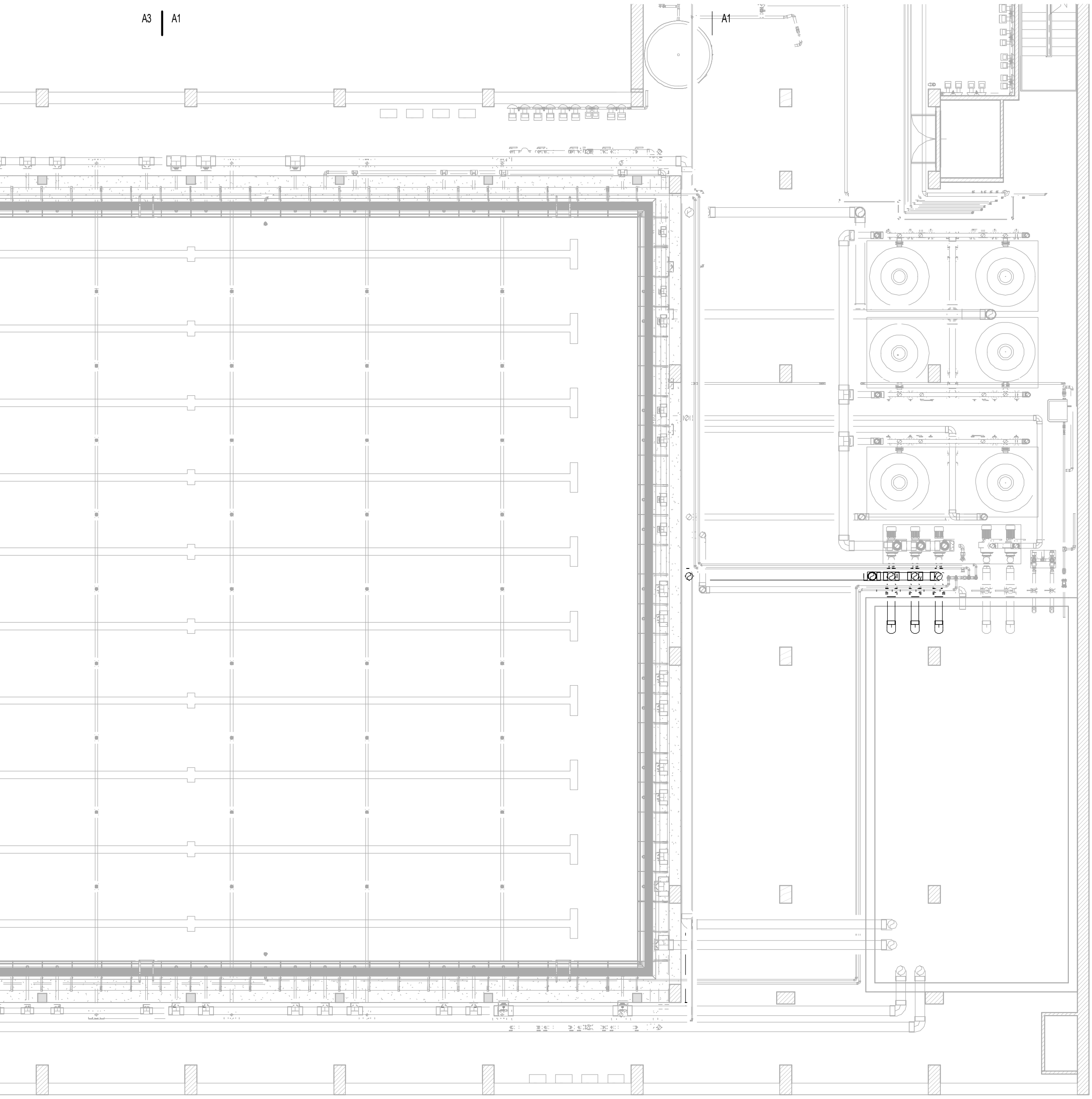


DC (mm)	NOMINAL PREASSURE			
	0.4 MPa	0.6 MPa	1.0 MPa	1.6 MPa
10	-	-	-	0.3
12	-	-	-	0.3
16	-	-	-	0.3
20	-	-	-	0.4
25	-	-	0.5	0.5
32	-	-	0.6	0.6
40	-	0.8	0.8	0.8
50	-	0.9	0.9	0.9
63	1.0	1.0	1.0	1.0
75	1.0	1.0	1.2	1.2
90	1.0	1.2	1.3	1.4
110	1.2	1.3	1.5	1.7
125	1.3	1.5	1.7	1.9
140	1.3	1.6	1.8	2.0
160	1.5	1.7	2.0	2.2
180	1.6	1.8	2.1	2.4
200	1.7	1.9	2.3	2.6
225	1.8	2.1	2.5	2.9
250	1.8	2.2	2.6	3.0
280	2.0	2.3	2.8	3.2
315	2.1	2.5	3.0	3.5
355	2.2	2.7	3.2	3.8
400	2.4	2.8	3.4	4.0
450	2.5	3.0	3.7	4.3
500	2.7	3.2	3.9	4.6

ACCORDING TO UNE 53.399

DIAMETER RELATION	
DC (mm)	DN (mm)
16	10
20	15
25	20
32	25
40	32
50	40
63	50
75	65
90	80
110	100
125	110
140	125
160	150
200	175
225	200
250	225
315	300

PIPE FITTING - PHWR-PO-01-SC			
Description	Nominal Diameter	FES_CODE	Count
45º ELBOW SOLVENT SOCKET PVC-U	225-225	01760	3
90º ELBOW PVCC-U solvent soket	150-150	01723	1
90º ELBOW PVCC-U solvent soket	225-225	01726	7
90º TEE PVCC-U solvent soket	175-175-175	01792	1
90º TEE PVCC-U solvent soket	225-225-225	01794	7
CONICAL REDUCER PVC-U solvent socket	225-150	02016	3
REDUCING BUSH PVC-U solvent socket	175-150	01934	3
REDUCING BUSH PVC-U solvent socket	225-175	01938	3



PIPE - PHWR-PO-01-SC			
Description	Nominal Diameter	Length (mm)	FES_CODE
PIPE PVC - PN10 SOLVENT SOCKET	150	4	02716
PIPE PVC - PN10 SOLVENT SOCKET	175	2	02718
PIPE PVC - PN10 SOLVENT SOCKET	225	68	02719

PIPE ACCESSORIES - PHWR-PO-01-SC			
Description	Nominal Diameter	FES_CODE	Count
BUTTERFLY VALVE SERIE PVC-U Dn225	225-225	46647	6

PLUMBING FIXTURES - PHWR-PO-01-SC		
Description	FES_CODE	Count
PREFABRICATED DRAIN Dn 110	28725	2
PREFABRICATED DRAIN Dn 110 WITH HOOK	SPECIAL DRAIN	1

