Content

Accredited Specialist 2
Our Strength 4
Post-Tensioning System 6
What is the Post-tensioning concrete 9
The Benefits 10
Bonded - UnBonded System 16
Post-tensioning Applications Slab 20
Construction Procedures 26
Planning for Opening 28
Projects 30
PSC Prestressing contracting is a leading company of Post tensioning technology in Middle East and North Africa market which supplies all the post tensioning materials with a very high standard, quality & executing the projects with a highly experienced teamwork, As well as approved applicator for many international post tensioning systems.

PSC Involved thoroughly in all the phases of the project; design, manufacture, Supply, and install our post tensioning system created especially for buildings.

PSC is a Post tension institute registered company operating a quality management system fully compliant with PTI specifications. The post-tensioning accessories are manufactured with the satisfaction of the quality control system and conforming to the requirements of international standards such as [PTI] and [BS4447].

We strive to offer the best technical support together with up-to-date Post-Tensioning Systems, to meet the challenging needs of our customers’ by providing advanced, time reducing and cost effective construction solutions.

Company core values:

Our client’s satisfaction is a constant measure of achievement, while this satisfaction is due to our commitment to our clients, it is directly related to the values through which PSC Construction & Engineering, manages its operation. These include:

• **Strength**
  We are a solid partner for our customers and all stakeholders based on the integrity and competence of our people, our decades of experience, our track record for delivering results and the backing of a global industry leader.

• **Performance**
  We demand excellence, deliver on our promises and continuously search for new and better ways to provide the best solutions for our customers and our stakeholders.

• **Passion**
  We care about and are personally committed to everything we do, our people safety and development, our customers and their success.

Scope Of Services

Based on its extensive and proven experience in the highly specialized area of post-tensioning construction, PSC offers a comprehensive range of professional services including:

• Consulting services and designs covering all aspects of post-tensioned construction.
• Quality controlled post-tensioning Supply materials, products and equipments.
• Project feasibility study for post-tension application.
• Preliminary design and cost estimation.
• Final design and shop / working drawings.
• Complete supply and installation of post-tensioning systems.

System features and products

PSC post-tensioning systems significant features and advantages:

• Wide selection of anchorage types
• Products are provided with full range of tendon sizes from single strand with up to 5 nos of 0.6 / 0.5 strand. (Bigger tendon sizes are also available upon request)
• Anchorage adaptable for both strand of (12.5 mm) and 0.6 (15.7 mm) according to standard ASTM A416 or BS 5896.
• Advanced stressing jacks equipped with automatic stressing heads and power wedge seating devices.
• The systems available in any number of stressing steps and sequences.
PSC Egypt strongly believes in getting involved with the customers project team from the conceptual stage so as to contribute positively in collaborating with the architectural and engineering teams from the very start, to achieve a more efficient and cost-effective construction method.

Our success is driven by our innovative solution to complex projects that met the client demands and within project budget. Our clients are turning to us for our ability to implement project management techniques and to serve as a reliable provider of knowledge-driven solutions for construction projects.

PSC engineers who make up the team embody our values of strength, performance and passion. Our employees have strong connections to these ideas, which have contributed significantly to the progressive growth, success and leadership of our company, they have helped us develop the solutions, systems and project methods required to bring innovation, quality and value to the projects we deliver for our clients.

Similarly, the technical team of highly competent engineers who have vast experience in construction and post tensioning methods, with the best construction techniques, Using latest technology and materials that contribute to high level engineering excellence, this brings a significant benefit to our clients.

**Memberships**

PSC prestressing system pride itself to hold membership in prestige associations and contributes with the associations in their educational activities in the area served by PSC.

- Post tension concrete institute
- American concrete institute

**PSC Design Solutions:**

PSC carries out complete design for post tensioned concrete applications. Experience and expertise gained from working on projects, are combined to deliver prompt, effective solutions. The company uses the latest design software which is continually updates to reflect current international construction code of practice.

**PSC Quality:**

All PSC products are manufactures from especially selected materials, which are fully inspected throughout each process. Prior to dispatch, the product is 100% inspected automatically to check dimensions and heat treatment. Sample component are are also type tested for additional security. All PSC components are batch marked to ensure traceability.

