

Engineering insurance and reinsurance

An introduction

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1. Foreword

A well-known dictionary defines engineering as “the activities or function of an engineer” and “the application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people in structures, machines, products, systems, and processes”. Both of these definitions have a strong relationship to the words “engineering insurance”, which the insurance industry uses as a collective term to describe various types of policies for the protection of construction works, as well as the erection and operation of machinery.

There are several specialised publications which deal with the individual lines of engineering insurance, but few which give an overview of this complex and extremely interesting branch. This bulletin attempts to provide a basic introduction to engineering insurance and reinsurance. It is intended for companies and underwriters who as yet have no profound experience in this fascinating field.

2. Engineering insurance – historical reflections

The origins of engineering insurance are to be found in the inspection of steam boilers. In the nineteenth century, in Great Britain during the industrial revolution, the frequent occurrence of explosions involving serious property damage and loss of life made it necessary to take steps to guard against such dangers. In 1854, prominent gentlemen interested in the use of steam decided to form the Manchester Steam Users' Association. Members were entitled to use the services of boiler inspectors who were employed by the association. This organization not only gave advice on how to prevent explosions but also undertook to guide its members in the most advantageous and economical method of using the plant. This principle is still maintained today. Plant owners can call upon the engineer-surveyor for advice and suggestions on plant operation and maintenance.

Though the Manchester Steam Users' Association rendered valuable services, it was not an insurance company. In 1858, however, in response to an evident need, certain members founded the first engineering insurance company, the Steam Boiler Assurance Company. This company started with the insurance of boilers, and its lead was soon followed by the formation of similar companies. At first only boilers were insured, but covers were gradually extended to pressure vessels of various kinds. Engine Insurance (known today as Machinery Breakdown insurance) began in 1872, and both boiler explosion and engine covers rapidly spread to other industrialised countries.

By the beginning of the twentieth century, the first insurance policies for loss of profits following machinery breakdown were being issued. At the same time, erection insurance (covering the on-site erection and assembly of machines) appeared. The policy was on a "named perils" basis and did not cover fire, but it offered reasonable protection for small and medium-sized erection projects.

From 1920 to 1930, some German and British companies introduced a contractors' policy providing insurance cover for buildings and civil works during the course of construction. Based on this policy, Contractors' and Erection All Risks policies were developed. However, neither of these types of policies reached any great importance until after World War II when postwar reconstruction and development brought these covers to their present standing.

With the advance of technology, other engineering policies such as Computer All Risks, Low Voltage and Electronic Equipment All Risks, and Deterioration of Stock following Machinery Breakdown were developed, along with business income protection covers such as Advance Loss of Profits, written in conjunction with Contractors' All Risks and Erection All Risks policies.

Today, new engineering insurance products are being sought. New insurance needs are arising in respect of risks such as prototype machinery, contractual liabilities and guarantees, and certain political risks (expropriation, confiscation, change of law etc) which have so far been considered uninsurable. These needs have been largely brought about by the aftermath of new project finance methods, and the transfer of these risk elements is often imposed by project financiers. In order to meet this demand, new insurance solutions – for example in the fields of non-liquidation, liquidated damages, availability and performance guarantees – have been and are being developed. At Swiss Re, we believe that engineering insurance will continue to evolve. The engineering insurance industry will undoubtedly have to remain flexible and adapt itself to new insurance needs as a result of the huge technological advances which the world is facing.

3. Engineering classes of business – a summary

The classes of business under the collective heading “engineering insurance” can be categorised as either property or business income protection policies; and as either non-renewable or annually renewable covers:

In principle, there are business income protection covers which dovetail with practically all engineering property covers. However, in this publication only the most common types are dealt with, bearing in mind that engineering insurance is essentially a material damage cover.

Property covers	Abbreviation
Contractors' All Risks (synonyms: Builders Risks, Course of Construction)	CAR ¹
Erection All Risks	EAR ¹
Contract Works All Risks	CWAR ¹
Contractors' Plant & Equipment	CPE ²
Machinery Breakdown (synonym: Boiler and Machinery)	MB ²
Boiler & Pressure Vessel Explosion	BPVE ²
Computer All Risks	COMP ²
Low Voltage & Electronic Equipment All Risks	LVEE ²

Business income protection covers

Advance Loss of Profits in conjunction with CAR, EAR, CWAR	ALOP ¹
Loss of Profits following MB	MLOP ²
Deterioration of Stock following MB	DOS ²

¹ = Non-renewable (or one-off) covers

² = Annually renewable covers

Some of the policies are of the broad, all risks type (property insurance against physical damage by all risks of loss except those specifically excluded), which offer protection against human and technical errors and the perils of nature. Certain combinations of cover are also possible: for example cover for contractors' plant and equipment may be endorsed to CAR, EAR and CWAR policies, or boiler and pressure vessel explosion to an MB policy.

Annually renewable engineering property and business income protection covers are also encountered under Industrial All Risks (IAR) policies – a multiline package policy which can include fire, marine, liability and engineering. It is usually bought by large industrial or commercial enterprises to protect all of their installations, whether at home or abroad. Policy forms are either standard or tailor-made although one form customarily dominates in each country. The main problem lies in interpreting the cover: all possible risks – even unknown ones – are insured unless explicitly excluded. Loss adjustment can also cause headaches, especially in the field of business income protection. Therefore, if written, it is imperative to ensure that the cover concept is transparent, that the IAR policy does not undermine the conditions usually applicable to the respective mono-line covers, that risk assessment is carried out separately for each type of mono-line, that the premium is commensurate with the risk, and that no technically unjustified discount is given.

4. When does engineering insurance begin?

Most projects usually start with a feasibility study. The CAR, EAR or CWAR policy (sometimes in conjunction with an ALOP cover) incepts at the beginning of the construction or erection phase and ends upon completion of the project. Then, depending on the type of risk, one or more of the annually renewable types of engineering policies provide cover during the operational phase. The exception to this flow is the annually renewable CPE policy which, depending on what is actually insured, may be in force during either the construction/erection phase or the operational phase, or both.

From feasibility study to operation

Off-site activities		On-site activities	
Phase	Feasibility study Design Manufacturing	Transport	
Possible covers	Fire & Extended Coverage Professional Indemnity	Marine Storage	
		Construction Erection Commissioning/testing	
		Operation	
		Contractors' All Risks (CAR) Erection All Risks (EAR) Contract Works All Risks (CWAR) Advance Loss of Profits (ALOP) Contractors' Plant and Equipment (CPE)	Fire & Extended Coverage Fire Loss of Profits Liability Contractors' Plant and Equipment (CPE) Boiler and Pressure Vessel Explosion (BPVE) Machinery Breakdown (MB) Loss of Profits following MB (MLOP) Deterioration of Stock following MB (DOS) Computer All Risks (COMP) Low Voltage and Electronic Equipment All Risks (LVEE)
		Engineering insurance involvement	
		Engineering covers	

5. Non-renewable (one-off) covers

Non-renewable policies are concluded for projects under construction and/or erection. The sums insured for such projects can easily reach millions of dollars, resulting in a real need for insurance cover for principals and contractors alike. In some markets, it is compulsory to insure construction and erection projects. Most financial institutions will not provide financing unless the project is protected by a suitable policy.

The period of insurance for all non-renewable covers – that is, the construction/erection phase of a project – commences immediately after the unloading of property to be insured on the site, or with the onset of the insured contract work. It ends for any part of the contract works when handed over to the principal, or when taken into use, or on the date specified in the policy wording, whichever occurs first. Therefore, the actual period of insurance is determined by the construction/erection time schedule.

All non-renewable policies have certain general conditions and general exclusions. Some of the main points are as follows:

General conditions

- The insured shall take all reasonable precautions to prevent loss, damage or liability and to comply with sound engineering practise, statutory requirements and manufacturers' recommendations designed to ensure the safe working of plant and equipment. Furthermore, the insured must also maintain in efficient condition all contract works, plant, machinery and equipment insured by the policy.
- The insured is obliged to immediately inform the insurers of any material change of risk (changes in the sums insured, construction/erection time schedule, design criteria etc). This is extremely important because such material changes in the risk itself can affect the insurer's exposure, and thus it may have an effect on the terms and conditions previously agreed for the risk.

- In the event of any occurrence which might give rise to a claim under the policy, the insured must immediately advise the insurers and supply all particulars and proofs of claim as may be required.

General exclusions

- Liquidated damages or penalties for delay or detention, or in connection with guarantees of performance and efficiency; loss of market.
- Wilful act or omission or gross negligence of any director, manager or responsible site official.
- Nuclear risks: losses arising from ionising radiation or contamination by radioactivity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, as well as losses caused by or contributed to or arising from nuclear weapons material.
- Political risks such as war, civil war, civil commotion, etc.

The common features of projects insured under non-renewable policies are normally limited to similarities in construction/erection and/or the type of risk. However, this is not sufficient to establish premium rates. The topography, geology, hydrology and natural perils exposure of each particular risk, fire protection measures, and several other technical factors, all have a considerable influence on hazards during construction/erection, and thus on the premium rate. Therefore, except for simple, homogeneous risks such as one-storey or two-storey residential houses, it is not possible to establish rating manuals with fixed tariffs. More complicated risks must be assessed individually. Rating guides based on experience and statistical analysis help the underwriter to assess risks, but the final premium rate must be determined individually using information provided by the insured. To ensure that information is supplied in complete and useful form, the insurer provides detailed questionnaires to be filled out, and may request plans and drawings.