CLIENT

NORTH

REVISION

Nº | DESCRIPTION | DATE

NOTES

DATE
26.10.2016

PROJECT
SWIMMING POOL 50X25X2

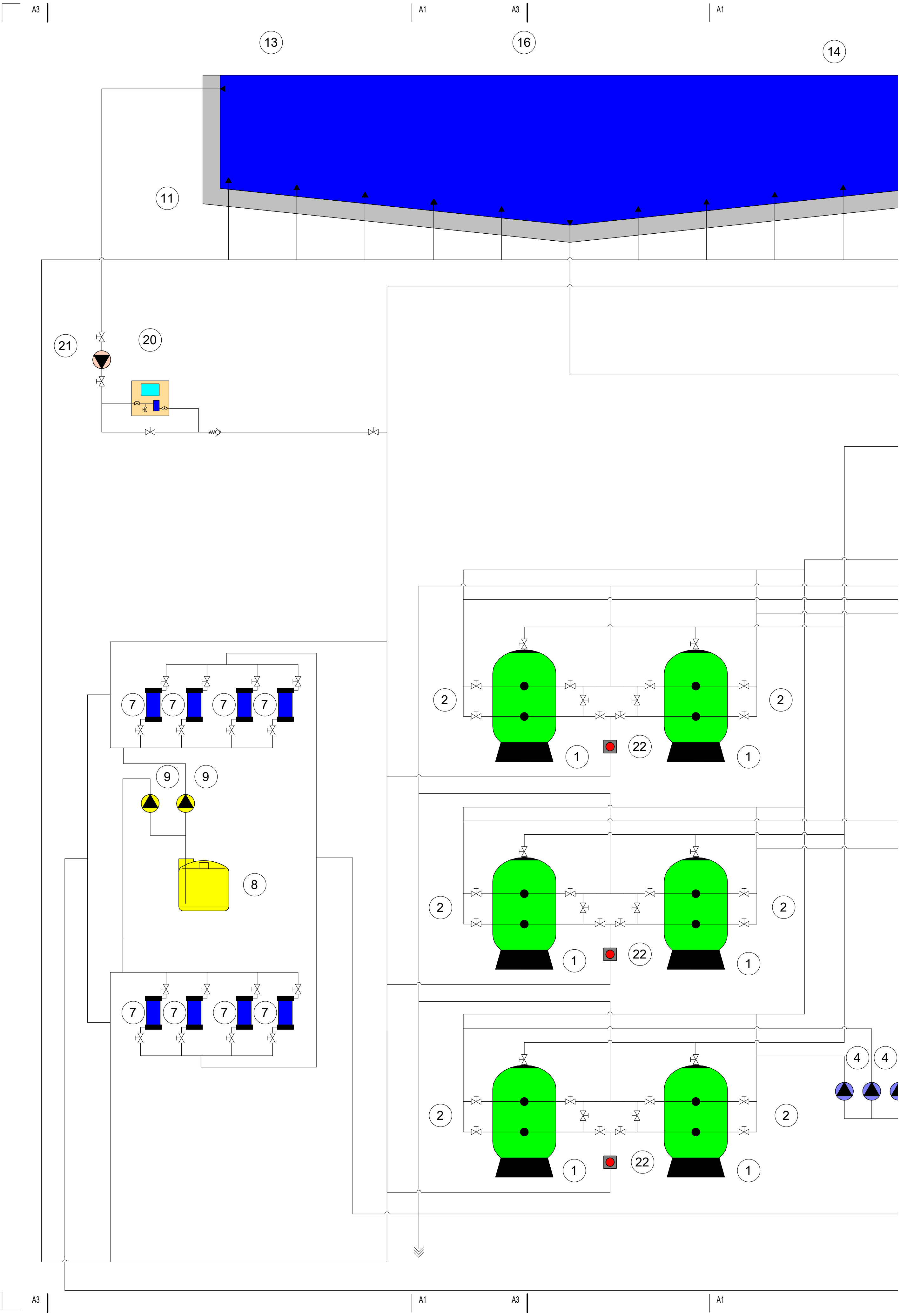
Nº PROJECT
16.000

Nº PLAN
M14

PLAN
ASPIRATION HYDRAULIC CIRCUIT

DIN/SCALE
A 1: 1/50
A 3: 1/100

A1


A3
A1
A3
A1
13
16
14
11
21
20
7
7
7
7
9
9
8
7
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7
2
2
1
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1
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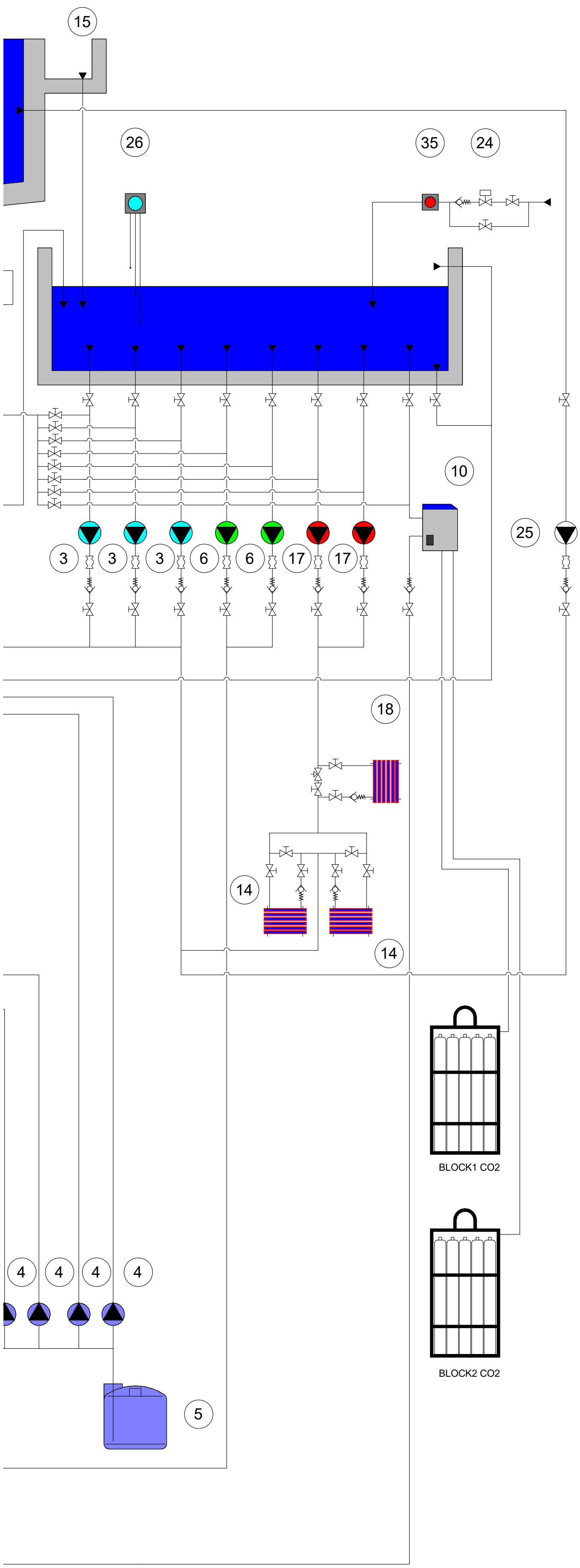
22
1
2
2
1
22
1
4
4
A3
A1
A3
A1



QUANTIFICATION P00&ID			
ID	CODE	DESCRIPTION	QUANT.
1	00706-000	Bobbin wound PRAGA filter D.2000 mm OUTLET 140 mm	6
2	00789-BS-20	Manual maifolds 5 valves Ø 140 mm (L instalation)	3
2	00789-BS-20	Manual maifolds 5 valves Ø 140 mm (R instalation)	3
3	56637	Centrifugal "KIVU" pump with prefilter (7,5 kW)	3
4	54528	Floculant dosing FLOC SYSTEM	6
5	28831	Polyethylene cylindrical tanck 1000 lts.	1
6	56634	Centrifugal "KIVU" pump with prefilter (5,5 kW)	2
7	57762	NEOLYSIS Zero Salt X UV 120g/h	8
8	09387-APQ	APQ CHLORINE TANCK 3000 lts	1
9	57135	CHLORINE DOSING PUMP 5Bar-20 lts/h	2
10	62862	GVG-Injector CO2	1
11	43588	Adjustable BCN 03 nozzle for liner pools	90
12	43590	Wall conduit D.90 mm	90
13	PX16005	Suction nozzle ANALYSIS system	1
14	PX16006	Suction inlet for prefabricated pool	4
14	ETNA-300	Water/Water plate heat exchanger 581 kW	2
15	41519	Suction nozzle for overflow pools with liner	95
16	28725	Drain in polyester and fibreglass 515 mm X 515 mm D.160 mm	3
17	LOBARA 3kW	Centrifugal pump with prefilter (3 kW)	2
18	ETNA-200	Plate HEAT EXCHANGER 200 kW (solar system)	1
20	54525	Smart Control pH/ORP/Cl2 p.p.m./ºC	1
21	UPA15-120-024	Recirculation analysis pump	1
22	20436	Woltman type turbine meters 8"	3
24	05372	PVC ball electric actuation & BSR safely block 2.5"	1
25	38780	Centrifugal pump with prefilter (2 kW)	1
26	12062	Water level control pannel	1
35	20431	Woltman type turbine meters 2.5"	1

SYMBOLS

- VIBRATION ABSORBENT
- NEEDLE VALVE
- CHECK VALVE
- MANUAL VALVE

CLIENT

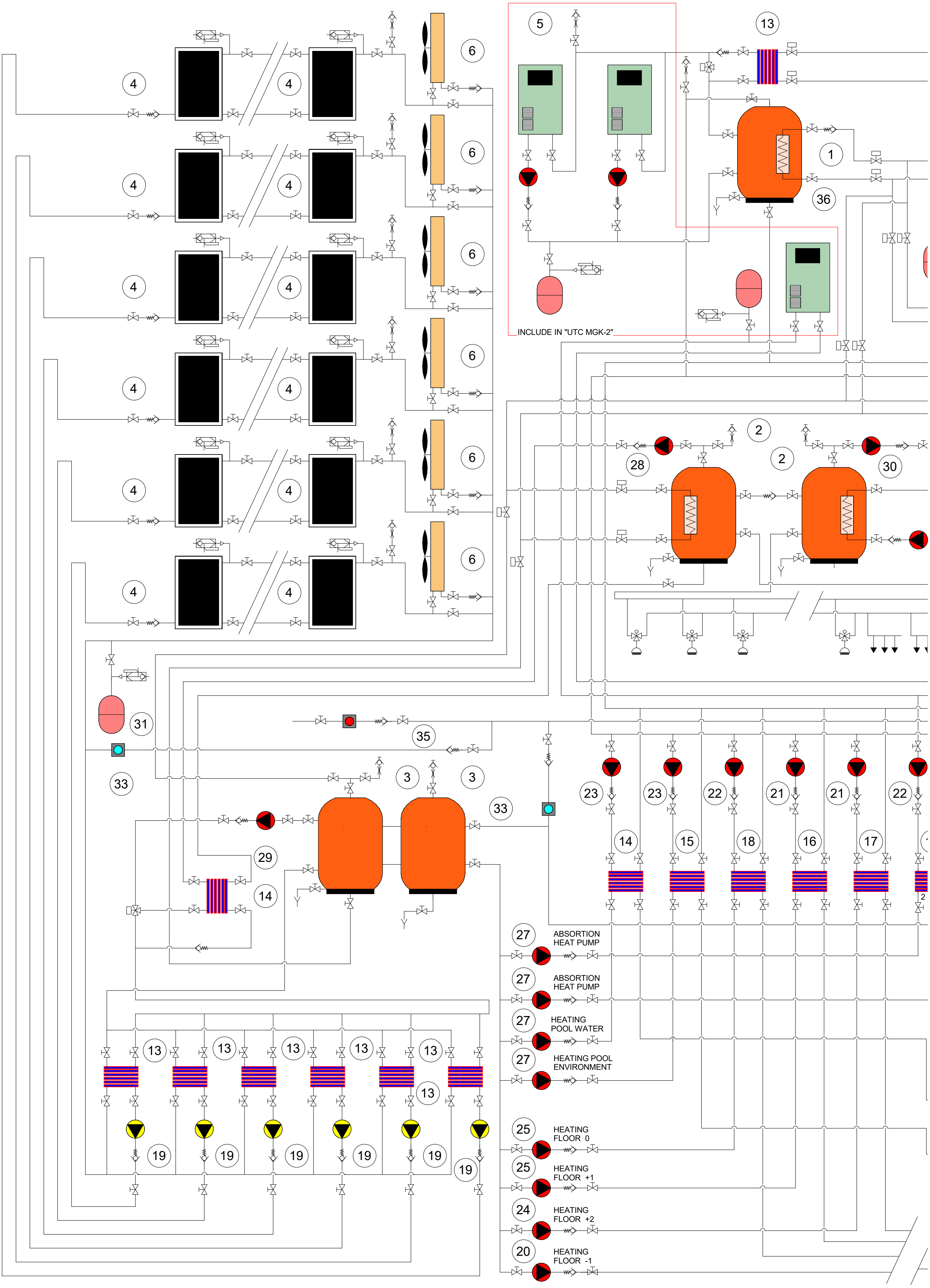
NORTH

REVISION

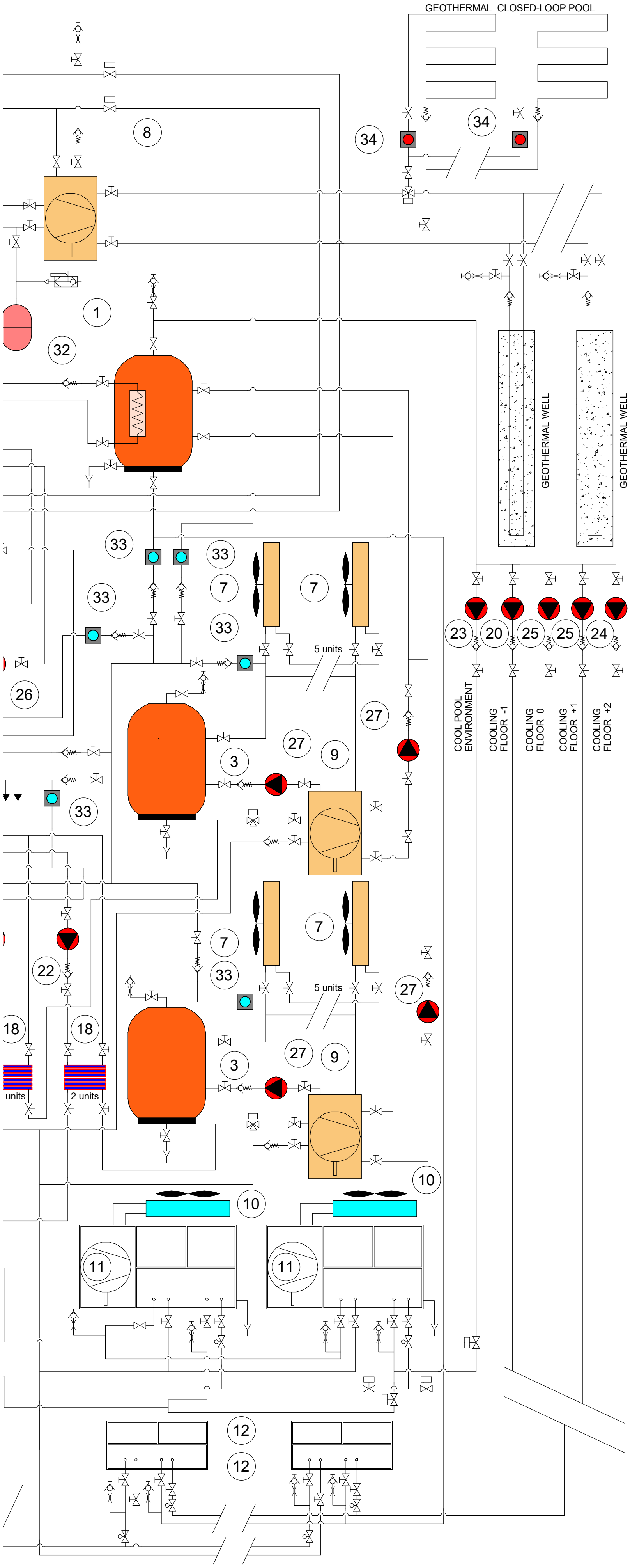
Nº	DESCRIPTION	DATE

NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
P00-P&ID	POOL WATER TREATMENT DIAGRAM	A 1: 1/50 A 3: 1/100