Delivering quality at every stage, PSC components are designed using the latest 3D parametric modelling and FEA software to ensure total product integrity. All new components are type-tested at external test facilities and many other third party inspection such as SGS and germinal lloyd. Full product traceability can be provided from the acceptance of raw materials, to final dispatch to the end user.

**PSC Commitment:**

Committed to providing a first class service, PSC has teams of engineers and technicians helping clients to select the efficient structure solution and the most appropriate equipment to meet their requirements and provide advice on related product issues, PSC also offers full maintenance and calibration of its equipment.

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**Our Strength**

PSC MENA Region Market share

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**Total post-tensioning slabs = 1,250,000 M²**

executed projects by prestressing contracting company.

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**Our post-tensioning system has been approved for use by:**

- Government departments
- Local authorities
- Engineering consultancies
- Multinational construction companies and organizations.

Also involved with remarkable consultants such as EHAIF, AECOM, LOUIS BERGER GROUP, PARSONS, as well as international consultants and contractors.
The post tensioning slabs for the building industry have been used with success in many countries since the 70s. As the construction industry moves into the 21st century, so the need for ever more efficient structural form continues to grow.

Nowadays, the cast in situ construction of slabs using post tension systems is an alternative that should be seriously considered. The increasing cost of materials, construction equipments, labor and transport demands the maximum optimization of resources. It also involves the use of high quality techniques, saves materials costs and is fast in execution.

The post tensioning method lightens the structure, allows the reduction of the slab thickness and allows releasing the formwork in record time and it even guarantees a higher durability.

APPLICATIONS

Post tensioning systems created especially for buildings, which have been used for projects as varied as:

- Office buildings
- Shopping Malls
- Sports centers
- Slabs on grad
- Rafts
- Residential Buildings
- Hospitals
- Theaters
- Parking
- Bridges
- Industrial Buildings
- Schools
- Hotels
- Tanks
- Silos

POST-TENSIONING SYSTEM

SAFE, SECURE AND SUSTAINABLE
WAY OF CONSTRUCTION
POST-TENSION CONCRETE

Post-tensioned concrete slabs have become a major factor on the construction of floor systems for commercial and residential buildings of all types. In their two most popular forms (one way slabs, two way flat plates) they have been found to be economical for structural applications in parking structures, apartment buildings, office buildings, hospitals, and industrial buildings of both the high-rise and low-rise type.

The principle is easily observed when loading together several books by pressing them laterally. Under such pressure the whole row gains enough stiffness and strength to ensure its integrity. In concrete structures, this is achieved by placing high tensile steel tendons (cables) in the element before casting, when the concrete reaches the desired strength; the tendons are pulled by special hydraulic jacks and held in tensioning using specially designed anchorages fixed at each end of the tendon.

This provides compressions at the edges of the structural member that increase the capacity of the concrete resisting tension stresses.

If tendons are appropriately curved to certain profile they will exert in addition to the compression at the perimeter a beneficial upwards set of forces that will counteracts applied loads, relieving the structure from a portion of gravity effects.

Post tensioning as a process requires specialized knowledge and well trained staff. Its usage makes construction easy with knowhow of fabrication, assembling and installation.
THE BENEFITS OF POST-TENSIONING SYSTEM

Post-Tensioning in Buildings
The use of Post-Tensioning in buildings offers numerous advantages and is increasingly used worldwide. PSC uses the Bonded Post-Tensioning System which is the most commonly used PT System.

Advantages
• Post-Tensioning provides longer spans, which reduces structural floor depths, resulting in larger column-free areas
• Less Reinforcement
• Thinner concrete sections Material, time & cost saving
• Stiffer walls to resist lateral loads
• Control of Cracking’s
• Positive deflection control
• Increase shear capacity of sections
• Stiffer foundations to resist the effects of shrinking
• Simpler stripping of formwork
• Fast construction cycles are envisaged
• Improved constructability
• More architectural freedom (Clear Spans up to 20m)
• Flexibility in subdivision of commercial and office floors
• Less material handling on site and storage
• Less labour on site
• Less environmental impact as reduced concrete and Steel volume are required.
Fast Track Construction

The speed of construction of a post-tensioned framed building is expedient use and re-use of formwork. Post-tensioning allows for the early recovery of formwork by early stressing of tendons. The construction of a post-tensioned slab is broadly similar to that for an ordinarily reinforced slab. Differences arise in the placing of the reinforcement, the bottom ordinary reinforcement of the slab and the edge reinforcement are placed. The ducts or tendons must then be positioned, fitted with supports and fixed in place. This is followed by the placing of the top ordinary reinforcement.