5.1 Contractors' All Risks insurance (CAR)

Contractors' All Risks (CAR) insurance policies cover all types of building and civil engineering construction and offer protection against the hazards which may threaten works under construction. Most construction projects include certain elements of machinery erection (eg installation of air conditioning and lifts in buildings). If such erection works are of an ancillary nature (not over roughly 10 – 20% of the total project value) they can be insured under the CAR policy, thereby making it unnecessary to issue an additional EAR, or a CWAR (Contract Works All Risks) policy.

Cover

The policy provides cover on an all risks basis for physical loss or damage to the insured property, providing such loss or damage is of an unforeseen and accidental nature, and is not otherwise excluded from the scope of the policy.

Insured parties

In most cases, the project as a whole is insured. Therefore, the insured parties (principal or employer, contractors and sub-contractors) are considered as one entity (the "joint insured").

Main hazards

The main hazards covered are: fire and explosion, theft, burglary, collapse, earthquake, seaquake, landslides, storm and flood. Certain perils (especially forces of nature) obviously vary from location to location, and the likelihood of loss or damage is also influenced by the actual type and method of construction.

Particular exclusions

In addition to the general exclusions, CAR policies also exclude normal making good, normal upkeep, consequential loss of any kind or loss of use, damage to plans, losses only discovered during the course of an inventory, wear and tear, corrosion, erosion, deterioration due to lack of use, and normal atmospheric conditions. The basic policy wording also excludes damage caused by defects in design, plans or specifications, as well as direct damage caused by defective material or bad workmanship.

Sum insured

The sum insured is the anticipated value (usually referred to as the "total contract value") of the completed works including materials, salaries, transport, custom duties and taxes, plus the value of any material or labour supplied by the principal. During the course of construction, the insured is obliged to advise the insurers immediately of any change in the sums insured. Upon completion of the project, the final total investment is declared, making it possible to adjust the provisional premium that was initially charged on the basis of the anticipated total contract value.

Loss settlement

Loss settlement is made on the basis of valid bills, documentary evidence and justification, as the case may require. The cost of any provisional repairs will only be borne by the insurer if such repairs constitute part of the final repairs and do not increase the total repair costs. The cost of any alterations, additions and/or improvements which may be undertaken as a result of any loss or damage are not indemnifiable.

In repairable damage cases, the basis for loss settlement is the cost of the repairs necessary to restore the property to its condition immediately before the covered occurrence, less salvage. Total losses are settled at the actual value of the property immediately before the loss occurred, less salvage – but never exceeding the sum insured stipulated in the policy, of course.

Claims are subject to a monetary excess, or deductible, borne by the insured. Most policies stipulate different excesses according to defined groups of perils, eg major perils (loss due to forces of nature or collapse); consequences of defective material/workmanship; and all other types of claims. The reasons for excesses are twofold: firstly to eliminate small claims, where administration costs often can exceed the claimed amount itself; and secondly, to ensure that the insured will comply with his obligation to avoid claims by taking all reasonable precautions to prevent loss or damage.

Third party liability

Contractors and subcontractors should have annually renewable general liability policies to protect their construction activities against claims made by third parties. However, in some countries it is common for CAR policies to include a restrictive third party liability section. This section protects the insured against third party claims for any bodily injury or property damage caused by construction activities. The intention behind a CAR policy's third party liability section is not to replace Contractors' General Liability policies. The section should operate as a subsidiary cover only, and there are a number of important exclusions:

- Expenditure incurred in repairing or replacing any work or property covered or coverable under the material damage section of the policy.
- Liability arising out of loss or damage to any property or land or building caused by vibration, or by the removal or weakening of support, or injury to any person or property occasioned by or resulting from any such damage. (Under certain circumstances and against payment of additional premium, this exclusion may be waived – and limited cover offered – by way of an endorsement to the policy.)
- Also excluded is liability arising out of:
 - a) bodily injury to, or illness of, the employees or workmen of the contractor(s), or the principal, or any other firm connected with the contract work;
 - b) loss or damage to property belonging to, or held in the care, custody or control of, the contractor(s), or the principal, or any other firm connected with the contract works, or of any employee or workman of one of the aforesaid;
 - c) any accident caused by vehicles licensed for general road use, or by waterborne vessels or aircraft;
 - d) any contract or agreement, unless such liability would have attached in the absence of such contract or agreement;
 - e) technical or professional advice given by the insured or by any person acting on behalf of the insured.

5.2 Erection All Risks insurance (EAR)

Erection All Risks (EAR) policies cover the erection of individual machines or complete plants – ranging from complete power stations to lifts and air conditioning equipment. The policy wording is similar to CAR. Many erection projects call for a certain amount of ancillary construction work (eg foundations for the machines to be erected, or a building to house them). If the value of such construction work does not exceed approximately 10–20% of the total project value, it can be covered under the EAR policy together with the machinery.

Cover

EAR policies provide protection on an all risks basis, including cover for the testing and commissioning of the erected machines – providing that they are not considered prototypes. Similar to CAR, EAR covers physical loss or damage of an unforeseen and accidental nature, which is not otherwise excluded from the policy. In contrast to CAR, however, EAR policies also cover faults in erection (ie bad workmanship occurring at the erection site itself).

Insured parties

The insured parties are as in CAR, with the addition that the machinery manufacturer may be included as an insured party if he performs a function on the erection site. However, cover is limited to accidents originating from on-site activities. The off-site design work and actual manufacturing of the machines at the manufacturer's premises are not covered.

Main hazards

The variety of hazards threatening erection works vary according to the type of works and location. If machinery erection takes place in buildings – and many projects do – the exposure to forces of nature (except flood and earthquake) is usually less pronounced than in CAR. One main hazard is fire or explosion, especially during the final erection phase when values at risk accumulate, or during testing when raw materials and/or feedstock are introduced. Equally serious is machinery breakdown during the testing and commissioning period. The possibility of substantial mechanical damage occurring during this phase should not be underestimated.

Exclusions

The exclusions are basically the same as under CAR policies.

Sum insured

As in CAR, the initial sum insured is the anticipated value of the completed works. If necessary, it must be adjusted during the course of erection. The final total investment is declared upon completion of the project. This permits final adjustment of the provisional premium, which is charged initially on the basis of the anticipated total contract value.

Loss settlement and third party liability

The comments made for CAR are also valid for EAR.

Definitions***Cold-testing (functional testing)***

The checking of parts and elements of insured property by mechanical, electrical, hydrostatic, or other forms of testing under “no load” conditions. Correct rotation of electrical motors is to be checked before coupling them to machines. Cold testing excludes the operation of furnaces or the application of any direct or indirect heat, the use of feedstock or other material for processing. In electrical power stations, cold testing excludes connection to a grid or other load circuit of electrical generating, transforming, converting or rectifying equipment.

Hot-testing (operational and commissioning tests)*

The checking of parts, elements and/or production lines of insured property under full or partial load and normal or simulated operational conditions including the use of feedstock or other material for normal processing or other media for load simulation. In electrical power stations, hot-testing means checking after connection to a grid or another load circuit of electrical generating, transforming, converting or rectifying equipment.

Commissioning*

The taking into operation or the putting under load of insured property or any part thereof with feedstock or other materials for processing; or in electrical power stations, the connection to a grid or other load circuit of electrical generating, transforming, converting or rectifying equipment.

Commissioning test, acceptance test*

Operation of insured property under production conditions for the purpose of attaining performance (quantity, quality) specification requirements.

* For insurance purposes, these three definitions are collectively known as the “Testing Period”.

5.3 Contract Works All Risks insurance (CWAR)

In some projects the sums insured for the construction part of a project and the erection part can be roughly equal: an example would be a hydroelectric power plant including the construction of a dam, river diversion and powerhouse buildings, and the erection of turbine generators with coolers, exciters and all auxiliary equipment. This normally entails issuing two separate policies – one for the construction works and one for the erection of the machinery. However, there is another possibility: In order to close any possible gaps in cover and to reduce administration, Swiss Re have developed a Contract Works All Risks policy which is a combination of the Contractors' All Risks and Erection All Risks policies. The insurance protection offered is as described under Contractors' All Risks and Erection All Risks policies (Chapters 5.1 and 5.2).

5.4 Extensions of cover and special clauses

There are numerous extensions of cover and special clauses which can be applied to CAR, EAR and CWAR policies. Application mainly depends upon the type of work to be done and the project location. The extensions of cover and special clauses are endorsed to the basic policy wording by way of specially worded endorsements. Only the most important and frequently used of these are described here.

