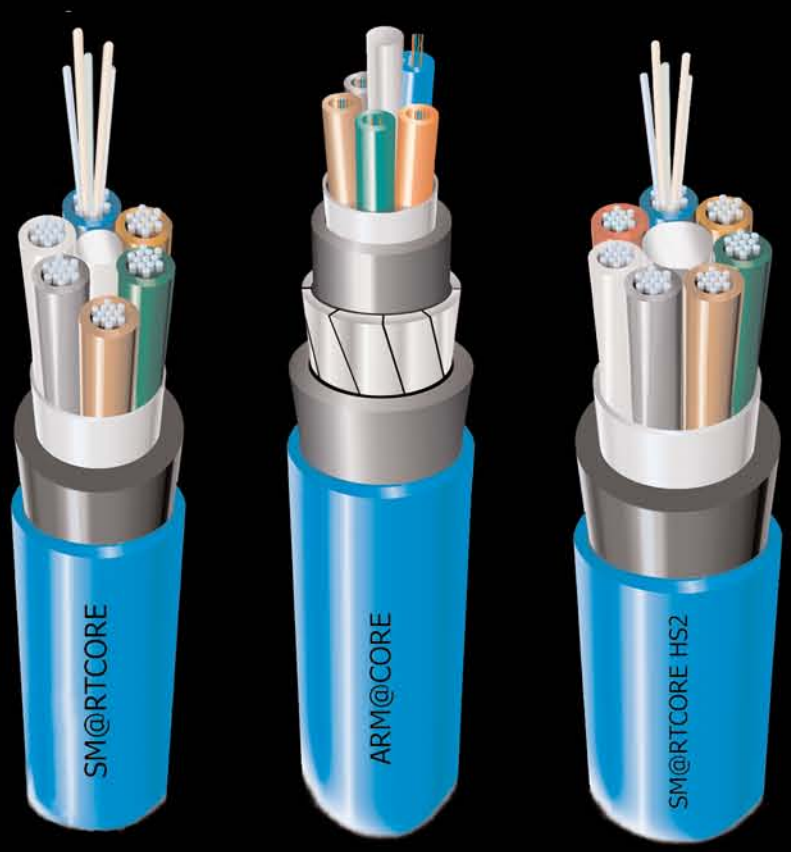
SM@RT Solutions

SM@RT Solutions for SM@RTer Networks

TELECOM



PRYSMIAN
CABLES & SYSTEMS

SM@RTCORE®

REDUCED DIAMETER LOOSE TUBE CABLE

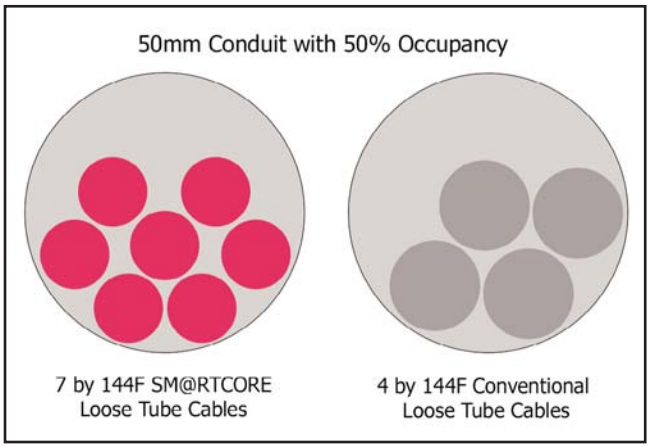
Prysmian's SM@RTCORE range of Fibre Optic Loose Tube Cables are a significant advancement in the technology of Loose Tube Cable manufacture. Using state of the art manufacturing technology and control, we have engineered down the size of our cables to levels well below tradition cable design. This reduction in size offers many benefits for both installers and network owners.

The main focus of developing SM@RTCORE was to provide a cable that helped alleviate the problem of crowded ducts. The table shown below compares the diameter of the various fibre counts with the diameter of conventional loose tube cables and shows the incredible reduction in cross-section that has been achieved.

Fibre Count	SM@RTCORE	Conventional Loose Tube	Reduction in Cross-section
2-72	9.1 mm	10.4 mm	23 %
96	9.9 mm	12.9 mm	41 %
120	11.2 mm	14.6 mm	41 %
144	12.4 mm	16.2 mm	41 %
216	13.0 mm	16.8 mm	40 %
288	14.5 mm	19.1 mm	42 %
312	15.3 mm	20.1 mm	42 %

The table above clearly shows the massive reduction in cross sectional area that has been achieved through the introduction of SM@RTCORE cable. This then translates directly into increased duct utilisation as shown in the diagram (right). With duct space becoming an increasingly sought after commodity the new cable offers many advantages to network owners.