The stressing of the tendons and in the case of bonded tendons the grouting also. However, these operations are usually carried out by the prestressing firm; the main contractor can continue his work without interruption. A feature of great importance is the short stripping times that can be achieved with post-tensioned slabs. The minimum period between concreting and stripping of formwork is about 4-3 days, depending upon concrete quality and ambient temperature. When the required concrete strength is reached, the full prestressing force can usually be applied and the formwork stripped immediately afterwards. Since this weight is usually less than that of a corresponding reinforced concrete slab, the cost of the supporting structure is also less.
Bonded Post-Tensioning Slab System consists of fully encapsulated, bonded multi-strand (two to five strands) tendons contained in flat ducts filled with a high-performance cementations grout that bonds the strands to the surrounding Concrete.

Intermediate anchorages provide continuous encapsulation at construction joints. Tendons are protected by both duct and grout.

These bonded multi-strand post-tensioning systems have been successfully applied to commercial building, healthcare and parking structure construction by PSC.

Benefits include enhanced crack and deflection control and a reduction in reinforcing steel. That allows for thin post-tensioning slab design reducing overall building height which lowers costs for foundation, frame and facade/cladding components. Because bonded tendons may be cut with only localized loss of capacity, another significant advantage of bonded PT is the ease of future building modifications.

Design advantages include increased span lengths and load-carrying capacities. Additionally, the reduction of mild reinforcing steel minimizes the primary sources of corrosion and significantly reduces life cycle maintenance costs.

Bonded post-tensioned concrete is the descriptive term for a method of applying compression after pouring concrete and the curing process (in situ). The concrete is cast around plastic, steel or aluminium curved duct, to follow the area where otherwise tension would occur in the concrete element.

A set of tendons are fished through the duct and the concrete is poured. Once the concrete has hardened, the tendons are tensioned by hydraulic jacks.

When the tendons have stretched sufficiently, according to the design specifications they are wedged in position and maintain tension after the jacks are removed, transferring pressure to the concrete.

The duct is then grouted to protect the tendons from corrosion.

ANCHORAGE COMPONENTS
- Pocket Former
- Wedges
- Anchor head
- Anchor plate casting
- Grout vent
- Corrugated metal flat duct
- Anchorage bursting reinforcement

Adaptable to a variety of structures, un-bonded mono-strand post-tensioning can be easily, rapidly and economically installed. Concrete construction applications for mono-strand systems include elevated slabs, slab-on-grade, beams and transfer girders, joists, shear walls and mat foundations.

PSC mono-strand post-tensioning systems use 0.5" and 0.6" diameter strands coated with a layer of specially formulated grease with an outer layer of seamless plastic extruded in one continuous operation to provide protection against corrosion. Each tendon is precisely coiled, cut, labeled, color-coded and delivered to the construction site. A wide variety of anchorage systems are available to meet design specifications.

Encapsulated un-bonded mono-strand post-tensioning systems are used in areas that are subject to corrosive conditions. Strands are protected at the anchorages using greased plastic sleeves and grease-filled end caps. Additionally, anchorage components are fully encapsulated in a high density polyethylene plastic covering and an optional encapsulated intermediate coupler anchorage system can be used to protect the strand at construction joints.

Un-bonded post-tensioned concrete differs from bonded post-tensioning by providing each individual cable permanent freedom of movement relative to the concrete, to achieve this; each individual tendon is coated with grease (generally lithium based) and covered by a plastic sheathing formed in an extrusion process.