Extensions of cover

Maintenance

The works contract (that is, the contract between the principal and the contractor which details the work to be carried out) often specifies a maintenance period (also referred to as the defects liability period) which begins at the time the works are provisionally handed over to the principal (ie when construction/erection work is completed), and ends when the works are finally handed over. Contractors often require insurance cover for these maintenance obligations, which usually last from 6 to 24 months. It is possible to give such cover by adding an endorsement to the construction or erection policy. There are two main types of maintenance cover: (a) “visits maintenance”, which covers damage which the contractor causes directly, when he is on-site with the purpose of complying with his maintenance obligations; and (b) “extended maintenance”, which provides the same cover as visits maintenance, plus cover for damage caused by the contractor during the construction/erection period but first discovered during the maintenance period. Both of these endorsements exclude loss or damage resulting from normal, regular duties associated with the proper upkeep and operation of the insured property (including normal plant management duties and instruction or training of the operating staff), no matter what the contractor's contractual obligations may be in this regard.

Furthermore, as it is usual for the principal or owner to conclude a cover for fire and extended perils upon completion of the project, maintenance endorsements will normally not be called upon to pay for fire and natural perils losses during the maintenance period.

Debris removal

Although debris removal may be found as an extension of cover, it is usually included in the basic policy wording. This cover is for the costs incurred by the insured for the clearing, removal and/or disposal of debris (eg bricks and rubble after the collapse of a building) following an event which is insured under the policy. The removal of other (extraneous) debris is also covered, providing such removal is made necessary by an indemnifiable loss (for example, the removal of silt following flooding). The limit of indemnity is expressed as a monetary limit per event; depending on the type of risk and location, it usually ranges between 1% and 10% of the total contract value.

50/50 clause

Goods in transit to the construction/erection site – especially if they are imported – are usually covered under a marine policy. Upon arrival at the site, such goods must be inspected for possible damage during transit. However, if the goods are to be left in their packing until later, the packing is inspected visually, and if any external sign of damage is found, the goods must be unpacked and inspected immediately. Claims for any damage revealed by such an incoming inspection can be lodged under the marine policy. However, if damage is discovered when the goods are unpacked at a later date, and it is not possible to establish whether the damage was caused before or after their arrival, settlement is made 50/50 under marine and construction or erection policies.

Existing property

Quite often, existing property is already located on the construction or erection sites, or in the immediate vicinity. If such property belongs to the insured – the principal and/or the contractor(s) – or is in their care, custody or control, it obviously cannot be considered third party property. However, it is possible to insure such property against loss or damage directly due to the construction, erection or testing of works covered under the material damage section of the construction or erection policy. Loss or damage is not covered if it is caused by forces of nature, or is due to any cause not related to the contract works. All consequential losses are also excluded from cover. The limit of liability is usually expressed as an aggregate limit for the period of insurance.

Contractors' Plant and Equipment

Most contractors conclude a separate policy for the plant and equipment they use in the construction or erection of a project. A separate policy is preferable because the cover is not limited to one particular site, as is the case with a construction or erection policy. However, sometimes the principal or contractor will prefer to include their plant and equipment under the construction or erection policy – especially if special plant is needed to do the job. Such inclusion is possible by way of a policy endorsement which must include a list – periodically updated – of the items covered. The period of insurance commences with the arrival of the plant on site and ends after notification to the insurer upon its withdrawal.

Expediting costs

Following an indemnifiable claim under the construction or erection policy, the contractor may have to order overtime, night shifts or work on public holidays; or it might be necessary to have goods delivered by express freight to keep the work on schedule and avoid payment of

late completion penalties. These costs can be covered by way of a policy endorsement. The sum insured is either expressed as a limit of indemnity per event or a percentage of the repair cost of any damage. The cover may be extended to include the cost of delivering goods by air freight.

Manufacturer's Risk (defects in design, material and workmanship)

There are a number of clauses which provide various degrees of cover for defects in the design, material and workmanship of a project. In most cases only the consequences of such defects are covered which means that the faulty part itself is excluded. For example, if during testing one of the blades attached to the rotor of a turbine generator set flies off, only damage to the rotor and/or the turbine casing is covered. The clauses replace the corresponding exclusions in the basic policy wording. An example of a clause providing cover for consequences of defective design material and workmanship is as follows:

“This policy excludes loss of or damage to and the costs necessary to replace repair or rectify:

- a) Insured property which are in a defective condition due to a defect in design plan specification materials or workmanship of such insured property or any part thereof.
- b) Insured property lost or damaged to enable the replacement repair or rectification of insured property excluded by a) above.

However paragraph a) above shall not apply to other insured property which are free of the defective condition but are damaged as a consequence thereof”.

Cross liability

This extension of cover attaches to the third party liability section of a CWAR, CAR or EAR policy. The widely used term “cross liability” often leads to confusion about what is actually covered:

“separate insured liability” would probably be a more accurate expression. The purpose of the endorsement is to specify that any person or body who is named as the insured in the policy schedule shall be considered as a separate and distinct entity. This means that the words “the insured” shall be considered as applying to each such person or body, just as if a separate third party liability policy had been issued to each of them in his name alone. However, in no event shall any insured be considered as a third party. Thus, if one named insured breaches the policy conditions, this will result in avoidance of the policy for him; however, third party liability cover will still remain in force for the other named insureds who have not breached the conditions of the policy.

Vibration, Removal or Weakening of Support

This is also an extension of cover attaching to the Third Party Liability section of CWAR, CAR or EAR policies. It extends liability to include the total or partial collapse or imminent danger of collapse to third party buildings and structures caused by vibration or by the removal or weakening of support, subject to certain conditions which include:

- The preparation of a report at the expense of the insured on the condition of any endangered building or structure in the vicinity of the works under construction or erection. The report must indicate any existing defects and be submitted to the insurers.
- The condition of any endangered building or structure must be sound or the necessary loss prevention measures must have been taken at the insured's expense prior to the commencement of the works which could endanger the third party property.

The endorsement does not cover damage to buildings or structures under demolition or declared by the relevant public authority to be dangerous; superficial

damage (eg cracks not impairing stability); damage which occurred prior to the commencement of the insured's operations or caused by an event not related to the insured works; claims directly or indirectly caused by loss or damage to underground services (pipes, cables etc.), roads, pavements and other slab-on-ground structures; or swimming pools.

Special clauses

Existing underground cables

Existing underground facilities (electric cables, telephone cables, water and gas pipes, sewers etc) are often present at construction/erection sites, and sometimes they have to be relocated before construction/erection commences.

However, no matter whether they have to be relocated or not, it is obviously the insured's duty to find out whether such underground facilities run through the site or in its vicinity, in order to avoid damage. The purpose of this special clause is to ensure that the insured takes all possible steps to locate such underground facilities. Therefore, repair costs following accidental damage to underground facilities are only indemnifiable if the insured has: (a) requested and obtained the exact position of all cables/pipes from the public authorities or owners of such underground facilities; and (b) traced their existence and indicated their location on the site. Consequential loss is not covered.

Used machinery

The erection of used (second-hand) machinery presents a special risk because it is no longer under the manufacturer's guarantee in most cases. Quite often it is not possible to determine whether the machinery is in first-class condition. Therefore, losses due to previous operation and testing/commissioning should be excluded from policy coverage. In addition to these points, the Used Machinery policy endorsement also excludes damage caused by dismantling, except in cases where dismantling has been insured under the same policy as

the re-erection. However, even then, it should be noted that there is no cover whilst the dismantled machinery is being refurbished or whilst it is in transit from one site to another. Marine insurance should be arranged to cover the latter peril.

Fire prevention measures

During construction and erection, the insured property is usually not so well protected against fire losses as compared with a completed and operational risk. The purpose of the Fire Prevention Measures endorsement is to ensure that certain basic measures are indeed taken in order to prevent fires. Such basic measures include the immediate removal of waste material, empty boxes, waste wood, paper etc from buildings and construction/erection works; or the relocation of any such material, until permanent removal, to the site's "safe" side (with respect to the direction of prevailing winds); the readiness of a firefighting crew and firefighting equipment before any machinery, equipment or interior furnishing is stored or installed in the bare structure of buildings or machine rooms; the presence of a watchman equipped with fire extinguishing equipment; and a direct communication line to the fire alarm centre whenever hot work is done (such as welding, flame cutting, the use of open fire for the application of hot coatings etc).

Construction of pipelines, conduits and mains

Trenches are excavated prior to the installation of pipelines, cables etc; and in order to avoid excessive damage due to the forces of nature (especially water), it is common practise to restrict the length of trench which may be open at any one time. The corresponding policy endorsement stipulates the lengths of individual trenches, as well as the total length of all trenches combined, which may be totally or partially open at any one time. In the event of a claim, only damage which occurs to the agreed length of totally or partially open trenches is indemnifiable. In the case of pipelines which have been partially laid but not properly connected, the endorsement also states that the open ends of the pipes shall be provisionally sealed at the end of each working day or when there is any immediate danger of flooding. Otherwise, the expenses for clearing and cleaning pipe sections of mud or silt are not covered.

Road construction

Similar to the construction of pipelines, conduits and mains, roads without final surfacing are susceptible to water damage (the base materials washing away). Therefore, the road construction endorsement restricts policy liability to certain agreed lengths of work faces which are uncompleted at any one time.