Owing to these reductions it is now possible to haul 7 by 144 fibre cables in to a P50 duct whereas conventional loose tube cables would have been restricted to 4 cables in the same duct, assuming 50% occupancy.



This reduction in size offers the potential to increase the number of fibres in a duct, lower the number of ducts needed or extend the life of existing ducts, all of which offer significant cost savings.

Another feature of all SM@RTCORE cable lies in the fact that it is manufactured with a composite outer jacket comprising a polyethylene sheath to which is bonded an outer layer of Nylon. The bonding is achieved by means of an adhesive tie layer that is extruded between the inner polyethylene sheath and the outer Nylon jacket.

The Nylon serves two purposes. Firstly, and primarily, it provides an effective barrier against attack from termites that can cause extensive damage to infrastructure in Australia if not protected by means of a physical barrier.

Secondly, the Nylon, owing to its smooth and glossy surface finish, provides a worthwhile reduction in the friction between cable and duct during hauling allowing longer lengths to be hauled without exceeding the maximum cable tension.

One of the problems that has always existed with Nylon is that due to its physical characteristics (hard and tough) it needs to be applied as a very thin layer or the cable becomes very in-flexible and too stiff to handle. An additional complication arrises if the Nylon is made too thin in that it wrinkles very easily when the cable is bent as may occur when storing spare cable in a pit. This effect reduces significantly the cable's protection from termite attack.

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This means then that conventional Polyethylene / Nylon jackets are a compromise in thickness to avoid excessive stiffness (of the cable) and to prevent wrinkling when bent. By bonding the two layers together the Nylon jacket can be made thinner and the thicker polyethylene sheath acts as a substrate to support the Nylon. Prysmian's Dee Why facility is equipped with state of the art machinery that allows the simultaneous application of the composite three layer sheath in a single process while closely controlling all critical dimensional parameters.

Other less obvious benefits of bonded Nylon are:

> No possibility of water passage between sheath and outer jacket avoiding the need to remove the Nylon before applying sealing heat-shrink to splice closures- the heat-shrink can be applied directly to the Nylon. It is advisable to abrade the Nylon with emery first but this is not absolutely necessary provided the jacket is free from grease and oil.

> Risk of air passage between sheath and Nylon eliminated allowing installation by means of air blowing.

> Eliminates damage to Nylon by caterpillar drives during air blowing cable installation.

> Improved cable flexibility.

Similarly to Riser and Breakout cables all SM@RTCORE designs encompass today's widely proven Dry water blocking technology using high absorption performance (Super absorbent corrosion inhibitor polymers) protection against longitudinal water penetration. In its state-of-the-art manufacturing processes Prysmian developed dry water blocking technology to a new level. On contact with water, dry elements swell instantly sealing all existent voids and jacket breaches and upon drying, the coating will re-generate and continue to provide protection (cycling action).

The smaller SM@RTCORE cables also offer the potential to fit longer lengths on a given size drum. For longer runs this can lower installation costs by maximising run lengths between drum change overs. It also minimises the transition point between fibre runs thus lowering splicing and connectivity cost and protects power budgets.

A smaller, lighter and more flexible cable is also easier and quicker to install. It is now the cable for choice for many Telco's and Contractors in Australia. The SM@RTCORE range is available in fibre counts from 2 to 624 fibres, and cables with tube counts over 12 use Prysmian's striped tube technology. Using a stripe on any tube greater than 12 means we can offer a unique coding system on all tubes. The old method of repeating colours has long caused issues and expensive mistakes during termination, and the use of a unique colour code on each tube minimises the potential for mistakes significantly.

SM@RTCORE - the smart cable.
Why not give it a try.

High Strength SM@RTCORE® HS2

HIGH STRENGTH CABLES FOR USE IN BLACK OR REACTIVE SOILS

SM@RTCORE HS2 (High Strength Reduced Diameter Optical Cable) is a new design which offers the advantages of a high strength cable in a size not much bigger than a conventional loose tube cable. As a result there is no trade off of size against the advantages of higher strength.