INCLUDE IN "UTC MGK-2"
ABSORTION HEAT PUMP
ABSORTION HEAT PUMP
HEATING POOL WATER
HEATING POOL ENVIRONMENT
HEATING FLOOR 0
HEATING FLOOR +1
HEATING FLOOR +2
HEATING FLOOR -1

A1



QUANTIFICATION P01&ID

ID	CODE	DESCRIPTION	QUANT.
1	MVV-5000-SB	Accumulation tank 5.000 lts	2
2	MVV-2500-SB	Accumulation tank 2.500 lts	2
3	SPU-2-5000	Accumulation tank 4.950 lts	4
4	CFK-1	Solar thermal collector 2.099 x 1.099 x 110	288
5	120.20.203	Thermal unit gas condensing boiler UTC MGK-2	1
6	LH 100/2	Air heater 72 kW	6
7	LH 100/3	Air heater 120 kW	10
8	MEGA XL-21	Ground source heat pump 88 kW	1
9	BDH8X95/100-45/40-10/15-20-R1	Absortion heat pump 98 kW	2
10	CDS-140	COMPISA condenser 140 l/h	2
11	BDP-140+F	COMPISA BDP dehumidifying unit	2
12	TDA-HP4-12	Air conditioning unit 1.9 kW	4
12	TDA-HP4-16	Air conditioning unit 2.4 kW	6
12	TDA-HP4-25	Air conditioning unit 3.1 kW	2
12	TDA-HP4-43	Air conditioning unit 4.2 kW	4
12	TDA-HP4-54	Air conditioning unit 8.4 kW	5
12	TDA-HP4-68	Air conditioning unit 10.9 kW	5
13	ETNA-90	Water/Water plate heat exchanger 105 kW	7
14	ETNA-500	Water/Water plate heat exchanger 581 kW	2
15	ETNA-580	Water/Water plate heat exchanger 675 kW	1
16	65539	Water/Water heat exchanger 105 kW	3
17	41426	Water/Water heat exchanger 20 kW	1
18	65541	Water/Water heat exchanger 210 kW	3
19	TPED-40 160/4	Heating recirculation pump 1.1 kW	6
20	TPED-32 40/4	Heating recirculation pump 0.25 kW	2
21		Heating recirculation pump 0.37 kW	2
22	TPED-32 120/4	Heating recirculation pump 0.55 kW	3
23	TPED-40 130/4	Heating recirculation pump 0.75 kW	3
24		Heating recirculation pump 1.1 kW	2
25	TPED-50 130/4	Heating recirculation pump 1.1 kW	4
26	TPED-65 60/4	Heating recirculation pump 0.55 kW	1
27	TPED-65 130/4	Heating recirculation pump 1.5 kW	12
28	TPED-80 90/4	Heating recirculation pump 2.2 kW	1
29	TPED-80 150/4	Heating recirculation pump 1.1 kW	1
30	TPED-40 80/4	Heating recirculation pump 0.25 kW	1
31	24.83.715	Expantion tank 1000 lts	1
32	24.00.458	Expantion tank 50 lts	1
33	24.84.442	Automatic filling station with disconnector	8
34	K1J-A15I	Automatic regulation flow rate 1/2"	40
35	20430	Woltman type turbine meters 2.5"	1
36	VG 3.290-D	Bolier water superheated	1

SAFETY VALVE
AUTOMATIC VALVE
PURGE VALVE
CHECK VALVE
MANUAL VALVE
WATER FLOW REGULATION VALVE
THREE WAY VALVE
FAUCETS
SHOWERS
THERMOSTATIC MIXING VALVE

CLIENT

NORTH

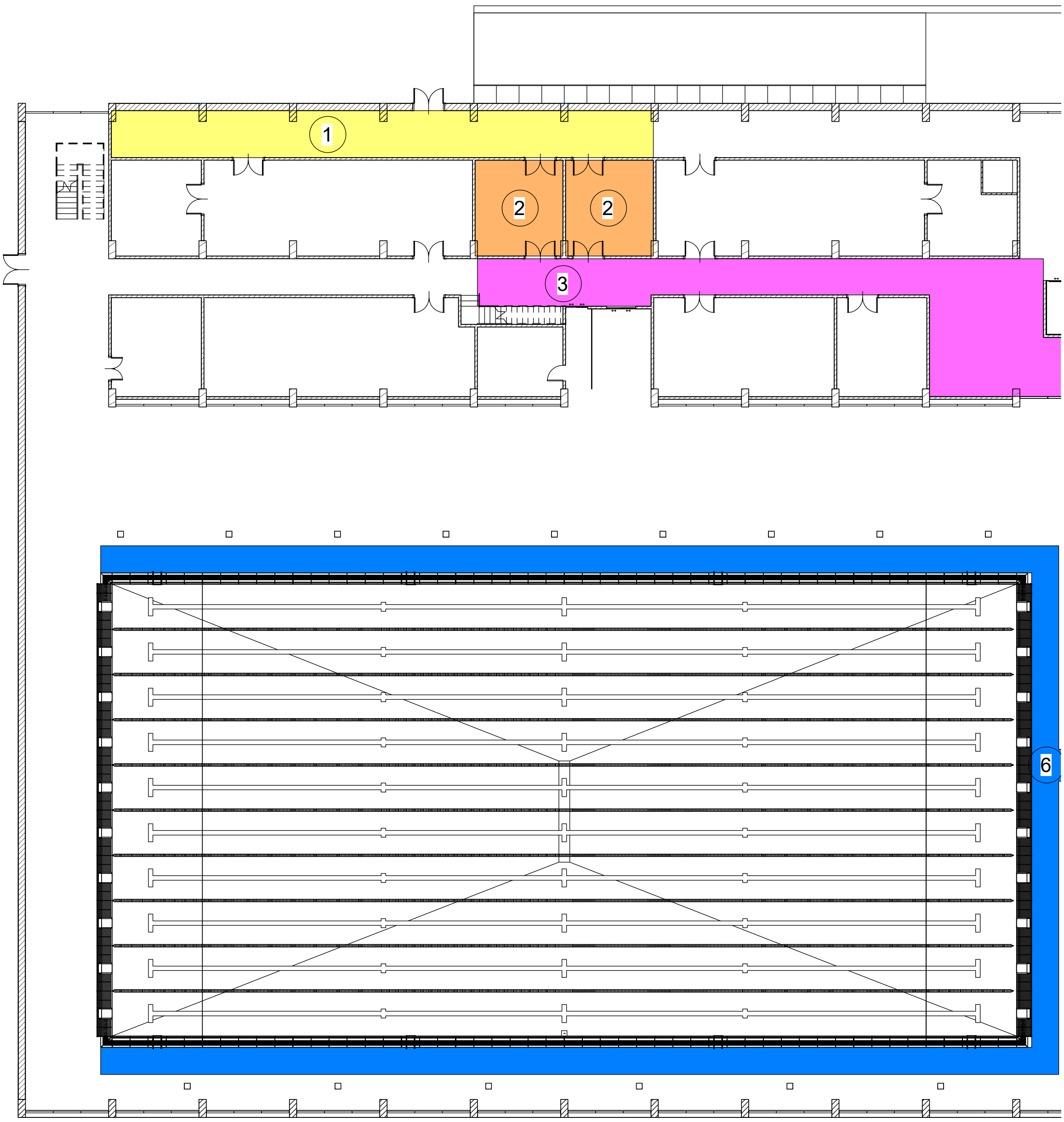
REVISION
Nº | DESCRIPTION | DATE

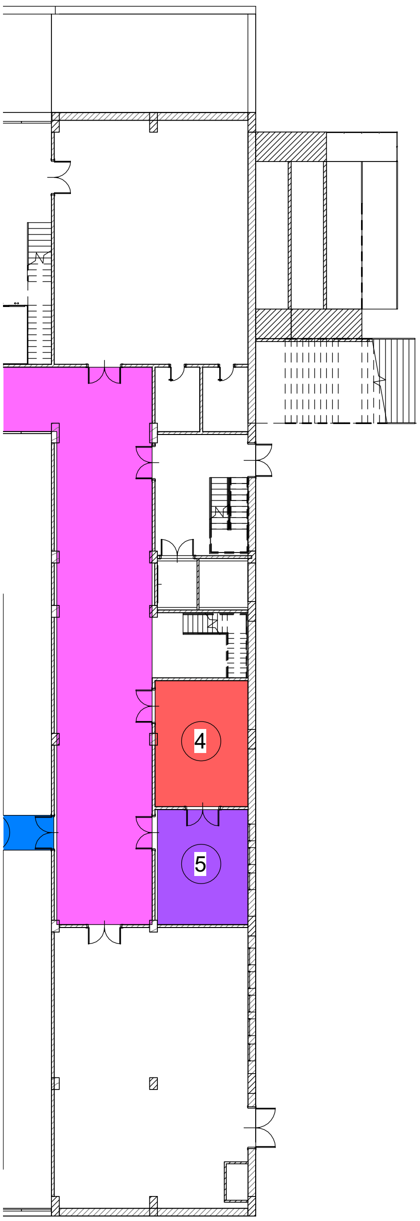
NOTES

DATE: 26.10.2016
PROJECT: SWIMMING POOL 50X25X2
Nº PROJECT: 16.000

Nº PLAN: P01-P&D
PLAN: HEATING DIAGRAM
DIN/SCALE: A 1: 1/50, A 3: 1/100

A1


1
2
2
3
6



PATH JUDGES	
SEQUENCE	ROOM
1	LATERAL CORRIDOR
2	JUDGES LOCKER ROOM
3	INTERMEDIATE CORRIDOR
4	ATHLETES PREPARATION ROOM 01
5	ATHLETES PREPARATION ROOM 02
6	POOL DECK

