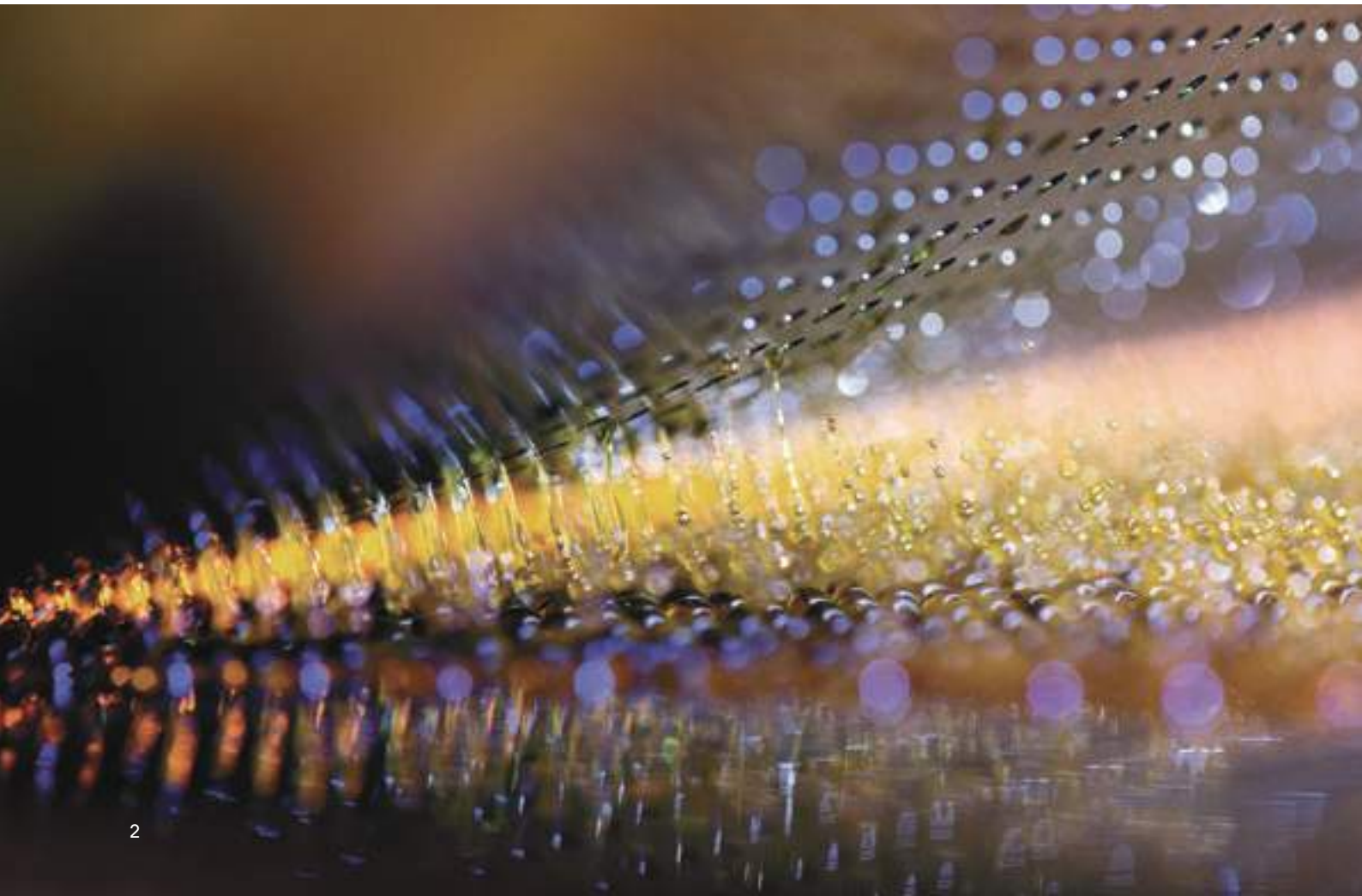
We have a long legacy of innovation in engineering within the sulphur industry. Our expertise extends beyond the solidification stage to encompass process systems, degassing, block pouring and melting.

ipco.com

WORLD LEADER IN SULPHUR PROCESSING AND HANDLING

THE SULPHUR COMPANY – A WORLD LEADER IN SULPHUR PROCESSING AND HANDLING

IPCO is a world leader in sulphur solidification and handling plants having delivered complete end-to-end systems from receipt of molten sulphur to loading of solid material to hundreds of companies around the globe since 1951.



Bulk ship loading directly from an IPCO sulphur forming and storage facility.

Molten sulphur being fed onto the steel belt to produce pastilles.

Today, the company manufactures equipment for sulphur degassing, molten loading for truck and rail, block pouring, remelting, a full range of sulphur solidification technologies, downstream storage and reclamation, as well as bulk loading for truck, rail and ships.