HS2 is a further development of the highly successful HS1 design (developed by Prysmian in our laboratory using the "Sydney Harbour Bridge" Test), which has proven itself in the field over many years. Lighter and more compact, HS2 has also been extensively tested in the lab using the "Harbour Bridge" test and against the same parameters to that of HS1.

A High Strength cable for use in reactive or black soils needs to be much more than just an enlarged Loose Tube cable. The addition of a thicker sheath and more strength members may increase crush and tensional strength, but does little to protect the cable against the torsional and shear forces that black soil areas may apply. As the ground contracts and cracks (see photograph below), large shear forces come into play and any cable running through the soil needs to be designed and tested with these unique conditions in mind. Close control of all major design parameters becomes extremely important if a High Strength cable is to perform successfully. Manufacturing parameters such as cable excess and cable coupling must be managed within very close tolerances and this can only be achieved using state of the art machinery and experienced engineering support that understands these parameters intimately.

The cracking effect seen in black soils.

Prysmian is the only local manufacturer that can control these parameters to the necessary level. This is illustrated by the fact that we are the only local manufacturer who can make a reduced diameter cable, an essential prerequisite to making a true High Strength cable. Conversely, a lack of full control of these parameters means you cannot make a reduced diameter cable and subsequently cannot make what we would define as a true High Strength cable.

High Strength cables operate in potentially hostile environments so it is critical that a high strength cable will perform as expected. With this in mind, Prysmian can offer 3 key benefits:

> Unparalleled experience in the local market with High Strength cables. The designs have proven themselves in the field in very hostile environments over long periods of time.
> The ability to test the designs in our lab with the recognised "Harbour Bridge" test.
> Close control of all important manufacturing parameters, such as excess fibre and cabling coupling. Extremely important if the cable is to perform as a High Strength cable.

We believe the above points need to be considered if a High Strength Cable is being sourced. Current High Strength customers, who include some of Australia's largest Telco's, know these issues are very important as a failure of a design would be catastrophic.

The new reduced diameter SM@RTCORE High Strength 2 Cable is available in fibre counts up to 42 fibres. (For larger fibre counts the High Strength 1 cable design is used). The smaller cable means that longer lengths can be manufactured on a given sized drum. This offers a number of real benefits and cost savings:

> Longer runs are possible, which minimises splicing, connectivity and active components, thus saving significant cost. Longer fibre lengths also help protect the power budget of the design.
> Reduced drum change-overs and set up, which offers installation time and cost savings.
> Significant transport cost savings, especially to remote locations, which is often where a High Strength cable is used.

If you are going to invest in a High Strength cable you need to make sure you will actually get one, and not just a standard cable with a thicker sheath. Prysmian supply 70 - 80% of Australia's Optic Cable needs, and in terms of High Strength cable we probably supply up around 98% of Australia's demand. Our facilities and knowledge of the cables are a major reason why we enjoy this position in the market place.

We strongly recommend you insist on a cable that is a proven local design, both in the lab and in the field. The insistence on 'Harbour Bridge' qualification is an important step for this, as is the choice of a manufacturer who understands the installation environment as well as the cable. At Prysmian we have that knowledge and experience.

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PRYSMIAN CABLES & SYSTEMS

Case Study

We have developed a case study of a typical High Strength cable installation which will help illustrate and quantify the possible costs savings available by using the SM@RTCORE HS2 design as opposed to the larger HS1 design. The scenario is as follows:

Route length:	250km direct plough.
Fibre Count:	24 Fibres Single Mode
Installation Location:	Delivery to Port Hedland WA
Manufacture Location:	Prysmian Sydney
Drum Size:	Standard steel drum (2.4m x 1.15m)

For a HS1 design a maximum of 12km can fit on a standard steel drum. By moving to the smaller SM@RTCORE HS2 design a maximum of 18km can fit on the same standard drum. The longer drum lengths offer several cost advantages.

The potential typical costs savings that can be captured by using a HS2 design over a HS1 design are summarised below.

Cost Components	% Cost Saving	Dollar Cost Saving
Transport	33%	$17000
Set up to plough/install	36%	$5000
Splicing	32%	$8000
Joint Installation	32%	$3000
Cable	9%	$53000
TOTAL	**13%**	**$86000**

These cost savings are an estimate and provided as an indicative guide only based upon budgetary costings. We would recommend that you model specific projects using the above cost components as a guide.