CLIENT

NORTH

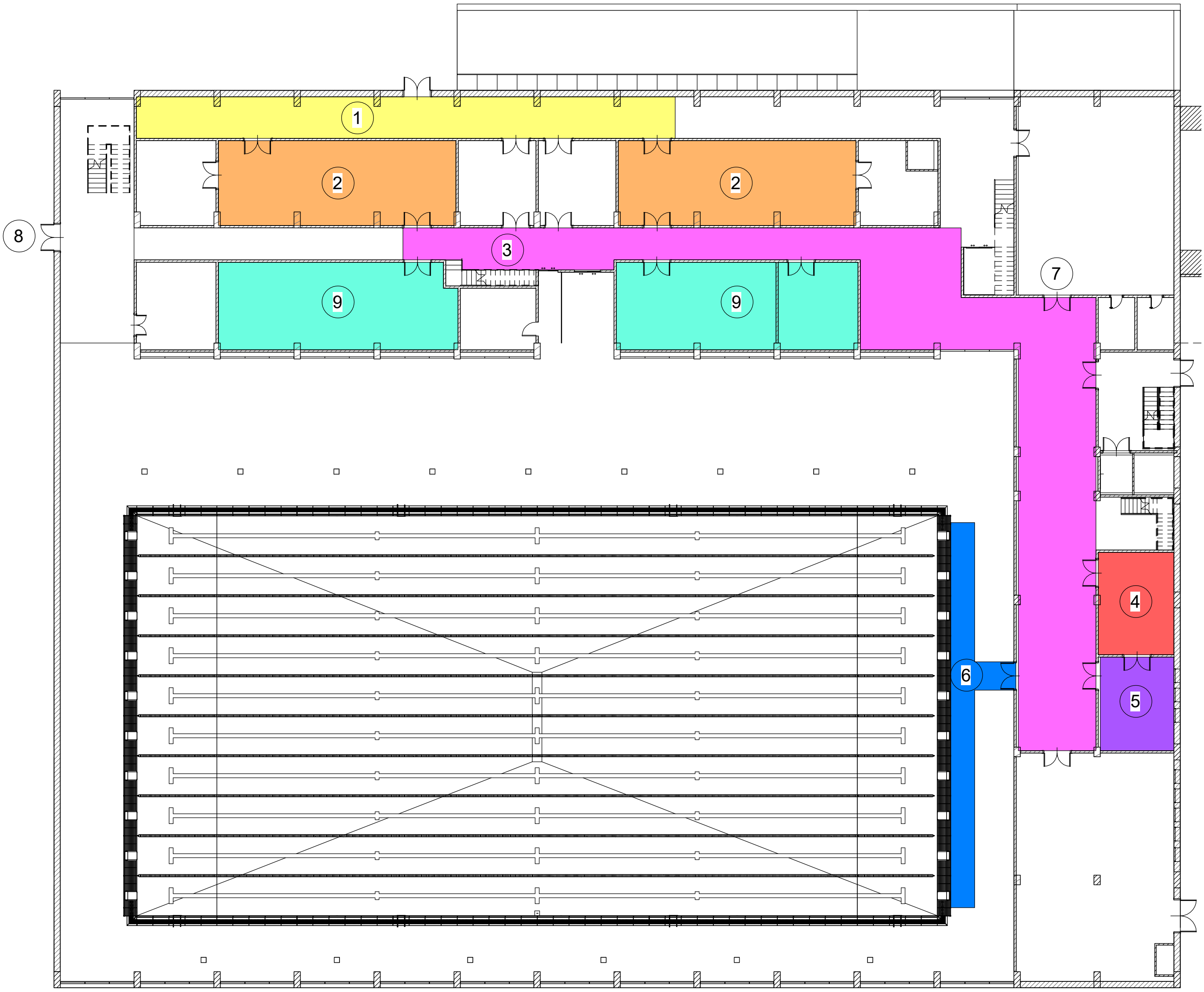
REVISION

Nº	DESCRIPTION	DATE

NOTES

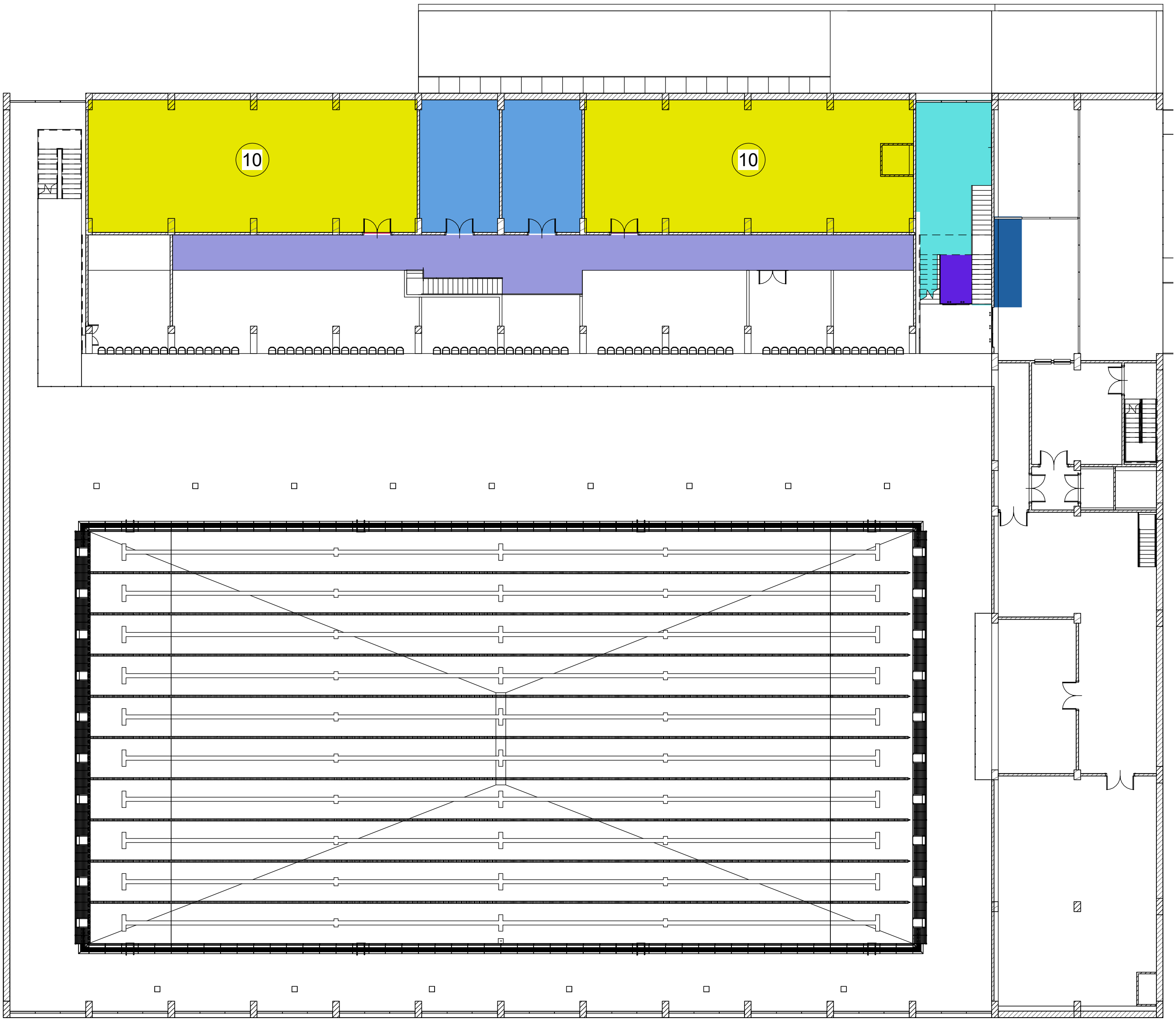
DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
PA01	JUDGES PATH	A 1: 1/50 A 3: 1/100

A1



1 GROUND FLOOR ATHLETES PATH

1 : 200



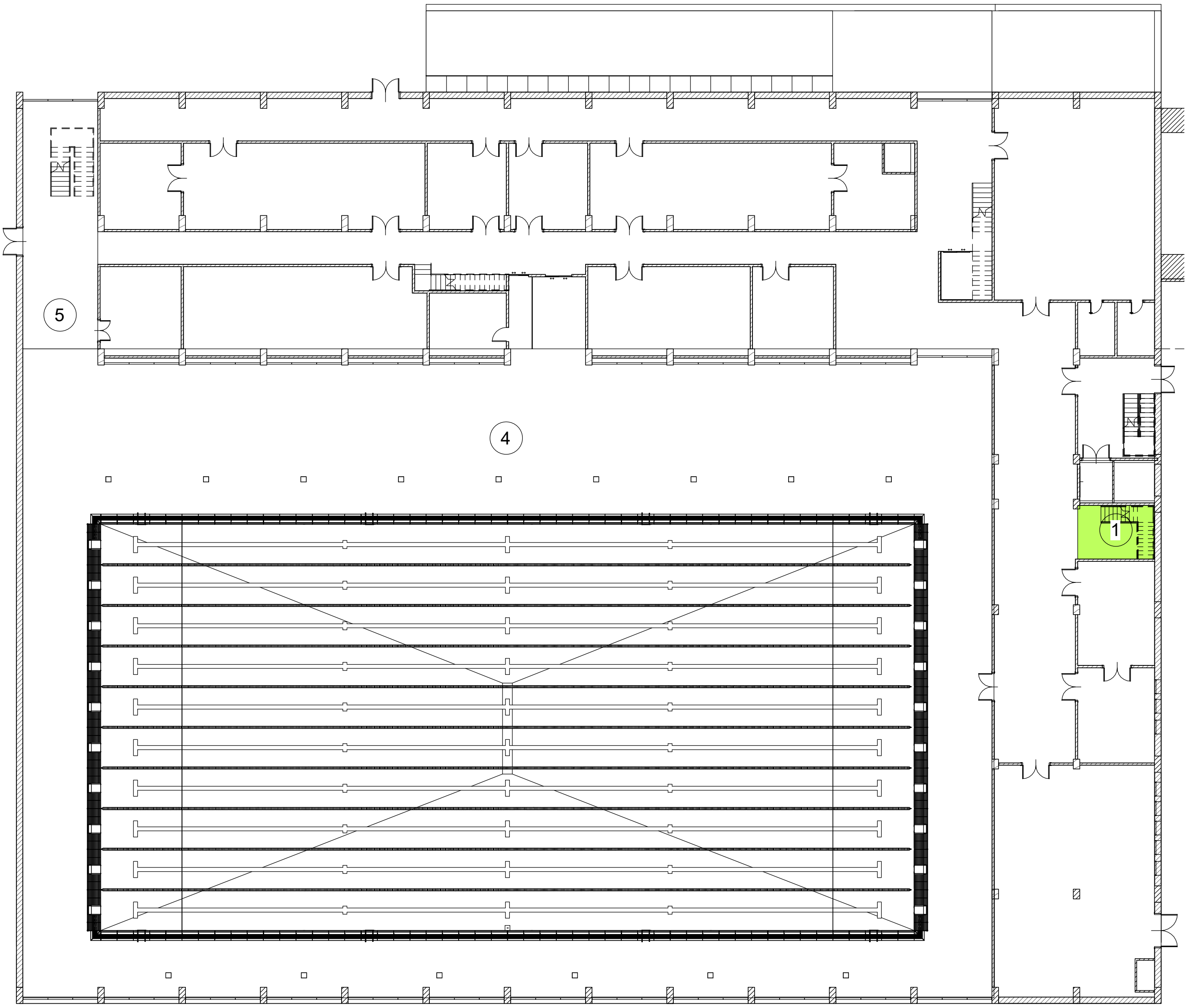
2 FIRST FLOOR ATHLETES PATH

1 : 200

CLIENT		NORTH
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN PA02	PLAN ATHLETES PATH	DIN/SCALE A 1: 1/50 A 3: 1/100