5.5 Advance Loss of Profits insurance (ALOP)

This type of insurance may also be encountered under the name CAR/EAR Loss of Profits, Delayed Earnings Insurance, Delayed Opening of Business, Delay in Start-up, Loss of Rent, and Loss of Interest. It is a business income protection cover with the aim of covering the principal's loss of gross profit resulting from a delay in completion of the construction and/or erection works. A prerequisite for granting ALOP is for an underlying CAR, EAR or CWAR policy to be in force. Normal working delays are not covered under ALOP.

Cover

Cover is limited to the actual loss of gross profit sustained resulting from a delay in the completion of the project; the delay itself must be caused by a loss covered under a CAR, EAR or CWAR policy. However, the ALOP cover does not embrace the full extent of perils covered under CAR, EAR and CWAR policies (see the exclusions).

Insured party

The insured party is only the principal or owner of the project to be constructed or erected as defined in the underlying CAR, EAR or CWAR policy.

Exclusions

The special exclusions for ALOP are that insurers shall not be liable for losses resulting from delay due to:

- extensions and alterations of coverage as granted to the material damage sections of CAR, EAR and CWAR policies, unless otherwise specifically agreed in writing;
- restrictions imposed by public authorities;
- alterations, modifications and improvements to the insured works that were effected after the occurrence of the material damage accident;
- shortage of funds, penalties, delays of supplies, late completion, non-completion, loss of contract;
- loss or damage to existing property or objects in the care, custody or control of the insured; loss or damage to the contractors' plant and equipment; loss or damage to operating media and feedstock;
- earthquake, volcanic eruption, tsunami, hurricane – unless otherwise agreed in writing.

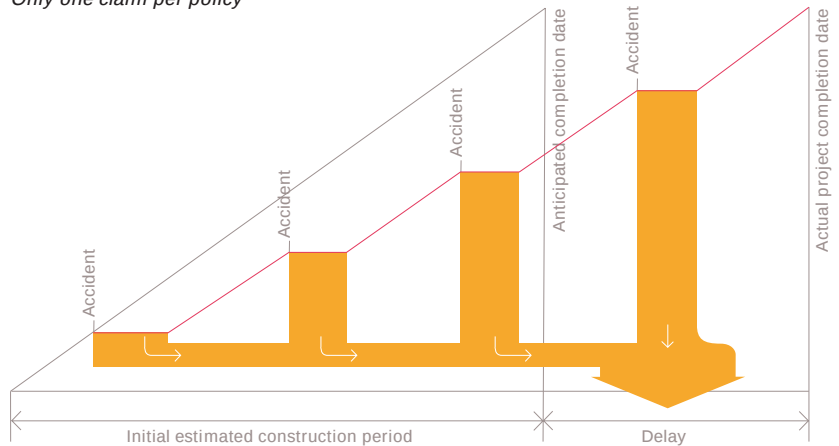
Sum insured

The sum insured is usually either the expected annual gross profit, revenue rent or fixed costs which obviously have to be defined case by case.

Period of insurance

The period of insurance is identical to that of the underlying CAR, EAR or CWAR policy, excluding the maintenance period.

Only one claim per policy



There can be no more than one claim under ALOP cover. This is because there is only one project completion date, regardless of the number of material damage losses. It is this single delay that triggers the insured's single ALOP claim.

Loss settlement

The period of delay – which serves as the basis of indemnity – starts at the date on which the project would have been completed had no accident occurred, but not earlier than the originally planned completion date of the construction and/or erection works as defined in the CAR, EAR or CWAR policy schedule. It ends with the actual date on which the project is completed, but not exceeding the length of time it takes with the exercise of due diligence and dispatch to rebuild, repair or replace such part of the property which has been lost or damaged to its condition immediately prior to the

occurrence of the accident. After receipt of sufficient evidence that a delay has been caused by an accident insured under the CAR, EAR or CWAR policy, indemnification is made on the basis of the actual incurred loss of gross profit or rental income for the actual period of delay. However, this period must not exceed a certain period of indemnity (usually 12 months) which is agreed upon inception of the policy. As the ALOP policy is subject to a time excess, the indemnifiable amount has to be reduced in the same proportion as the period of delay less the time excess bears to the period of delay.

6. Renewable covers

Renewable covers are concluded for installations, equipment and machinery once they are ready for commercial operation, ie after completion of construction/erection and upon successful testing and commissioning. Policies are usually renewable annually. Hence, contrary to non-renewable covers, it is possible to review the terms and conditions every 12 months.

Such policies have their own peculiarities in respect of the actual scope of cover granted. These are more fully described in the following chapters on the individual types of cover generally available. However, similar to non-renewable covers, all renewable policies are subject to certain general conditions and general exclusions. Some examples are as follows:

General conditions

- The insured shall take all reasonable steps to maintain the insured property in efficient working order and to ensure that no item is habitually or intentionally overloaded. The insured shall fully observe the manufacturers' instructions for operation, inspection and overhaul, as well as governmental, statutory, municipal and all other binding regulations in force concerning the operation and maintenance of the insured plant and machinery.
- In the event of any material change in the original risk; alteration, modification or addition to an insured item; departure from prescribed operating conditions, whereby the risk of loss or damage increases; or changes in the insured's interest (such as discontinuation or liquidation of the business, or being placed in receivership), the policy shall be voided unless its continuance is agreed in the form of an endorsement signed by the insurance company.

- In the event of any occurrence which might give rise to a claim under the policy, the insured must immediately advise the insurers and supply all particulars and proofs of claim as may be required.

General exclusions

- Damage arising out of wilful act, wilful negligence by the insured or its management.
- Faults or defects existing at the time of commencement of the insurance policy which are within the knowledge of the insured or its management.
- Loss or damage for which the manufacturer or supplier of the property is responsible either by law or under contractual obligations.
- Nuclear risks: losses arising from ionising radiation or contamination by radioactivity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, as well as losses caused by, or contributed to, or arising from nuclear weapons material.
- Political risks such as war, civil war, civil commotion etc.

In many cases it is easier to establish correct premium rates for renewable covers than for non-renewable risks because proven machinery have many common features and are often subject to similar claims. Therefore, statistical analysis has enabled premium rating manuals to be established for various types of machine or branches of industry. However, due to fast technical developments, underwriters today face large problems in rating new or prototype machinery, for here little or no statistical analysis is available. Thus in such cases, the involvement of an engineer with in-depth knowledge of the new technology is indispensable.

6.1 Contractors' Plant and Equipment insurance (CPE)

Construction and erection works often call for the use of heavy, specialised machinery such as tunnel boring machines, earthmoving equipment, cranes, pumps, air compressors etc. It is possible to cover such plant and equipment by way of an appropriate endorsement under CAR, EAR or CWAR policies. However, specific items of plant are usually only on one construction/erection site until the particular job for which they are designed for is completed. Obviously, such jobs do not last for the whole construction/erection period and the plant is moved on to the next site as soon as its job is finished. Therefore, in most cases, cover granted by means of an endorsement to the CAR, EAR or CWAR policy would not be suitable, because such policies are limited to loss or damage caused at one particular construction/erection site only. It is preferable to issue an annually renewable Contractors' Plant and Equipment policy, because it caters for plant and equipment used at different locations.

Cover

Cover is on an "all risks" basis, and is basically for unforeseen and accidental physical loss or damage due to external causes (see the particular exclusions).

Insured party

The owner of the insured plant and equipment.

Main hazards

The main hazards are: fortuitous working accidents, fire, burglary, theft, faulty operation, natural perils such as earthquake, storm and flood, collision and overturning.

Particular exclusions

In addition to the general exclusions, CPE policies exclude mechanical and electrical breakdown. However, if an accident occurs as a result of such a breakdown, these consequences are indemnifiable. Further exclusions are: normal wear and tear; lack of oil or coolant; deposits of rust; exchangeable tools and parts; fuel etc; vehicles licensed for general road use; waterborne vessels; total or partial emersion in tidal waters.

Sum insured

The sum insured is the new replacement value of all plant and equipment insured under the policy, including all freight costs, custom duties and erection costs.

Loss settlement

In case of a partial loss (ie a claim which does not exceed the actual value of the machine at the time of the accident), all repair costs are indemnified which are necessary to restore the machine to its operating condition immediately before the accident (less the agreed excess carried by the insured). Should the actual value of the machine or part thereof be increased due to the repairs, the indemnifiable amount is reduced by taking depreciation into account.

In case of a total loss (ie when the damage exceeds the actual value), the indemnity is the actual value at the time of the loss (less the excess and any salvage).

Depreciation is a very important factor in the settlement of plant and equipment claims. Especially in the case of mobile plant, working environments are often extremely hard. Consequently, many types of plant have a limited life span and depreciation is much more rapid than for stationary machines.

6.2 Boiler and Pressure Vessel Explosion insurance (BPVE)

This type of insurance provides protection against the dangers of explosion and collapse of boilers and pressure vessels. The policy is widespread in markets influenced by the United Kingdom. It is not so well known in other markets where cover is more often provided by way of a Machinery Breakdown and Fire policy.

Cover

The cover embraces material damage to boilers and pressure vessels. In addition, it includes cover for material damage to other property belonging to the insured, third party property damage, and fatal or non-fatal injuries to third parties not employed by the insured, always providing that such loss is a consequence of a boiler or pressure vessel explosion or collapse. However, the classical policy excludes damage or liability caused by fire preceding or following explosion, as well as natural hazards such as wind-storm, typhoon and hurricane, or volcanic and seismic events.