Transport Savings

Longer lengths per drum mean you can fit approximately 50% more cable on a truck, cutting transport costs significantly. This is becoming increasingly important as the cost of transport rises and can result in considerable cost savings for remote locations, which is typically where these cables are used.

In our case study we transport the cable from Sydney to Port Hedland on semi trailers. You can fit 7 drums on a semi trailer. Using the HS1 design we would need 21 drums to complete the project. This is 3 semi trailers.

By moving to the SM@RTCORE HS2 design we would need 14 drums to complete the project, 7 drums less. We would therefore only need 2 semi trailers for transport, requiring 1 semi fewer. The typical cost to send a semi from Sydney to Port Hedland is approximately $17000. Thus, by not having to use an additional semi trailer we capture a saving of approximately $17000.

Set Up Times

Longer lengths also mean less set up time for the total project. You can set up to plough 18km in one run, as opposed to only 12km. This can offer significant time and cost savings during the total installation. We estimate that the saving is 36% or approx $5000 for the total project.

Splicing Costs

Longer route lengths also minimise the number of splice points across the total route. If using 12km length the project would need approx 22 splice points at a minimum. By using 18km lengths the number is reduced to 15 splice points at a minimum, a reduction of 7 splice points. This cuts splicing and connectivity costs as well as protects the power budget across the total run. We estimate the potential saving in this area is approximately $8000 or 32%.

Joint Installation

Longer lengths also mean less joints and pits and the cost saving we estimate here is $3000 or approx 32%.

Cable Cost

Last, but by no means least, is a reduction in the cost of the actual cable. A smaller cable means less materials and this offers a cost saving. The saving on a 24 fibre cable is approx 9% and this represents approx $53000 on the total 250km run.

(For more information on Cable Designs for Black Soils and the Harbour Bridge test please email or call Prysmian using the contacts listed on the back cover)

ARM@CORE®

RODENT PROOF NON-METALLIC CABLE

A nylon sheath will provide a good level of resistance to white ant / termite attack but will provide little or no resistance to rodent attack. Any cable that needs to be rodent proof will need to be physically armoured with a material that can stop rats and other rodents from penetrating it. The two options are a Glass Reinforced Plastic rod (GRP) armour or metallic Corrugated Steel Tape (CST) armour. The first option has the advantage of being non metallic, so if an all dielectric cable is needed it is the best option. It is also significantly smaller than a CST armoured cable which maximises run lengths and is easier to handle. This design of cable is armoured by non metallic GRP flat rods. It offers very good crush resistance and is rodent proof. We call this cable our ARM@CORE Rodent Proof All Dielectric Cable.

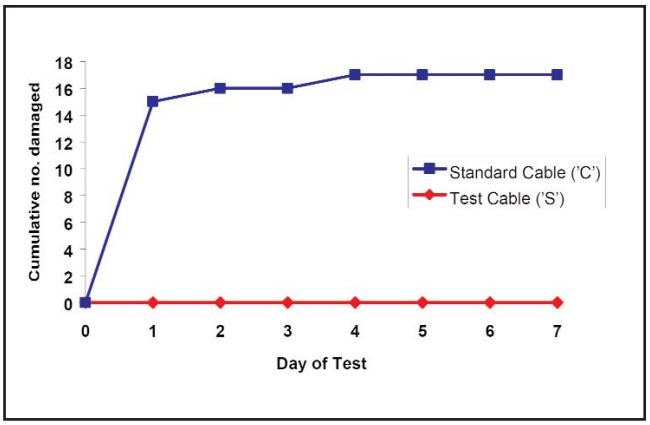
The photos below are taken from an independent report Prysmian commissioned to test the performance of the ARM@CORE design, (please contact Prysmian for a copy of the full report)*.

The cable at the top of the first photo shows the ARM@CORE design (S). The rats can penetrate through the outer sheath but cannot penetrate through the GRP armour. This means the inner core of the cable is fully protected from rodent attack. The bottom cable in the photo is a conventional loose tube cable (C) and was totally destroyed by rats within 7 days. In fact, some standard test cables were destroyed within 24 hours. It also highlights the fact that a nylon sheath offers absolutely no protection from rodent attack.

The ARM@CORE cable uses SM@RTCORE reduced diameter technology and offers a rodent proof cable that is not much larger than a conventional loose tube cable (see diagram on opposite page). This means that flexibility and ease of installation is maintained. The all dielectric design means that lightning strikes and high soil resistivity issues that we experience in Australia are negated, and complicated and time consuming earthing requirements are also not needed.