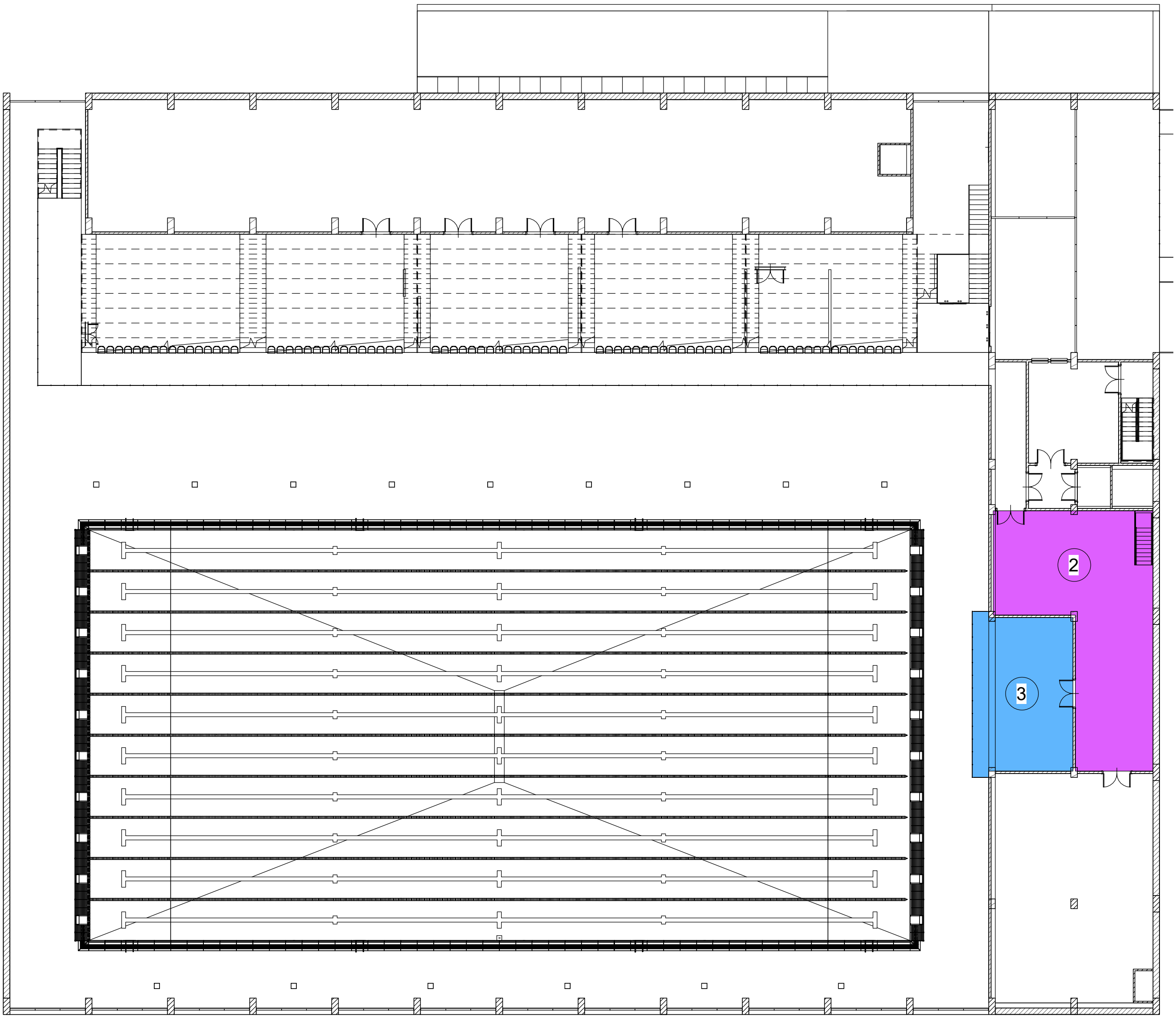
PATH ATHLETES	
SEQUENCE	ROOM
1	LATERAL CORRIDOR
2	LOCKER ROOM
3	INTERMEDIATE CORRIDOR
4	ATHLETES PREPARATION ROOM 01
5	ATHLETES PREPARATION ROOM 02
6	POOL DECK
7	PRESS ROOM
8	WARM UP
9	MASSAGES & TREATMENTS
10	GYM

A1



1 GROUND FLOOR AWARD CEREMONY PATH

1 : 200



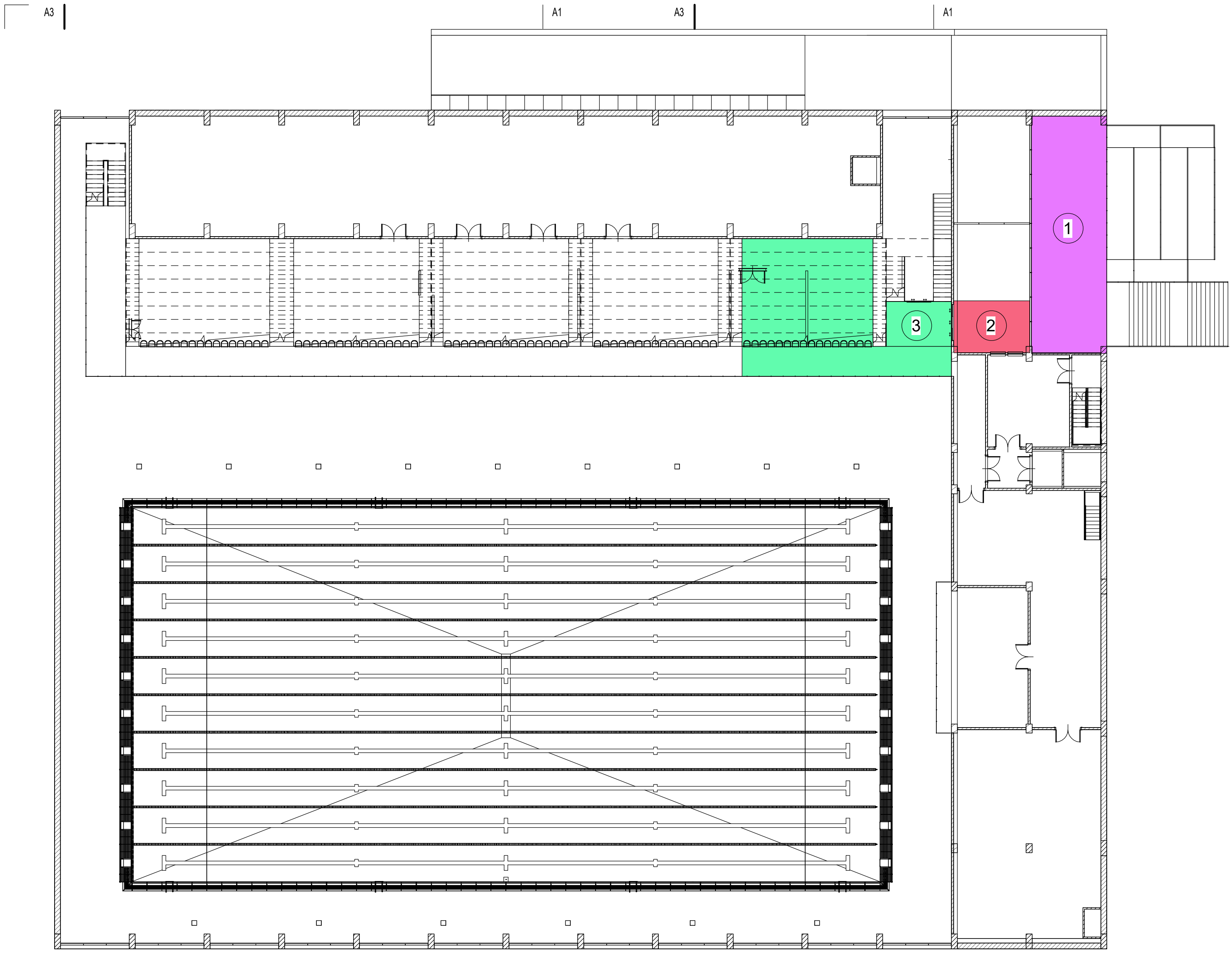
2 FIRST FLOOR AWARD CEREMONY PATH

1 : 200

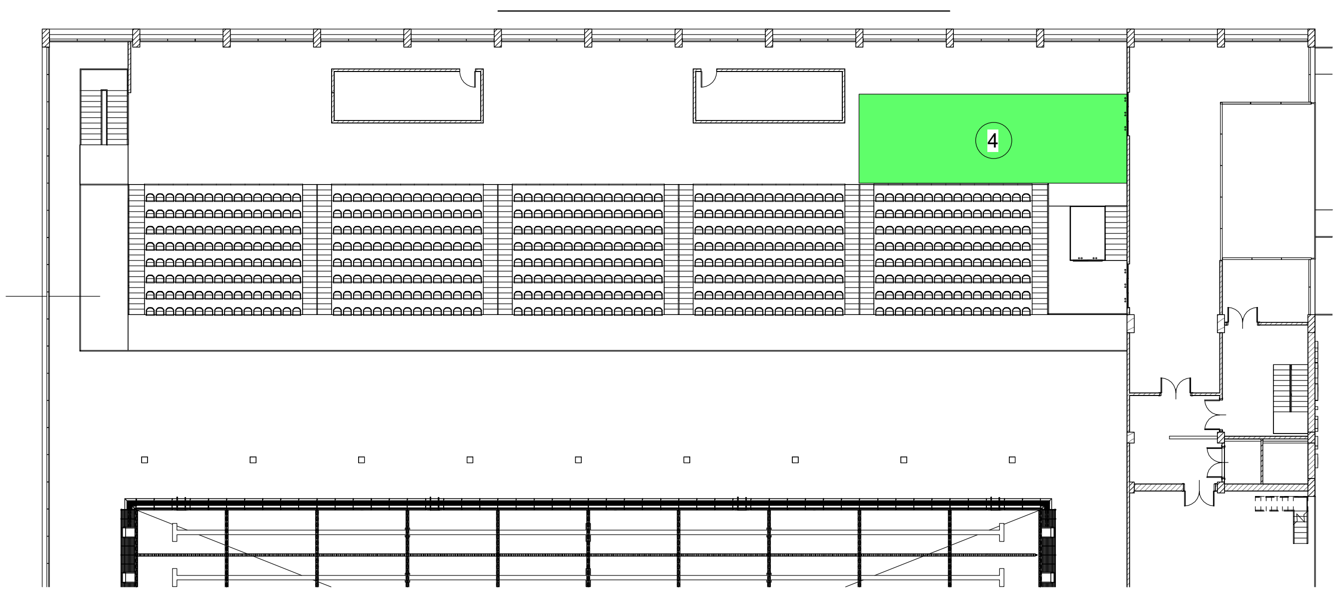
PATH AWARDS CEREMONY	
SEQUENCE	ROOM
1	STAIRS
2	MIXED ZONE
3	PODIUM
4	HONOR ROUND
5	OPPOSITE CORRIDOR

CLIENT		NORTH
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN PA03	PLAN AWARDS CEREMONY PATH	DIN/SCALE A 1: 1/50 A 3: 1/100