By way of policy endorsement, flue gas explosion (explosion of ignited flue gases in boiler furnaces, flues or stacks) may be covered.

Insured party

The insured party is the owner of the plant.

Main hazards

As the name says, the main hazards are explosion and collapse, which are often caused by excessive internal pressure or lack of water. The definitions of these terms are as follows:

- Explosion: the sudden and violent rending of the plant by force of internal steam or other fluid pressure (other than pressure of ignited flue gases unless otherwise agreed in writing) causing bodily displacement of any part of the plant together with forcible ejection of contents.

- Collapse: the sudden and dangerous distortion (whether or not attended by rupture) of any part of the plant caused by a crushing stress by force of steam or other fluid pressure (other than the pressure of ignited flue gases unless otherwise agreed in writing).

Particular exclusions

The most important particular exclusions are damage or liability caused by: explosion of flue gas (unless otherwise agreed: see “Cover”), hydraulic tests; other tests exceeding the maximum pressure permitted by the inspecting authority; wilful setting of safety valves above that specified by the authorities; failure of individual tubes; and wear and tear.

Sum insured

The classical BPVE policy usually embraces three different sums insured:

- material damage (value of the boilers and/or pressure vessels);
- surrounding property (limit of indemnity);
- third party liability (limit of indemnity).

Some BPVE policies show only one overall sum insured for the three covers. In such cases, indemnification follows the same sequence until the overall sum insured is exhausted: for example, if the overall sum insured is fully used for the material damage loss, there is no cover for surrounding property or third party liability.

Loss settlement

The basis of loss settlement for material damage claims is the cost of repairs necessary to restore the property to its condition immediately before the accident occurred, less salvage or – in case of total loss – the actual value of the property, also immediately before the accident occurred. Surrounding property and third party liability claims are settled in accordance with the actual loss, subject to the limits of indemnity. An agreed monetary excess is deducted from the indemnifiable amounts.

6.3 Machinery Breakdown insurance (MB)

Machinery Breakdown (MB) insurance offers protection against sudden and unforeseen physical loss or damage to machinery which has been erected and is operational or at rest. It is basically an accident insurance and cannot be construed as a “life insurance” for machines. This is because machines have only a limited life span due to wear and tear: therefore, machinery owners must depreciate their machines annually and establish reserves for replacement.

Cover

Following an insured event, the policy pays for all repair costs, provided the cost of repair does not exceed the actual value of the machinery at the time of the loss. In the case of a total loss (ie when the repair costs exceed the actual value of the machinery), the actual value is indemnified.

Insured party

The owner of the machinery.

Main hazards

The main causes of damage covered under MB policies include: fortuitous working accidents; a machine's tearing apart due to centrifugal force; short circuits; defects or faults in design, material or manufacturing; and incorrect operation.

Particular exclusions

In addition to the general exclusions, MB policies also exclude corrosion, erosion, wear and tear; breakdown due to testing or intentional overloading; damage for which the manufacturer or supplier is responsible either by contractual obligations or law; exchangeable and consumable items such as fuel, tools, belts, cutting edges etc; hazards covered under other types of insurance such as fire, explosion, earthquake, theft, burglary etc.

Sum insured

The sum insured is the new replacement value of the insured machinery which can be defined as the cost of replacing a machine by a new one of the same capacity, including transport and erection costs as well as taxes and customs duties.

Loss settlement

More than 90% of MB claims are partial losses. In case of a partial loss (ie a claim which does not exceed the actual value of the machine), all repair costs are indemnified which are necessary to restore the machine to the operating condition immediately before the accident occurred, less the agreed excess, which is borne by the insured, and any salvage. The indemnity includes the costs of new parts where necessary, dismantling and re-erection costs, ordinary freight charges, and custom dues and taxes. However, whenever the actual value of a machine or part thereof at the time of the loss is increased by the repair, the indemnifiable amount is decreased by taking depreciation into account. This refers in particular to the rewinding of electrical motors, re-blading of rotors etc.

In the very rare case of a total loss (ie when the damage exceeds the actual value), the indemnity is the actual value at the time of the loss, less the excess and salvage.

6.4 Loss of Profits following Machinery Breakdown insurance (MLOP)

Similar to Loss of Profits following Fire, MLOP covers the financial consequences of a machinery breakdown.

Cover

The cover is limited to the actual loss of gross profit sustained due to a loss covered under an MB policy, and also insures costs incurred in reducing the amount of a claim.

Insured party

The insured party is the owner of the machinery as defined in the MB policy.

Particular exclusions

The particular exclusions are basically the same as in the MB policy. In addition, the MLOP policy does not cover any increase of loss of gross profit due to: bodily injury; circumstances which are in no causal connection with the accident (eg delay incurred in obtaining import licences, foreign exchange etc); extensions or improvements of the machinery effected after the occurrence of the accident; lack of capital; or any restrictions imposed by public authorities.

Sum insured

The sum insured is the gross profit which is the annual total of net profit and standing charges. If required, cover can be extended to include wages and salaries which are added to the standing charges. The total sum insured is

determined every year on the basis of the insured's accounts. As exact figures are not known until after the end of the year, the sum insured is calculated provisionally, on the basis of the preceding year's accounts. This provisional figure usually includes a safety margin in order to avoid underinsurance. When the exact figures become available, an adjustment is made.

Period of insurance

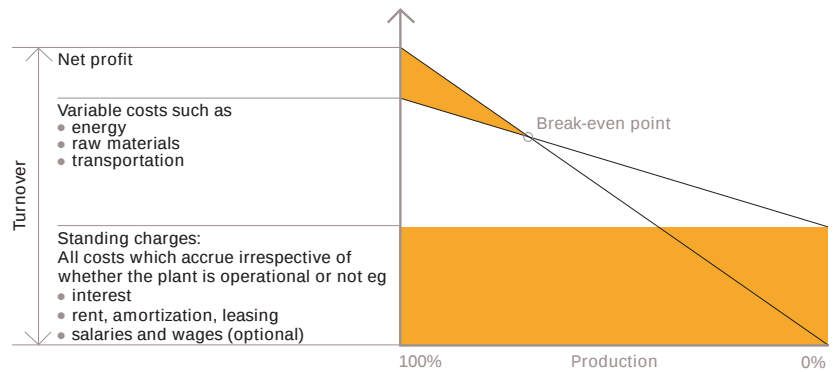
The period of insurance is identical to that of the underlying MB policy – usually one year. Though the actual period of indemnification may vary from case to case, it rarely exceeds 12 months.

Loss settlement

The settlement of claims in plants with very regular production using common production lines is fairly straightforward. In plants with fluctuations of production and/or where the loss may be reduced by using existing reserve capacity during or after an insured event, settlement becomes rather complex.

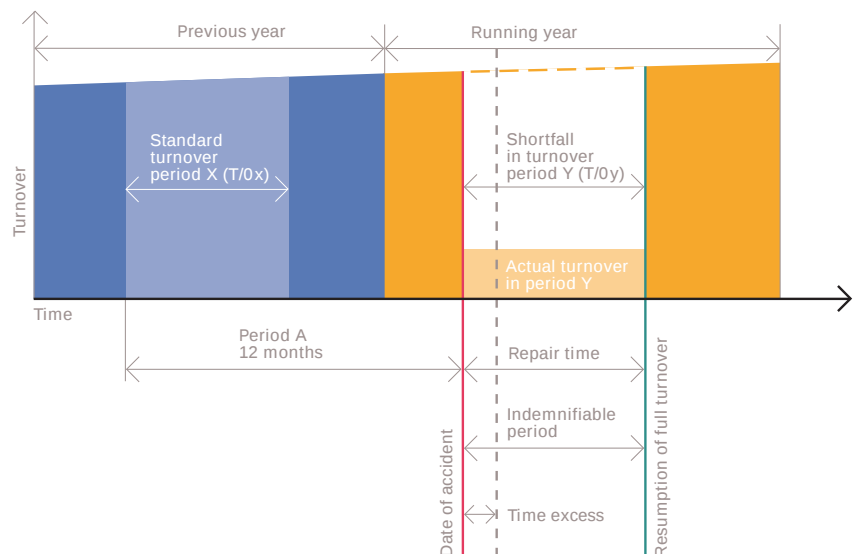
Claims must be documented by sufficient evidence that the interruption was in fact caused by an accident covered under an MB policy. Indemnification is made according to the actual incurred loss of gross profit for the actual period of interruption, less an amount calculated proportionally on the basis of the time excess stipulated in the policy.

MLOP: sum insured (gross profit)



■ Gross profit = net profit + standing charges

MLOP: basic principles of loss settlement



Loss adjustment formula:

$$(T/Ox - T/Oy) \times Z \times \frac{\text{Repair time} - \text{time excess}}{\text{Repair time}}$$

whereby Z (ie rate of gross profit) = $\frac{\text{Gross profit in period A}}{\text{Turnover in period A}}$

The indemnifiable amount is the sum produced by applying the rate of gross profit (Z) in period A to the amount by which the turnover during the indemnity period falls short of the standard turnover (turnover in period X minus actual turnover in period Y).