ANCHORAGE COMPONENTS
- Pocket former
- Wedge
- Anchor plate casting
- Anchorage bursting reinforcement
- P.E. Connector
- Unbonded strand greased and P.E. coated
- Encapsulated plastic anchor cap
The un-bonded mono-strand system offers the following advantages:

• Thin, light and flexible tendons that allow maximum tendon eccentricity in relatively thin members and are easy to handle and place
• Only small friction losses during stressing
• Factory provision of corrosion protection for the pre-stressing steel
• No grouting necessary
• Economical, replaceable, and greater layout flexibility
• The ability to de-stressing the tendons before attempting repair work
• The procedure of grouting is eliminated which leads to faster in construction process

The advantages of the bonded systems include:

• Full exploitation of the yield strength of the pre-stressing steel
• Improved cracking behavior by activation of bond forces, reducing the amount of additional non-pre-stressed steel required for crack control compared with an un-bonded system
• For the flat duct system: thin tendons allow maximum tendon eccentricity in relatively thin members
• For the multi-strand system: the ability to transfer large forces using large tendons.
• Higher ultimate flexure strength
• Simple technique for demolishing or providing future opening
POST-TENSIONING APPLICATIONS

SLAB ON GRADE

Usage:
PSC post tensioning system is used in the construction of slabs on grade. Warehouses, distribution centers, container terminals, airports, pavements, residential slabs and recreational slabs for tennis courts and skating rings are common applications.

Problems of reinforced slabs on grade
- Shrinkage is not controlled
- Disruption of repairs
- Concrete cracking
- Wheel damage
- Displacement
- Out of service
- Maintenance
- Breaking up
- Joints fail
- Spalling

Advantages of post-tensioning Slab on grade

Crack control:
Post-tensioned slabs reduce the risk of cracking more effectively than other reinforced slabs because of the compressive forces that are applied by the post-tensioning cables.

Joints savings:
- Less joints – lower initial cost post tensioning can reduce jointing by a much as $90, this means removing $90 of the problems in the future

Time saving:
- Less excavation time
- Less installation time
- Less clean up time
- Less joint placement time
- Faster concrete placement

Cost Saving:
The thinner slab, absence of reinforcement, absence of costly internal jointing and the cost saving from the construction time which saved by casting large areas, all contribute to save costs.

Joints savings:
- Less joints – lower initial cost post tensioning can reduce jointing by a much as $90, this means removing $90 of the problems in the future

Supporting any load:
The PSC Slab on grade can be designed to accommodate any loading requirement.

Fast-track construction:
Post-tensioned slabs can be constructed much faster than conventional reinforced slabs. Time is also saved by using fewer joints and narrower footings with less excavation and less concrete. Large pours of more than 2,500m² are a common feature of post-tensioned slabs on grade.

Flatter slabs:
The risk of slab curling is greatly reduced with fewer joints and greater joint spacing. This produces a smoother ride and less maintenance for vehicles.

Reduced maintenance:
The use of fewer - or even no – joints significantly reduces the need for future maintenance. Studies have shown that the major costs over the life of a structure involve joint maintenance. With a post-tensioned slab, the costs of joint and crack repair are reduced as too is the damage to plant caused by the breakdown of joints.

Deflection control:
Expansive soils, which expand when wet and shrink when dry, can cause foundation movements and cracking. Post-tensioning increases the slab’s flexural and tensile capacities, making it more resistant to problematic soils.

Super flat floors:
Post tensioning avoid
- Joints spalling
- Curing
- Cracks
- Super flat floors may well become common place in the warehouse / distribution center build in the future.
A raft slab, also known as a ‘Slab on Grade’, is used at the base of a structure to support the load from above via a number of integrated edge when internal beams designed within the concrete floor plate. This is generally used when the site's geology is unfavourable due to high water tables or unstable surrounding foundations. Airports, car parks, warehouses, and water tanks around the world are currently benefiting from StrongForce’s cost-effective design and construction solutions of post-tensioned on grade slabs.

The properties of a transfer slab are very similar to that of a raft slab, the only difference being its location within the structure. Transfer slabs occur where engineers need to shift the structural load through a building, for example where a column layout is arranged over another.

The multistrand system can be used in the edge and internal beams of the slabs to help control and transfer the extremely high localised forces. Beams of up to two metres thick are not uncommon but when compared to traditional reinforced concrete methods, a multistrand solution is far superior in the efficiency of beam height, construction time and budget.