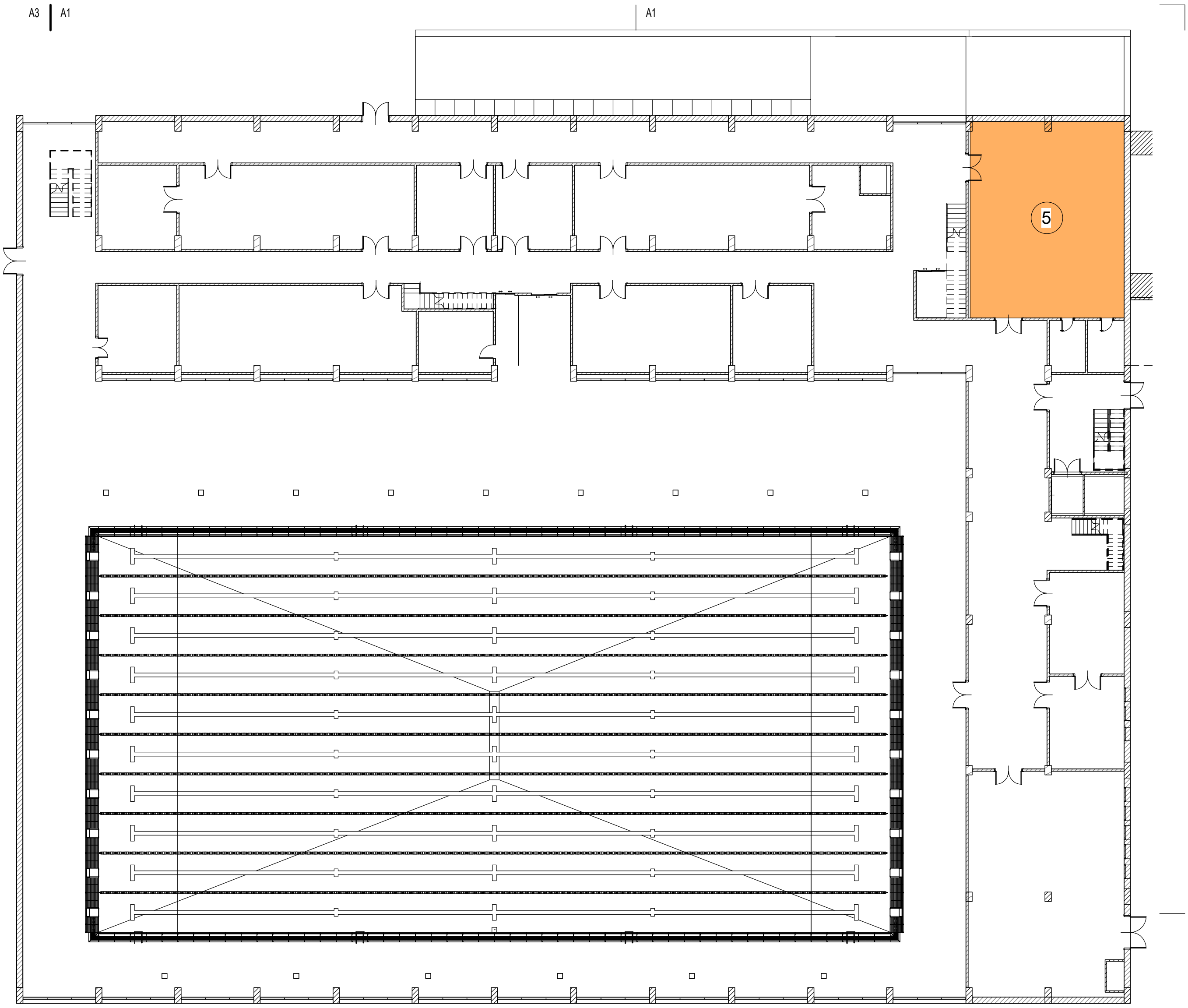
A1



1 FIRST FLOOR PRESS PATH
1 : 200



3 SECOND FLOOR PRESS PATH
1 : 200



2 GROUND FLOOR PRESS PATH

1 : 200

PATH PRESS	
SEQUENCE	ROOM
1	OPEN HALL
2	ENTRANCE
3	GRADES
4	CAFERETIA
5	PRESS ROOM

CLIENT

NORTH

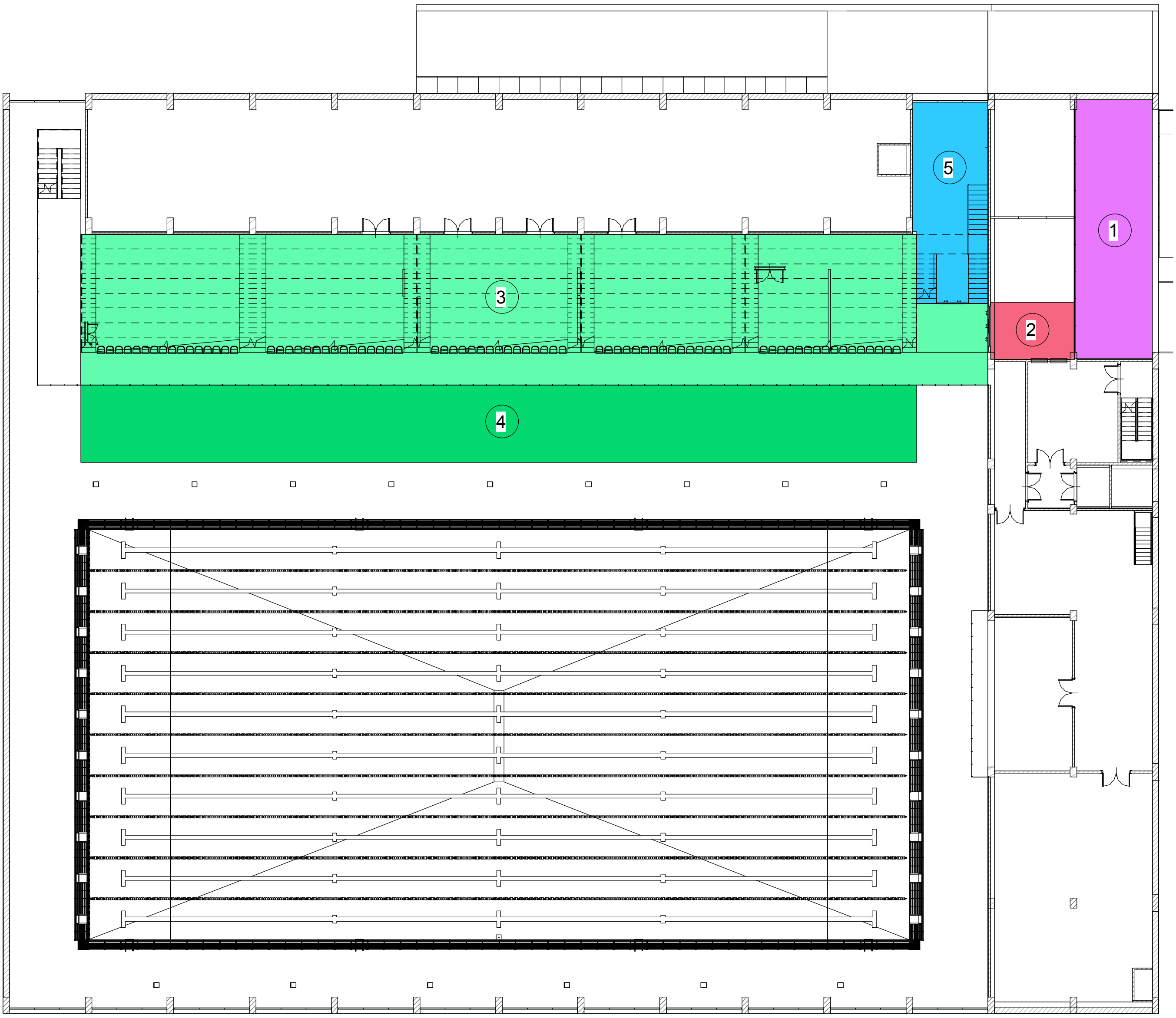
REVISION

Nº | DESCRIPTION | DATE

NOTES

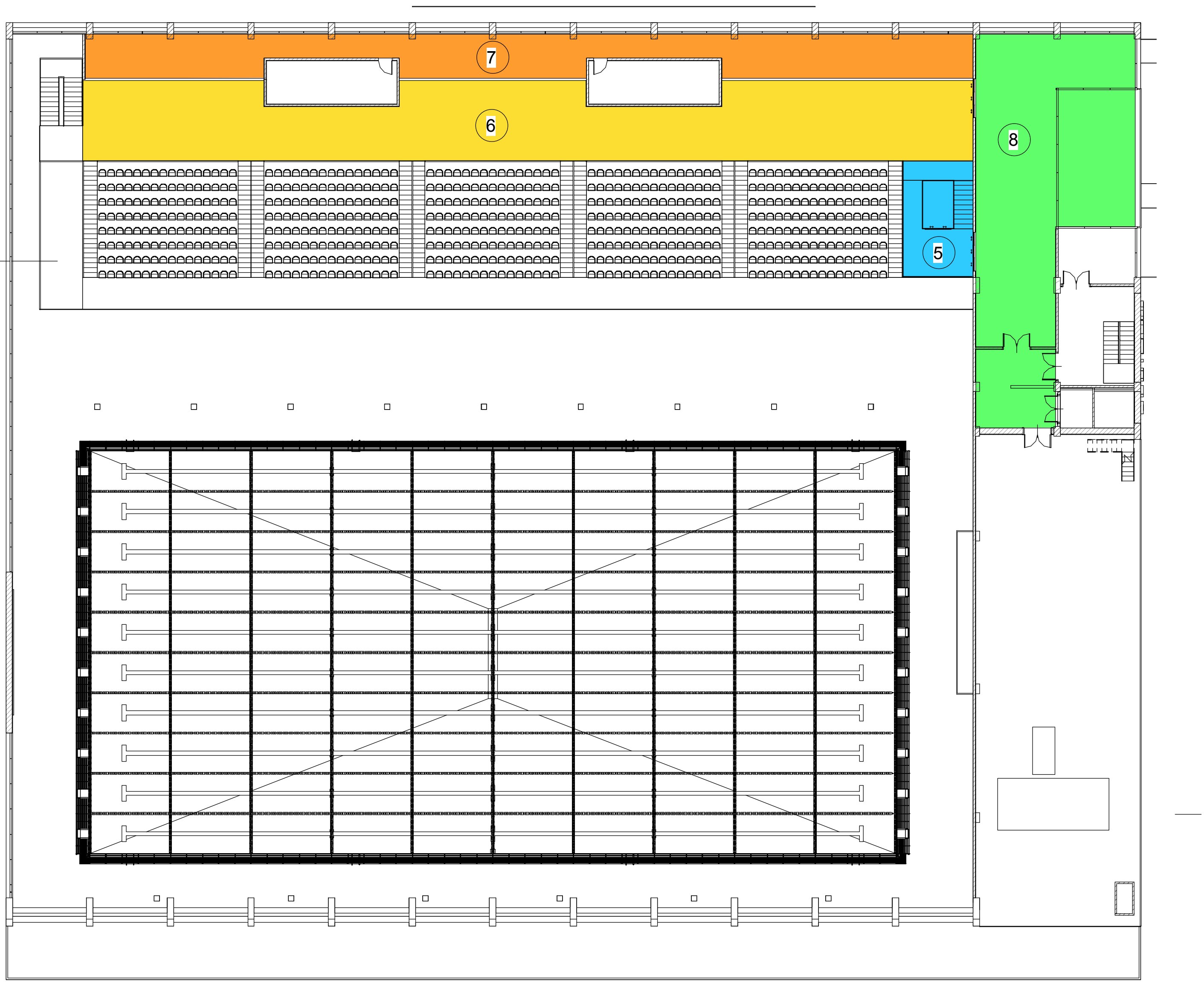
DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	PLAN	DIN/SCALE
PA04	PRESS PATH	A 1: 1/50 A 3: 1/100