6.5 Deterioration of Stock insurance (DOS)

DOS is special insurance for the protection of perishable goods stored in warehouse-type cold stores or rooms. The policy is not intended for goods stored in retail shops/stores.

Cover

Cover is for perishable goods (eg meat, fish, vegetables, fruit) stored in cold stores which suffer damage as a consequence of an insured machinery breakdown accident. Such damage occurs as a result of rise or fall in temperature, a change in the concentration of gases or the action of refrigeration media escaping from the equipment in cold stores, due to a breakdown of the refrigeration system or by the loss of cooling media.

The policy may be extended to include losses caused by failure of the public power supply, providing that the power supply is usually reliable and that an emergency power plant is available.

Insured party

The insured party is the owner of the goods in store (who is not necessarily the same as the owner of the cold store itself).

Particular exclusions

The particular exclusions pertaining to the DOS policy are shrinkage, inherent defects or diseases of the stored goods, natural deterioration or putrefaction of stored goods, improper storage and packaging, deviations from designer's specifications, overloading of storage chambers beyond their maximum rated capacity, and failure of the public power supply unless otherwise agreed by endorsement.

Sum insured

The sum insured for goods stored for a lengthy period of time is normally the estimated selling price on the expected date of sale. In respect of frequently changing stock, the sum insured is the purchase price for the maximum amount of goods stored at any one time. In the latter case, the sum insured and premium is determined on the basis of monthly declarations.

Period of insurance

DOS policies are usually concluded for 12 months. However, the policy schedule must show the storage period(s) and the anticipated sales date(s) of the goods in store.

Loss settlement

Depending on the sum insured (estimated selling price or purchase price), the indemnity (in the event of a loss) is either:

- a) the difference between the estimated average selling price for the insured period and the proceeds obtained from the goods affected by the accident; or
- b) the difference between the purchase price and the proceeds obtained from the goods affected by the accident.

If at the time of loss the goods are of greater value than the declared sum insured, the indemnity is reduced in the same proportion that the sum insured bears to the amount required to be insured.

The excess which is usually defined as a percentage of the loss is deducted from the final loss settlement figure.

6.6 Computer All Risks insurance (COMP)

The Computer All Risks policy offers complete protection for entire computer configurations. Due to the inclusion of so-called “internal damage” (incorrect operation, negligent or malicious acts etc), the standard policy is not suitable for personal and portable computers, which should only be insured against external damage (fire, forces of nature etc).

Cover

The policy is of an all risks nature, covering unforeseen accidental loss or damage from any cause whatsoever other than those specifically excluded. It is divided into three sections:

- *Material Damage* to the computer configuration itself;
- *Loss of Data and Data Media* covering the data material itself (tapes, discs, punch cards etc) and the reconstruction of such data as a result of an insured material damage accident;
- *Additional Costs* for the continuation of computer operations following an insured material damage accident using other installations including rent, overtime and data media.

The Loss of Data/Data Media and Additional Costs sections are optional, but cover cannot be purchased without the corresponding Material Damage section.

Insured party

As computers are either bought, leased or rented, the insured party may be the owner, or the leasing or rental company, depending on who concludes the policy.

Main hazards

The main hazards are fire, water damage, theft and faulty or incorrect operation.

Particular exclusions

The particular exclusions for each of the three sections are listed below.

Material Damage section:

- loss or damage for which the seller, lessor or maintenance company is responsible;
- loss or damage resulting from the use of the insured object after damage has occurred but before permanent repair has been effected;
- normal wear and tear, gradual deterioration due to normal atmospheric conditions;
- seismic activities (however, earthquake cover may be included by special agreement);
- consequential loss of any kind, or loss of use.

Loss of Data/Data Media section:

- normal wear and tear of media;
- erroneous programming, perforating, loading or printing;
- discarding or erasing of data which has not been caused by insured damage.

Additional Costs section:

- costs for loss containment unless otherwise agreed with the insurer;
- costs arising from circumstances which are not connected with the insured material damage;
- consequential loss such as loss of market or interest.

Sums insured

Material Damage: the new replacement value of the computer configuration.

Loss of Data/Data Media: a reasonable limit of indemnity based on the estimated cost of a loss.

Additional Costs: A limit of indemnity based on the estimated costs per day multiplied by the number of working days per year, or alternatively, a first loss basis.

Loss settlement

Material Damage claims are settled on the same basis as described under Machinery Breakdown. Loss of Data/Data Media and Additional Costs claims are settled according to the actual loss, but obviously cannot exceed the limits of indemnity stipulated in the policy.

6.7 Low Voltage and Electronic Equipment All Risks insurance (LVEE)

This insurance basically follows the Material Damage section of the Computer All Risks Policy, and offers protection for all types of electronic equipment such as telephone exchanges, electronic measuring equipment and hospital equipment.

Cover

The policy covers unforeseen accidental loss or damage on an all risks basis.

Insured party

The owner of the insured equipment (or in certain cases the renting or leasing company).

Main hazards

The main insured perils are incorrect operation, burglary, theft, faulty design and material, short circuit, excessive voltage, fire, forces of nature except seismic activities (however earthquake may be included by way of endorsement) and any damage caused by water.

Particular exclusions

These are the same as the Material Damage section of Computer All Risks policies.

Sum insured

The sum insured is the new replacement value of the electronic equipment as specified in the policy schedule.

Loss settlement

Loss settlement follows the conditions as stipulated for Machinery Breakdown.

7. Reinsurance

7.1 Forms and types of reinsurance

Engineering reinsurance methods are no different from those used for other classes of insurance such as fire or casualty. Reinsurance is either placed on a facultative basis, an obligatory basis or a combination of the two.

Forms of reinsurance

Facultative reinsurance is the oldest form of reinsurance. Risks are reinsured individually, whereby the insurance company can freely decide if it wants to reinsure a particular risk or not. The reinsurer, too, may decide without any obligation whether he wants to accept in reinsurance, or decline the offered risk. Facultative reinsurance is used in cases where, after the insurer has used up both its retention (the amount which it is prepared to bear for its own account) and the capacity available to it under obligatory reinsurance programmes (if any), there is still a surplus amount needed to make up the risk's total sum insured. It is also used for risks or perils which are excluded from obligatory reinsurance programmes.

Obligatory reinsurance is treaty (contract) reinsurance for portfolios. In obligatory reinsurance, the direct insurer is obliged to cede to the reinsurer a contractually agreed share of the risks defined in the reinsurance treaty. The reinsurer is obliged to accept that share: hence the term "obligatory". The reinsurer cannot therefore refuse to provide insurance protection for an individual risk falling within the terms and conditions of the treaty. Nor may the direct insurer decide not to cede such a risk to the reinsurer. As a rule, obligatory reinsurance treaties are terminable on an annual basis.

Types of reinsurance

In every type of *proportional reinsurance*, premium and claims are shared between the insurance company and the reinsurer in the same proportion as stipulated in the contractual agreement. According to the type of contract, this proportion is identical for all risks ceded to the contract (quota share), or it can vary from risk to risk (all other proportional

reinsurance). Therefore, if a reinsurer accepts 90% of a risk, for example, and the retention of the insurance (ceding) company is 10%, both premiums and claims are distributed in the same ratio 90:10, ie proportional to the corresponding commitments.

In proportional reinsurance, the price the reinsurer pays for receiving the business is the "reinsurance commission". This commission, which the reinsurer pays to the ceding company, is normally expressed as a percentage of the original gross premium. Originally, the idea behind this commission was to help the insurance company with its acquisition and operating costs – which a reinsurer does not have to the same degree. Such costs include agents' commissions, administration, and claims adjusting costs (except external expertise and court costs). However, in today's competitive marketplace, the nature of the reinsurance commission has become more commercial, and underwriting results form part of the criteria for agreeing on the actual percentage.

In *non-proportional reinsurance*, no proportional distribution of premium and claims is fixed between the ceding company and reinsurer in advance. Distribution of a claim depends on the actual claims amount. The amount of a claim which a ceding company is prepared to bear for its own account is contractually agreed. This is known as the "deductible" or "excess point". That part of a claim which exceeds this deductible is borne by the reinsurer up to an agreed limit. As price for this reinsurance cover, the reinsurer expects to receive an adequate portion of the original premium. In calculating this price, the reinsurer takes into account the claims experience made during the previous years (= experience rating) or the future loss expectancy according to the kinds of risks involved (= exposure rating). The reinsurer is only obliged to pay when the reinsured portfolio or reinsured risk suffer losses which exceed the excess point.

7.2 Engineering reinsurance

Although in recent years there has been a certain trend towards non-proportional reinsurance, engineering risks are mainly reinsured on a proportional basis. The reasons lie in the nature of the portfolios, which are usually unbalanced (mixture of non-renewable and annually renewable risks; long-tail – ie several years duration – for CAR and EAR risks; the relationship between premium generated and exposure; and the large reinsurance capacity needed to cover risks with extremely large sums insured). Some large insurance companies do have non-proportional reinsurance programmes but their portfolios are large and diversified, giving enough balance to enable them to conclude such programmes.