Rodent attack comparison: Severest attack examples.
ARM@CORE (S) vs. Conventional Loose Tube Cable (C)

Stages of Rodent attack damage from day 1 (top) to day 7 (bottom)
ARM@CORE (S) vs. Conventional Loose Tube Cable (C)



(Left) A simple graph from the report showing the damage done to each cable over the 7 day test period.
C is the Conventional loose tube cable and S is the ARM@CORE cable.

If an all dielectric cable is not required, metallic CST armour can be used to provide a barrier to rodent attack.

A GRP or CST armour also provides good crush strength which may be an added advantage depending on installation conditions. If the direct plough trench is not back filled with sand, and if the local backfill material is rocky or stony, then the additional armour will provide added protection for the cable during back filling. It may also allow the operation to run faster and also provides some insurance if using low skilled labour, or labour not skilled in optic ploughing. A sacrificial sheath can also be added for additional mechanical strength.

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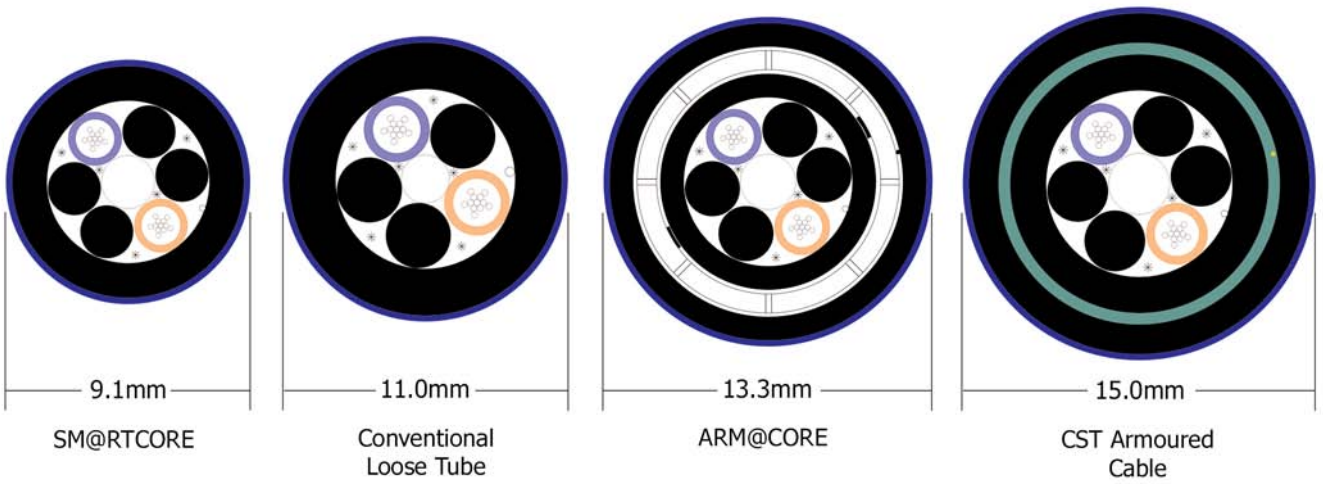

Size comparison: SM@RTCORE, Conventional Loose Tube, ARM@CORE and CST Cables.

The ARM@CORE design is a heavy duty robust loose tube design that has been designed for Australian conditions and Australian rodents and has been proven both in the field and in the lab. We would recommend that overseas designs be viewed cautiously as many have not been designed with Australian rodents in mind and have not been tested in Australian conditions or in the lab using Australian rodents.

Another area of concern with some overseas designs is in regards to OH&S. The Prysmian ARM@CORE cable uses GRP rods to fully armour the cable and offer the robust protection needed to block rodents. Some overseas designs use a tape that incorporates slivers of glass in the tape. The theory is the rats eat into the tape, experience pain as the glass cuts their mouth, and do not proceed to eat it. Working with this tape in the field when terminating the cable may raise OH&S issues.

The cable is a small part of the overall network investment. We recommend that where rats may be a potential concern that an investment is made in a Rodent proof design. The incremental cost of this investment is very small when compared to the total network cost and will mean that the cable is well protected from attack.

** Independent report conducted by the Robert Wicks Pest Animal Research Centre, Queensland Government Natural Resources and Mines. Report titled: "Testing Telecommunication Cables for Susceptibility to Damage by Rodents".*

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