A1



1 FIRST FLOOR SPECTATORS PATH

1 : 200



2 SECOND FLOOR SPECTATORS PATH

1 : 200

PATH SPECTATORS	
SEQUENCE	ROOM
1	OPEN HALL
2	ENTRANCE
3	GRADES
4	RETRACTABLE GRADES
5	STAIRS & LIFT
6	CORRIDOR
7	SHOWROOM
8	CAFERETIA

CLIENT

NORTH

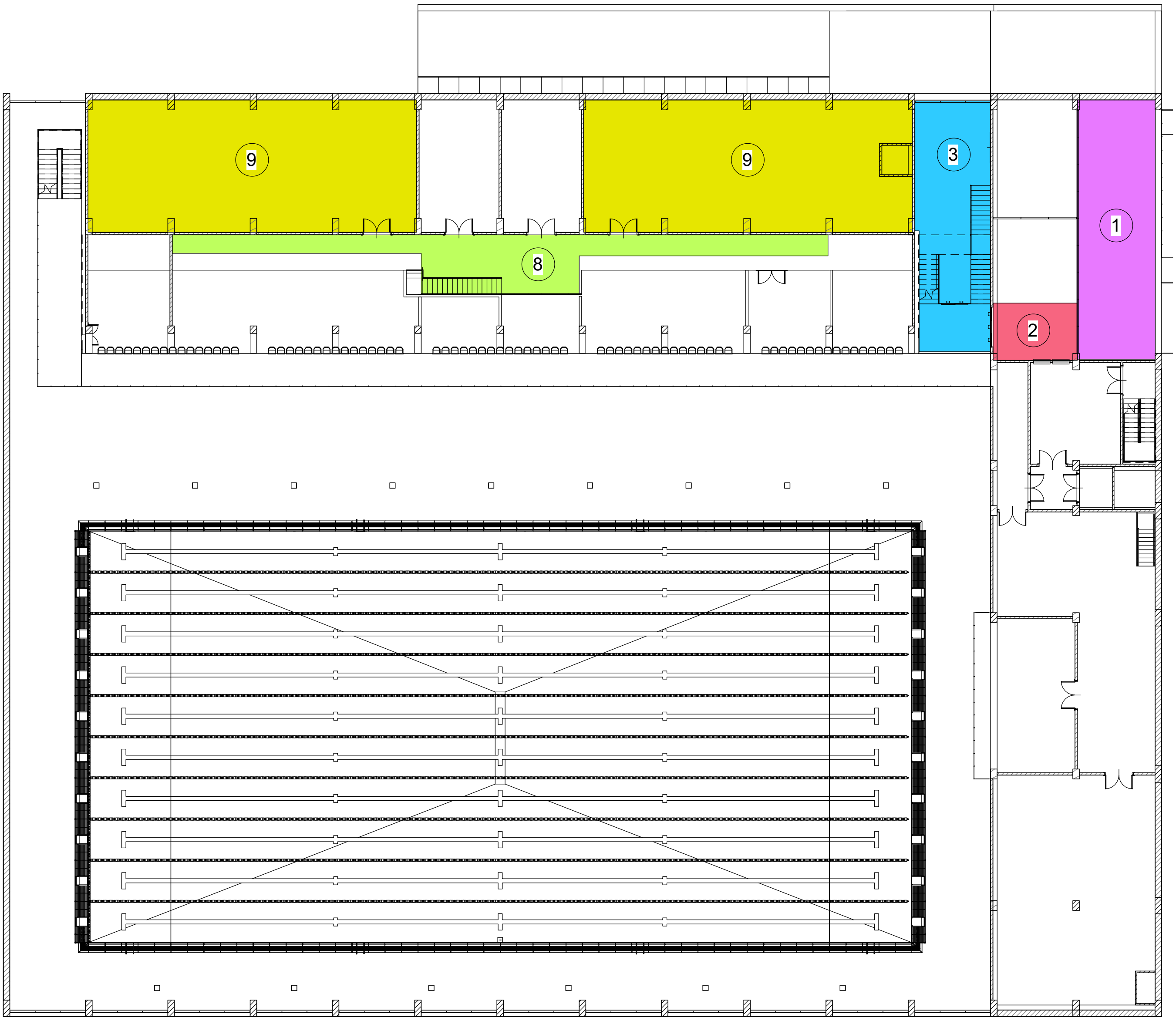
REVISION

Nº	DESCRIPTION	DATE

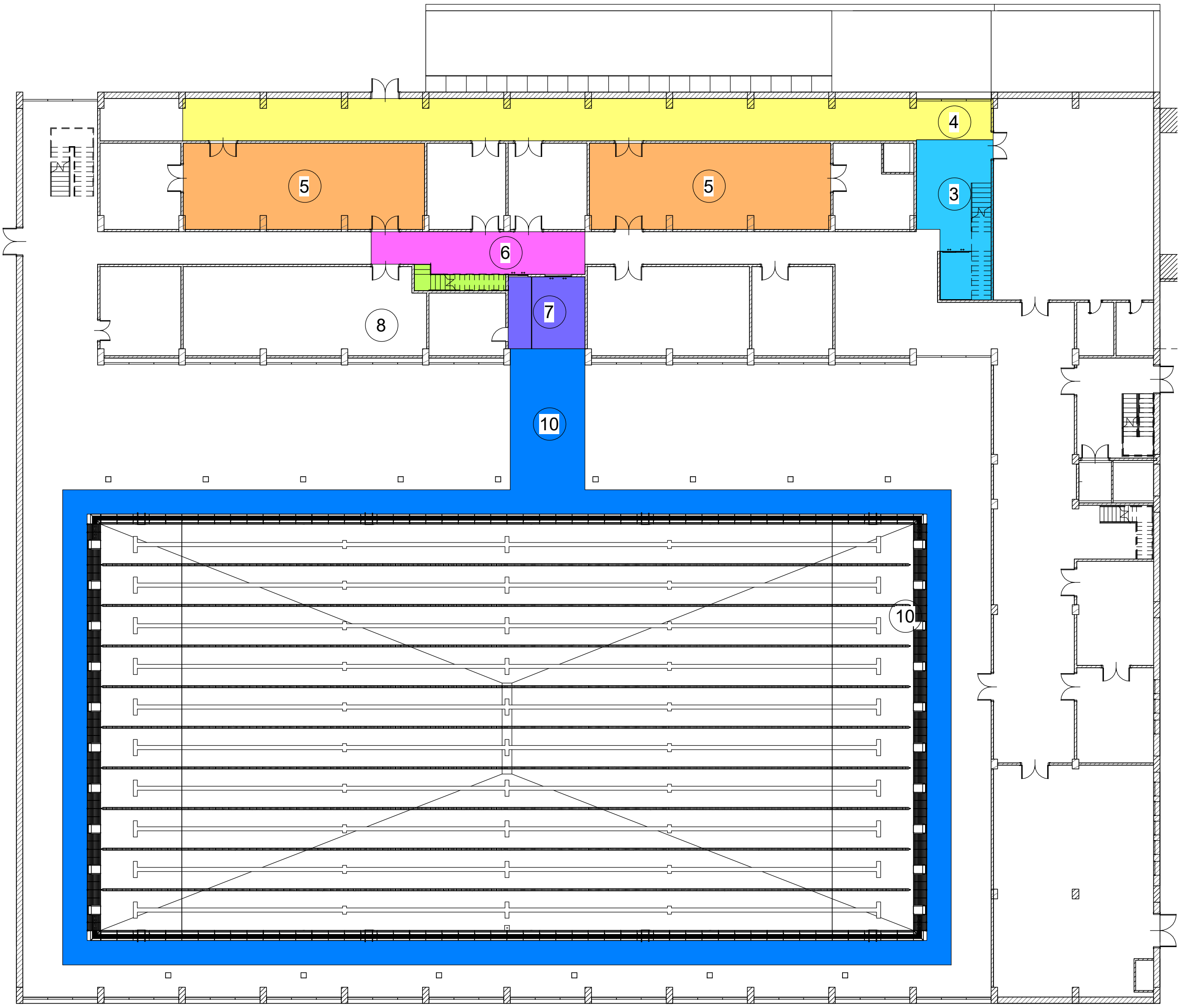
NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	PLAN	DIN/SCALE
PA05	SPECTATORS PATH	A 1: 1/50 A 3: 1/100

A1



1 FIRST FLOOR ATHLETES TRAINING & FREE TIME PATH
1 : 200



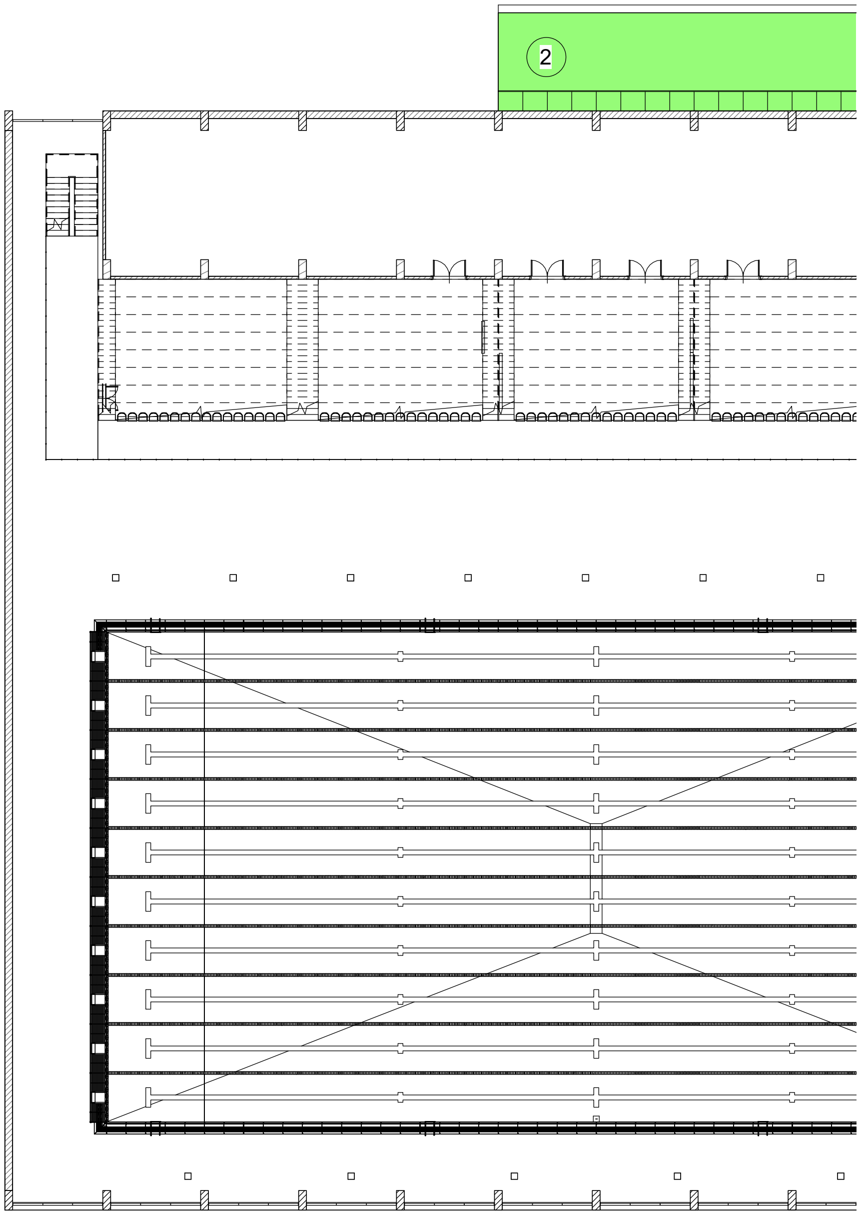
2 GROUND FLOOR ATHLETES TRAINING & FREE TIME PATH