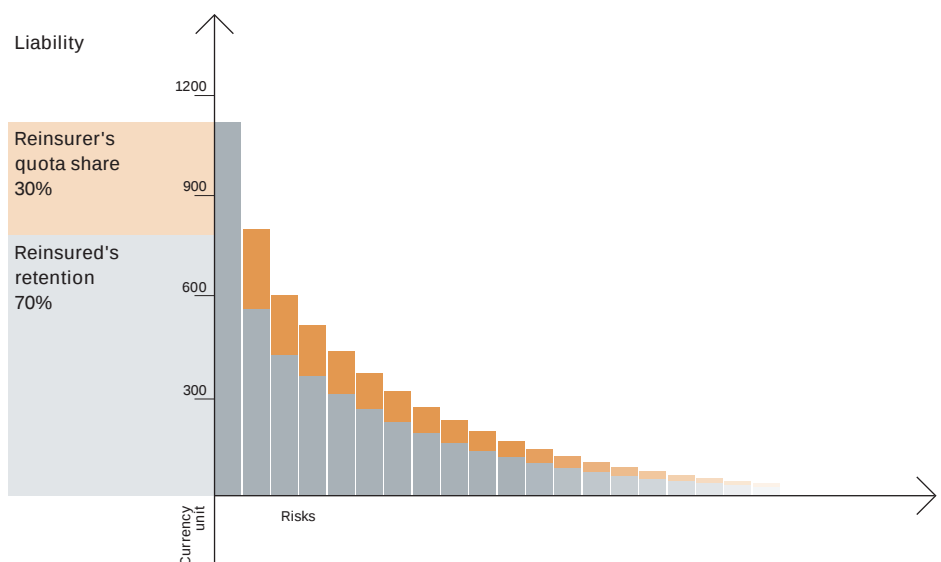
The form of proportional reinsurance cover most commonly encountered in engineering reinsurance is the surplus treaty, although quota share treaties are also widespread. Quite often, these two types of treaties are combined into one reinsurance programme. Proportional facultative reinsurance plays a very important role for the placement of amounts which exceed normal treaty capacities.

Quota share treaty

In quota share treaties, the reinsurer accepts a fixed percentage (ie quota) of all insurance policies which fall within the scope of the contractually specified terms and conditions of the treaty. This quota is decisive for the distribution of liability, premium and claims between the ceding company and the reinsurer.

This type of reinsurance treaty is easy to operate and administration costs are low. Its disadvantage is that it does not take into account the different reinsurance needs of a ceding company because everything is tied to fixed percentages. In particular, quota share reinsurance treaties do not help to balance a portfolio; that is, they do not limit the exposure posed by peak risks (for example, those with very high sums insured). By the same token, the quota share treaty may function in areas where reinsurance cover may not be really necessary. Under certain circumstances, this can restrict the ceding company's profit. Despite these disadvantages this type of treaty is often used to cover engineering risks – especially when a

Risk sharing under a quota share treaty



new class of business is being marketed or the engineering portfolio is in the development phase. As in such cases claims experience is not available, calculation of the premium can be uncertain. With quota share treaty reinsurance, the reinsurer assumes part of this uncertainty. In addition, quota share treaties are suited to keep the risk of random fluctuation and the risk of change over a whole portfolio within acceptable limits.

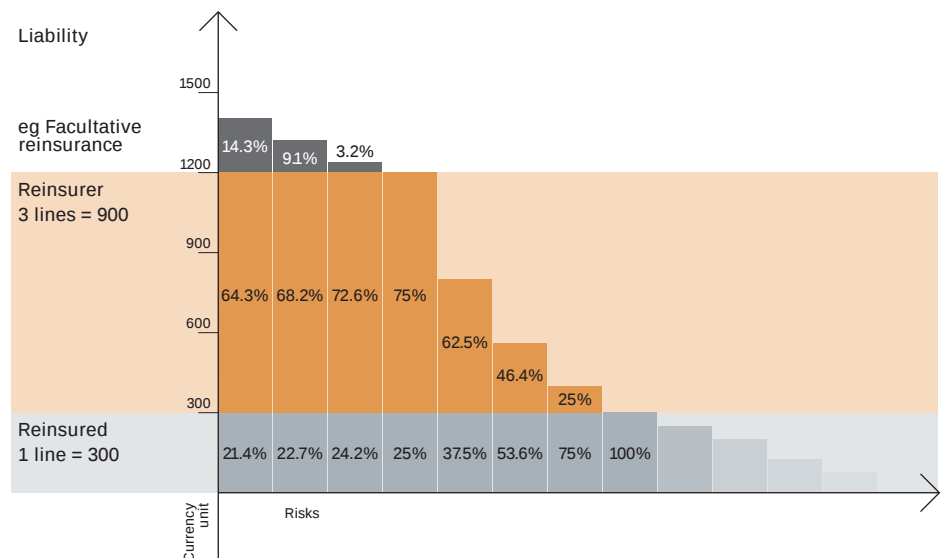
Surplus treaty

With the surplus treaty, in contrast to quota share treaties, the reinsurer does not participate in all risks. The ceding company retains risks up to a certain maximum limit (called a "line") for its own account. The retention can vary according to the type of risk. Liability for amounts which exceed the ceding company's retention (ie amounts in excess of one line) are assumed by the reinsurer. The reinsurer's maximum

liability must be established as well: this is done by forming "surpluses" defined as an agreed number of lines, where one line is equal to the ceding company's retention for that particular type of risk. The same ratio which results when a risk is distributed into the retention and reinsurance cession is then used in distributing liability, premiums and claims between the ceding company and the reinsurer.

The surplus reinsurance treaty is an excellent aid for the insurance company in creating a balanced portfolio. Because the retention can be set according to the type of risk and the claims expectancy, this type of treaty allows the insurance company to bring a risk it has accepted into line with its financial means. The disadvantage of the surplus treaty is that it is complicated to administer. Costs are therefore high unless computer support is available.

Risk sharing under a surplus treaty



7.3 Engineering treaty wordings – terms and conditions

The wording of engineering reinsurance treaties is basically the same as for other lines of business. However, the underwriting and reinsurance for engineering risks is in some ways different from traditional lines. These differences can be summarized as follows:

- lack of spread due to the relatively low number of risks;
- exposure to technological changes such as new materials, new methods of construction, prototype design, new dimensions, higher temperatures etc;
- often above average exposure to hazards of nature and the long-tail nature of CAR and EAR insurance.

These points make it worthwhile to examine the following treaty terms and conditions:

Conditions of cessions

In other lines of business such as fire or casualty, many markets have associations or bodies which prepare policy wordings and rating tariffs that are generally followed by local insurance companies. Apart from a very few markets, this does not hold true for engineering. Furthermore, in many insurance companies, engineering insurance does not produce a large share of the premium income. Consequently, because of cost reasons, underwriting is often handled by the Miscellaneous department. This obviously restricts the accumulation of know-how. On the other hand, a professional reinsurer such as Swiss Re with a separate Engineering department is able to accumulate a wealth of underwriting know-how because of its large, world-wide portfolio. Therefore, it is not unusual for the reinsurer to provide its ceding company with policy wordings and rating guides with the corresponding underwriting information and instructions. The relevant clause in the treaty wording reads as follows:

“The Reinsurer furnishes the Company with the policy conditions and rating principles for the business ceded to this treaty; the Company binds itself to apply their rules and premium rates”.

Claims consultation

In order that the ceding company may draw on the reinsurer's world-wide experience in the settlement of claims, a claims consultation clause is often incorporated into the treaty wording:

“Claims affecting this treaty are settled in consultation with the Reinsurer whenever a claim is likely to exceed... (an agreed amount). This consultation shall commence at once whenever a claim of the aforementioned magnitude is brought to the knowledge of the Company”.

Treaty capacity

Compared to fire, engineering reinsurance treaties are usually quite unbalanced. A typical fire treaty produces a premium volume-to-capacity ratio of around 1:1 or 1:2 whereas the ratio for engineering treaties is around 1:10 and can even reach 1:30 or more. The main reason for this is that cessions of CAR and EAR risks are erratic because of their non-renewable nature, and their sums insured can vary from modest to extremely high.

The annually renewable risks such as Machinery Breakdown and Computer All Risks present a more balanced range of sums insured, and treaty capacity is usually based on a company's portfolio for these classes of business.

Clearly, capacity may be increased by concluding a second surplus treaty over and above an existing first surplus; but unless the number of cessions is large enough and the relationship of such additional capacity to the average exposure is fairly balanced, it is preferable to make use of facultative capacity for sums exceeding the first surplus treaty limits, because engineering risks are often heavily exposed and one single loss may ruin treaty results for many years.

Portfolio withdrawal in case of treaty cancellation

In most property treaties, the portfolio is operated on a “clean-cut” basis. This system is not suitable for engineering business because especially in respect of CAR and EAR, policies can be of many years’ duration. The premiums earned increase with the gradual completion of the works, with a disproportionate share allocated to the final stages of construction or erection, where the major loss potential lies (higher values at risk). Calculations of the unearned premium can be made; but as they have to be made individually for every risk, this can be very time-consuming. Therefore, as far as CAR and EAR are concerned, risks are run-off to their natural expiry. For annually renewable covers such as Machinery Breakdown, treaty cover continues to the next original policy renewal date.