Advantages for Raft Slabs

- Reduced excavation and sub-base preparation
- Faster construction
- Reduced ongoing maintenance costs
- Ability to cast slabs on grade greater than 2,500sqm without joints
- Reduced chances of cracking
- Almost no reinforcement required
- Less concrete is needed
- Greater savings
- Post-tensioned slabs on grade can carry greater loads than those that have been traditionally designed

Advantages for Transfer Slabs

- Superior efficiency of beam height using multistrand solution
- Reduced construction time
- Reduced costs
Extensively used in bridge and transportation structures, bonded multi strand post-tensioning systems have also been successfully applied to commercial building construction. A single multi strand tendon can hold up to fifty-five 0.5" or 0.6" strands encased in plastic or steel duct and is fully bonded using a high-performance grout.

When bonded multi strand post-tensioning systems are used for large structural members, such as beams and transfer girders, design advantages include increased span lengths and load-carrying capacity and reduced deflection. Additionally, because the strands are stressed simultaneously, less labor is required resulting in cost savings.

Advantages of Bonded Post-tensioning Tendons are:

- Reduction of depth of beams
- Less reinforcement of the beams
- Time and cost saving
- Free spans up to 35 meter without columns
- Use of high strength strands improve a members ability to withstand a higher blast load
- For beams bonded tendons can be profiled to counter the internal forces resulting from a lost column and to resist moment reversals that can occur during a blast event
Construction Procedures

1. Marking of tendons in both directions
2. Installation of tendons in one direction
3. Installation of tendons in both direction
4. Fixing live end anchor
5. Fixing dead end
6. Fixing Grouting vent
7. Pouring of concrete
8. Stressing and cutting of tendons
9. Grouting of tendons
Bonded Tendons

Bonded tendons are located within oval shaped galvanised ducts which are injected with cement grout following the post-tensioning procedure. Consequently when such a tendon is severed, the free end will become de-tensioned but after a short transmission length the full tendon force will be effective. This distance is in the order of 800 to 1000 mm.

Present quality assurance methods and supervision ensure that the tendons have been adequately grouted after the application of pre-stress. If a penetration is required that will need the termination of a bonded tendon, then the procedure follows that for a fully reinforced structure.

Cutting a bonded post-tensioned tendon is, structurally, the same as cutting through conventional reinforcement. The tendon, however, needs to be ‘terminated’ in order to give full corrosion protection (as does conventional reinforcement).

Propping the slab

Adjacent spans may require temporary propping depending upon the number of tendons severed at one time. It is rare for a slab to carry its full design load. A design check based on actual loading at the time of the modification may show props to be unnecessary.

Un-bonded Tendons

These tendons come individually greased and plastic coated and are therefore permanently de-bonded from the slab.

PLANNING FOR OPENING

There is no doubt that during the lifetime of a structure the requirements of a tenant may alter with time or the tenant may change several times. Each new tenant will have his own requirements for mechanical, hydraulic and electrical services, as well as loading arrangements and general layout. Therefore, for a building to remain readily, it must have the flexibility to accommodate openings for stairs, services or lifts, and the possibility for changes in loading patterns.

Holes through pre-stressed slabs can be accommodated easily if they are identified at the design stage. Small holes (less than 300 mm x 300 mm) can generally be positioned anywhere on the slab, between tendons, without any special requirements. Larger holes are accommodated by locally displacing the continuous tendons around the hole. It is good detailing practice to overlap any stopped off (or ‘dead-ended’) tendons towards the corners of the holes in order to eliminate any cracking at the corners in ribbed slabs; holes can be readily incorporated between ribs or, for larger holes, by amending rib spacing or by stopping-off ribs.

When unbonded tendons are severed, the prestressing force will be lost for the full length of the tendon. When contemplating the cutting of an unbonded tendon it is therefore necessary to consider the aspects noted below.

Cutting the tendons

The strand is packed with grease which prevents an explosive release of energy when the tendon is severed. Even so a gradual release of force is recommended. This can be achieved by using two open throat jacks back to back. After cutting the strand the force can be gently released by closing the jacks.

Propping the slab

Adjacent spans may require temporary propping depending upon the number of tendons severed at one time. It is rare for a slab to carry its full design load. A design check based on actual loading at the time of the modification may show props to be unnecessary.