1 : 200

PATH ATHLETES TRAINING & FREE TIME	
SEQUENCE	ROOM
1	OPEN HALL
2	ENTRANCE
3	STAIRS & LIFT
4	LATERAL CORRIDOR
5	JUDGES LOCKER ROOM
6	INTERMEDIATE CORRIDOR
7	FOOTBATH
8	STAIRS
9	GYM
10	POOL DECK

CLIENT		NORTH
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN PA06	PLAN ATHLETES TRAINING & FREE TIME PATH	DIN/SCALE A 1: 1/50 A 3: 1/100

A1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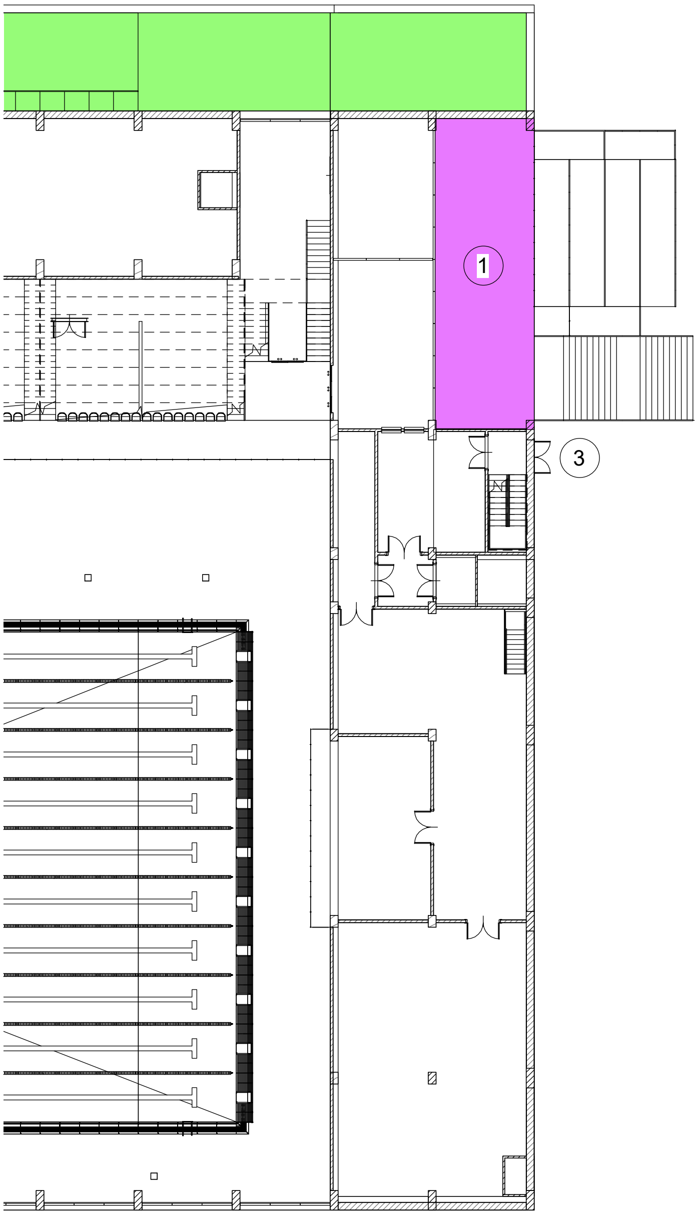


PATH STAFF & DIRECTIVES	
SEQUENCE	ROOM
1	OPEN HALL
2	RAMP
3	LATERAL DOOR (GROUND FLOOR)

CLIENT

NORTH

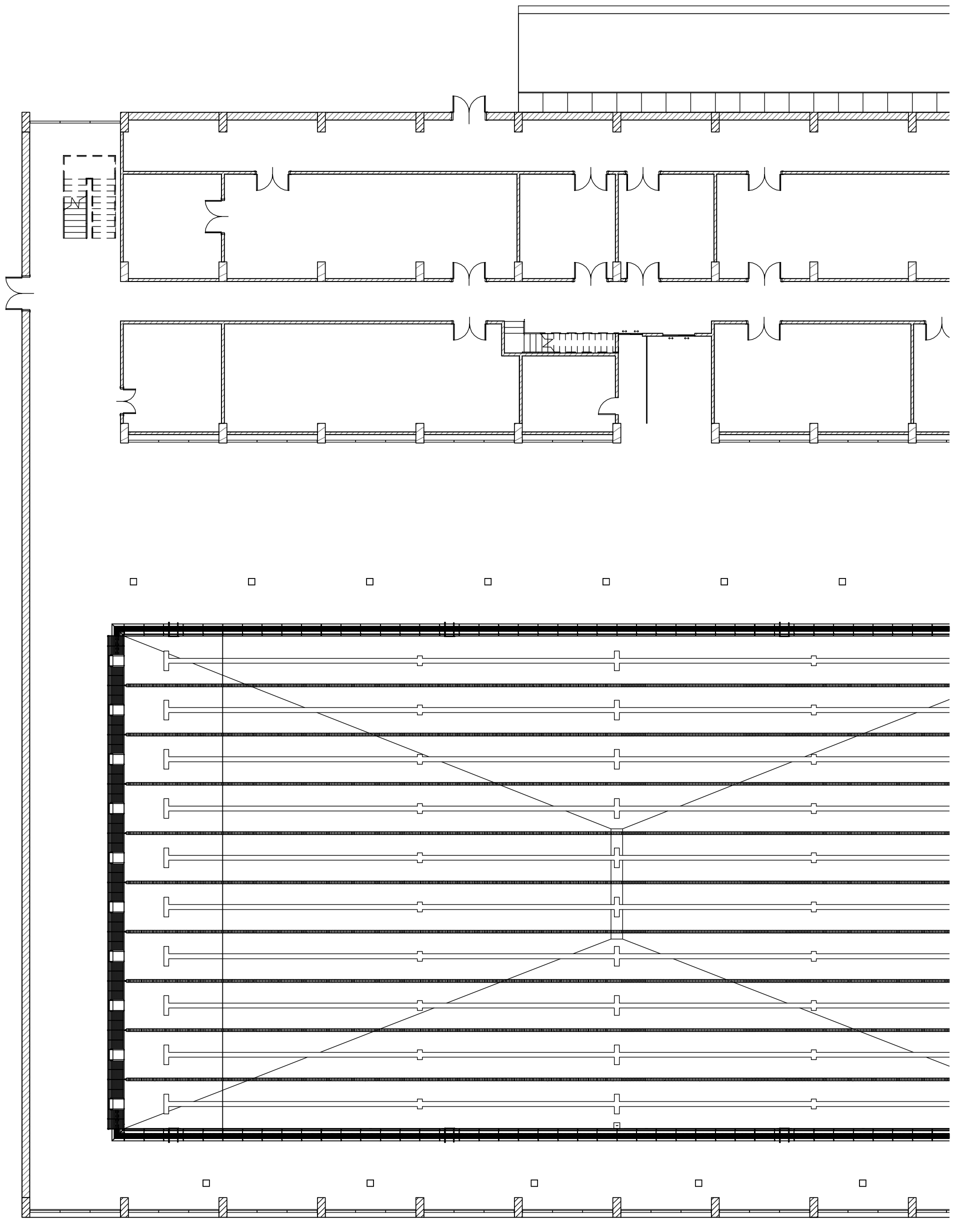
REVISION

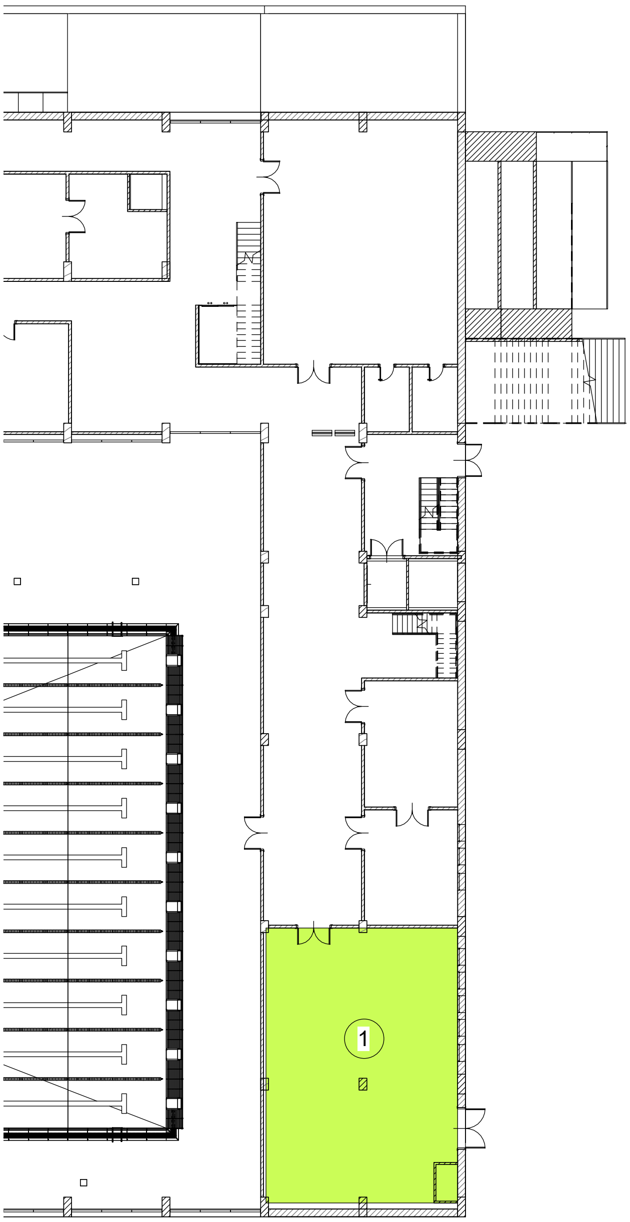
Nº	DESCRIPTION	DATE

NOTES

DATE	PROJECT	Nº PROJECT
26.10.2016	SWIMMING POOL 50X25X2	16.000
Nº PLAN	**PLAN**	**DIN/SCALE**
PA07	STAFF & EXECUTIVES	A 1: 1/50 A 3: 1/100

A1





PATH TV	
SEQUENCE	ROOM
1	TV ROOM

CLIENT		NORTH
REVISION Nº	DESCRIPTION	DATE
NOTES		
DATE 26.10.2016	PROJECT SWIMMING POOL 50X25X2	Nº PROJECT 16.000
Nº PLAN PA08	PLAN TV PATH	DIN/SCALE A 1: 1/50 A 3: 1/100

A1

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COMPETITION POOL SOLUTIONS