Table of retentions

Engineering treaties usually have a table of retentions. Its main purpose is to create an optimal balance in the company’s retained account and to limit reinsurance treaty capacity for heavy risks with a large loss potential. It also stipulates that third party liability (when written in conjunction with and forming part of CAR, EAR and BPVE policies) is retained and ceded in the same proportion (percentage) as the material damage section of such policies.

It is important for the table of retentions to be used properly, and for the ceding company and reinsurer to discuss its function and application together. Incorrect application can result in a low

ceded premium volume and unused treaty capacity. The following examples illustrate how the table of retentions should be applied.

For the purpose of these examples, we will assume that a surplus reinsurance treaty is in force with the following capacity:

Maximum retention: 100 000 for the best class of risk

1st surplus capacity: 10 lines equal to 1 000 000

a) Machinery Breakdown insurance, treaty reinsurance cession example

Risk: Beer brewery

Total sum insured: 5 000 000 comprising 25 machines plus auxiliaries such as piping, instrument panels etc.

Highest value of the individual machines: 1 000 000

Premium rate: 5‰ of 5 000 000 = 25 000

We will assume that a beer brewery is classified as a risk where 100% of the retention may be used.

One cession method would be to cede each insured machine separately according to their individual sums insured. As many items would have sums insured which are equal to or less than the retention, the treaty would only be exposed to machines which have individual sums insured in excess of 100 000. This is antiselection, and contrary to the principles of a proportional treaty.

Another method would be to base the cession calculation straightaway on the total sum insured. This would produce the following result:

	Sum insured	Premium	%
Retention	100 000	500	2
1 st surplus (10 lines)	1 000 000	5 000	20
Facultative placement	3 900 000	19 500	78
Total	5 000 000	25 000	100

This method results in too little retained premium for the ceding company, and quite often, an unnecessary facultative placement.

The best method is to make initial calculations based on the machine with the highest sum insured (in this example 1 000 000) and apply the resulting percentages to the total sum insured:

Retention	: 100 000 = 10 % of 1 000 000
1 st surplus (max. 10 lines)	: 900 000 = 90% of 1 000 000

Retention/treaty cession

	Sum insured	Premium	%
Retention 10% of 5 000 000	500 000	2 500	10
1 st surplus: 90% of 5 000 000	4 500 000	22 500	90
Total	5 000 000	25 000	100

In case of a claim, distribution would be in exactly the same proportion, ie 10 % of the claim is allocated to the retention and 90% to the 1st surplus treaty.

When comparing the cession methods described above, one notes that the last method fulfills certain important criteria: full treaty capacity has been used as far as possible, premium has been correctly allocated, and there is no antiselection because all machines have been ceded proportionately. Additionally, there is no need for facultative reinsurance in this example, which obviously will save administrative costs.

One can of course argue that the retention and treaty capacity have been exceeded. However, in Machinery Breakdown treaty reinsurance, it is not really the total sum insured that counts.

Cession calculations are governed by the machine with the highest individual sum insured because plants insured under Machinery Breakdown are very rarely subject to total losses. Most claims are partial and affect one machine only. Therefore, although the limits have effectively been exceeded, there is no undue overexposure to the retention or the treaty.

The cession method described above only applies to Machinery Breakdown. It cannot be used for other classes of engineering business. For instance, CAR and EAR cessions are based on the total sum insured of the material damage section of the cover plus all endorsements which carry a sum insured. This is because contrary to Machinery Breakdown, such risks can suffer a total loss.

b) Contractors' All Risks Insurance, treaty reinsurance, cession example

Risk: Road works

Sums insured:	
Construction works	
(estimated total contract value):	2 900 000
Debris removal	
(limit of indemnity):	50 000
Contractors' Plant	
and Equipment:	50 000
Total sum insured:	3 000 000

TPL limit: 200 000

Premium rate: 6‰ of 3 000 000 = 18 000

We will assume that the table of retentions allows 75% of the treaty capacity for this type of risk. The retention is therefore 75 000 (75% of 100 000).

Retention/treaty cession

	Sum insured	TPL	Premium	%
Retention	75 000	5 000	450	2.5
Surplus 10 lines	750 000	50 000	4 500	25.0
Facultative placement	2 175 000	145 000	13 050	72.5
Total	3 000 000	200 000	18 000	100

7.4 Recent developments in reinsurance

The traditional types of reinsurance described previously in this chapter are widely used at present for placing engineering risks. These types of reinsurance will definitely continue to be applied in the future but they will be complemented by alternative risk transfer via finite reinsurance. Finite risk reinsurance is based on the same instruments as traditional reinsurance. However, it does have certain distinguishing characteristics. These include:

- the assumption of limited risk by the reinsurer;
- a multi-year contract period;
- sharing the result with the primary insurer; and
- the explicit inclusion of future investment income in agreeing the price.

These features open the way to new ways of looking at insurance and reinsurance, and are generating increasing interest among insurance companies.

- *Assumption of limited (finite) risk by the reinsurer:*

In finite risk contracts, the primary insurer (cedent) transfers two things: first, the risk that losses will be settled sooner than expected, commensurately reducing investment income from the reserves formed to cover those losses, and second, a limited but significant underwriting risk. In reality, the underwriting risk is the risk that actual losses paid over the term of the finite contract may turn out to be greater

than expected.

- *Multi-year contract term:*

Many traditional reinsurance contracts are agreed, at least initially, for a one-year period (though they may run for much longer). However, multi-year contracts can provide cedents with long-term cover under reliable conditions, and furnish finite risk reinsurers with a continued flow of premiums. This provides both parties with considerably greater latitude for negotiating prices and conditions, and secures a long-term partnership.

- *Sharing of result with the cedent:*

A substantial part of the profits accruing over a multi-year period is paid back to the cedent, so that there is a close connection between the cedent's own loss experience and the actual cost of reinsurance. In this way, the cedent receives "compensation" for the limitation of the risk assumed by the finite risk reinsurer.

- *Future investment income as a pricing component:*

Expected investment is explicitly defined as a factor in the premium calculation. This consideration of the time value of money has a special effect in certain types of liability business, where settlement may take decades.

Finite risk reinsurance adds a new dimension to a community of risks: risk financing over time as opposed to a risk-balancing proposition on an annual basis as seen in conventional reinsurance.

Among other things, finite products can:

- stabilize reinsurance costs and capacity availability;
- smooth result fluctuations;
- expand underwriting capacity;
- provide (partial) protection against as-yet-unreported claims; and
- optimize the balance sheet.

Finite products can also be combined with traditional reinsurance solutions in blended covers. The advantages of such blended covers: a single reinsurance programme under which insurers can arrange a price for each specific type of risk; and this not only for a period of several years, but also for risks from several different lines of business. Also, primary insurers utilizing such covers profit from reduced transaction costs for risk protection.

Features of finite risk reinsurance products

Assumption
of limited risk
by reinsurer

Sharing
of result
with cedent



Multi-year
contract term

Explicit inclusion
of investment
income



8. Engineering and Swiss Re

A fax, the computer signals an incoming e-mail, the telephone rings:

“Can you help me? I need reinsurance cover for a large construction risk. It's a USD 100 million development with two 35-storey office towers on top of a 3-floor shopping centre podium with 5 basements situated in the heart of a large city. The site is triangular in shape with a 10-storey 30-year-old hotel about 10 metres away on one side, a newspaper printing plant on another, and a 6-lane highway on the third side. The insured needs full design cover and all the usual extensions as well as vibration and ALOP. We want to quote 6‰ on TCV. What do you think and how much capacity do you have available?”

“In two months time we are holding a seminar for our insurance agents. The subjects are Machinery Breakdown and Machinery Loss of Profits Insurance. Can you delegate a speaker from Swiss Re?”

“Our engineering insurance portfolio has grown substantially over the past two years. The administration of reinsuring the risks individually on a facultative basis is becoming too costly. Can you help us to set up a reinsurance treaty programme?”

“We have just had a large loss during the erection of a power station. The circumstances of the claim are rather unusual. Could you please assist us in the claims handling?”

“Our new engineering underwriter is an engineer, but has limited experience in engineering insurance matters. May we send him to you for a few weeks for training?”

Every day, Swiss Re's Engineering department is faced with requests for technical assistance and for quotations for risks of various degrees of complexity ranging from relatively simple housing projects to multi-million dollar petrochemical risks and power stations.

For us, service, expertise and professionalism are paramount. That's why Swiss Re Group employs over 50 civil, mechanical and electrical engineers worldwide for handling facultative risks, a product management/development team, several experienced treaty underwriters, and a back-up team of competent account administrators. Most of our engineers previously worked in construction, erection and plant operation. The in-depth, specialised knowledge gained in such working environments is of immense value in recognising special hazards and perils in relation to engineering insurance coverages.

In Zurich, our people are divided into market groups that specialise in the needs of their respective regions. The engineering account managers and usually their deputies travel extensively in the markets to assess our clients' needs, deal with treaty and facultative underwriting, carry out risk inspections, provide claims handling services, and arrange seminars and workshops.

Contact us for more information about our worldwide engineering activities or if you would like copies of our specialised publications dealing with the various classes of engineering business. We are here to help you.

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