Forming the hole

When the edge of the slab is re-concreted new anchors are cast in to enable the remaining lengths of tendon to be Prestressed, thus restoring full structural integrity. The above operations are not difficult but will require the expertise of a post-tensioning sub-contractor.
El-Serafy Mega City, KSA

Contractor: Mubarak El-Guthmy Contracting
Consultant: Al-Abnia Consultant Office.
Scope of Work: Design, Supply & Install of Tensioning Slabs
Total PT Quantity = 450,000 M² of PT Slabs

Novotel, KSA

Contractor: Al-Radwan Contracting.
Consultant: Al-Otaishan Consultant Office.
Scope of Work: Design, Supply & Install of Post Tensioning Slabs.
Total PT Quantity = 15,000 M².

LG Show Room, KSA

Contractor: Saudi Cyparian Construction Company, Ltd.
Consultant: Al-Qatary Consultant Office.
Scope of Work: Design, Supply & Install of Post Tensioning Slabs.
Total PT Quantity = 7,000 M².
<table>
<thead>
<tr>
<th>Project</th>
<th>Contractor</th>
<th>Consultant</th>
<th>Scope of Work</th>
<th>Total PT Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office Building, Qatar</td>
<td>Contractor: AL MASAKEN TRADING &amp; CONTRACTING CO.</td>
<td>Consultant: ARAB CONSULTING ENGINEERS MOHARRAM-BAKHOUM</td>
<td>Design, Supply &amp; Install of Post Tensioning Slabs.</td>
<td>9,000 M².</td>
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<td>Resid Building, Qatar</td>
<td>Contractor: AL HASSAN INTERNATIONAL Trad. &amp; Cont. Co. W.L.L</td>
<td>Consultant: APG</td>
<td>Design, Supply &amp; Install of Tensioning Slabs</td>
<td>10,000 M² of PT Slabs</td>
</tr>
<tr>
<td>4 Villas Majlis, Qatar</td>
<td>Contractor: AL MASAKEN TRADING &amp; CONTRACTING CO.</td>
<td>Consultant: AL-SADD ENGINEERING CONSULTANT</td>
<td>Design, Supply &amp; Install of Tensioning Slabs</td>
<td>16,000 M² of PT Slabs</td>
</tr>
</tbody>
</table>
RESID BUILDING, QATAR
Contractor: MONTERIAL CONSTRUCTION W.L.L
Consultant: AL-ALAMEIA ENGINEERING CONSULTANTS
Scope of Work: Design, Supply & Install of Tensioning Slabs
Total PT Quantity = 7,000 M2 of PT Slabs.

MAJLIS, QATAR
Contractor: M/s TACMON
Consultant: TOP DESIGN ENGINEERING CONSULTANTS
Scope of Work: Design, Supply & Install of Tensioning Slabs
Total PT Quantity = 5,000 M2 of PT Slabs

Contractor: BADR EL HAZEK QATAR W.L.L.
Consultant: ARABIAN ARCHITECTURE GROUP
Scope of Work: Design, Supply & Install of Post Tensioning Slabs.
Total PT Quantity = 12,000 M2.

Commercial BUILDING, QATAR
Contractor: ALMASAKEN TRADING & CONTRACTING CO.
Consultant: QATAR CONSULTING ENGINEERING CENTER
Scope of Work: Design, Supply & Install of Tensioning Slabs
Total PT Quantity = 22,000 M2 of PT Slabs.
Proposed HOTEL, QATAR

Contractor: AL MASAKEN TRADING & CONTRACTING CO.

Consultant: AL-SADD ENGINEERING CONSULTANT

Scope of Work: Design, Supply & Install of Tensioning Slabs

Total PT Quantity = 6,000 M2 of PT Slabs

8VILLA, QATAR

Contractor: AL BANDARY ATLASCAT.

Consultant: MR. ABDULRAHMAN ABDUL LATIF A A AL MANA

Scope of Work: Design, Supply & Install of Tensioning Slabs

Total PT Quantity = 10,000 M2 of PT Slabs

RESID BUILDING, QATAR

Contractor: AL HASSAN INTERNATIONAL Trad. & Cont, Co. W.L.L

Consultant: DOHA DESIGN CENTRE

Scope of Work: Design, Supply & Install of Tensioning Slabs

Total PT Quantity = 4,000 M2 of PT Slabs