Our Rotoform system, designed for small to mid-size capacity requirements, is the world's most widely used process for the production of premium quality pastilles and offers unrivalled product uniformity and environmentally friendly operation.

Where higher capacity is required, our sulphur granulator drum system is a fully automated, once through, sulphur granulation process based on rotating drum technology.

More than 700 Rotoform systems are currently in use across the sulphur industry and our expertise extends far beyond the solidification stage, encompassing everything from the receipt of molten sulphur from the SRU to a complete range of downstream handling operations.

Reap the benefits of single source supply by working with ‘the sulphur company’

Choose to work with IPCO and you open the door to a wealth of expertise covering every aspect of sulphur processing and handling.

We can design, integrate and commission equipment for every stage of the process, from upstream preparation, degassing and filtering of molten sulphur through a range of different solidification options, to down-stream conveying, storage, reclamation and bagging or bulk loading.

Our experts can also help you maximize productivity and achieve a faster ROI through operator training and planned maintenance programs.

Process system expertise
Our sulphur processing systems are employed around the world – often in remote locations or challenging conditions – and we support them all through a global service network. So wherever you’re based, you get the support you need.

Our engineering, consulting and project management teams have the expertise to undertake end-to-end project management from feasibility studies and front end engineering design (FEED) through to complete engineering procurement construction (EPC) packages.

This includes installations where considerations such as the potential risk of earthquakes or specific local weather conditions need to be taken into account.

And by assuming total responsibility for a project, we not only ensure full system optimization but can also deliver cost savings through significant project efficiencies.

Strength and stability of a global engineering group
Choose IPCO and you benefit not only from our technical expertise but also from the reassurance of working with one of the world’s foremost engineering groups.

IPCO is a high-technology engineering business with advanced products and world-leading positions within selected areas. We also benefit from the strength and stability that comes with being an internationally active, mid-size company owned by the Wallenberg foundations.

- Engineering & consulting services.
- Block pouring.
- Melting.
- Liquid sulphur degassing.
- Small/mid-size capacity solidification.
- High capacity solidification.
- Storage (silo or stock pile).
- Reclaiming.
- Bagging.
- Truck/rail/ship loading.
- Global service and spare part supply.

Ship loading with telescopic chute to reduce dust creation.

Developing the solutions to meet a global sulphur challenge

Premium quality forming

While elemental sulphur can be stored and transported in its molten form, it is usually more practical and economical to convert it into a solid state, certainly – as is often the case – when it is to be shipped from one continent to another.

It was in order to establish standards for formed sulphur – and its suitability for transportation (i.e. export) – that, in the late 1970s, SUDIC (Sulphur Development Institute of Canada) set about defining what has now become globally recognised as a 'premium' quality product.

In determining this quality, SUDIC looked at friability and fines content, both critical to efficient, clean and environmentally safe production and handling. The other major factor was moisture content; excess moisture not only adds weight, leading to unnecessary transportation and melting costs, but also results in increased acidity, causing corrosion in conveyors, silos, trucks, rails cars and ship holds. A 'wetter' product is also more susceptible to freezing into lumps during cold weather, a significant factor in colder climates.

Together, these factors determine not only the quality of the formed sulphur but also the ease with which it can be handled and the potential impact on the environment during storage and transportation (formed sulphur can be handled as many as 15 times between solidification and subsequent reprocessing).

We have therefore focused the design and development of all IPCO sulphur forming products – as well as our complete array of downstream handling equipment – on ensuring that SUDIC premium quality sulphur reaches the end user.

The perforated feed device on IPCO's Rotoform system helps ensure premium quality sulphur solidification

Circular stockpile – 30 000 tons.

Specifications

According to the SUDIC definition, premium quality sulphur will meet the following specifications 21 days after forming:

Mean size	between 2 and 5 mm
Size distribution	less than 5% bigger than 4.75 mm
	minimum 75% between 4.4 and 2.4 mm
	less than 2% smaller than 1.18 mm
	less than 0.1% smaller than 0.3 mm
Moisture	less than 0.5% by weight
Friability	less than 1% fines (< 0.3 mm) under stress level I
	less than 2% fines (< 0.3 mm) under stress level II
Bulk density	1 040 kg/m^3 loose, 1 200 kg/m^3 agitated
Angle of repose	not less than 25°
Compaction	below 0.2% fines by weight (< 0.3 mm) under static load
	below 0.5% fines by weight (< 0.3 mm) under dynamic load

IPCO forming equipment meets or exceeds these specifications.

Low cost, high capacity sulphur degassing, block pouring and melting

Liquid sulphur degassing

IPCO sulphur degassers provide an economical means of reducing poisonous hydrogen sulfide in liquid sulphur.

Its high degassing capability – H_2S is reduced to less than 10 ppm – minimizes the potential for downstream regulatory safety violations and its robust design and ease of operation ensures low operating and maintenance costs.

Self contained, compact and portable, this skid mounted unit is supplied with all necessary wiring and pipework and is extremely easy to use:

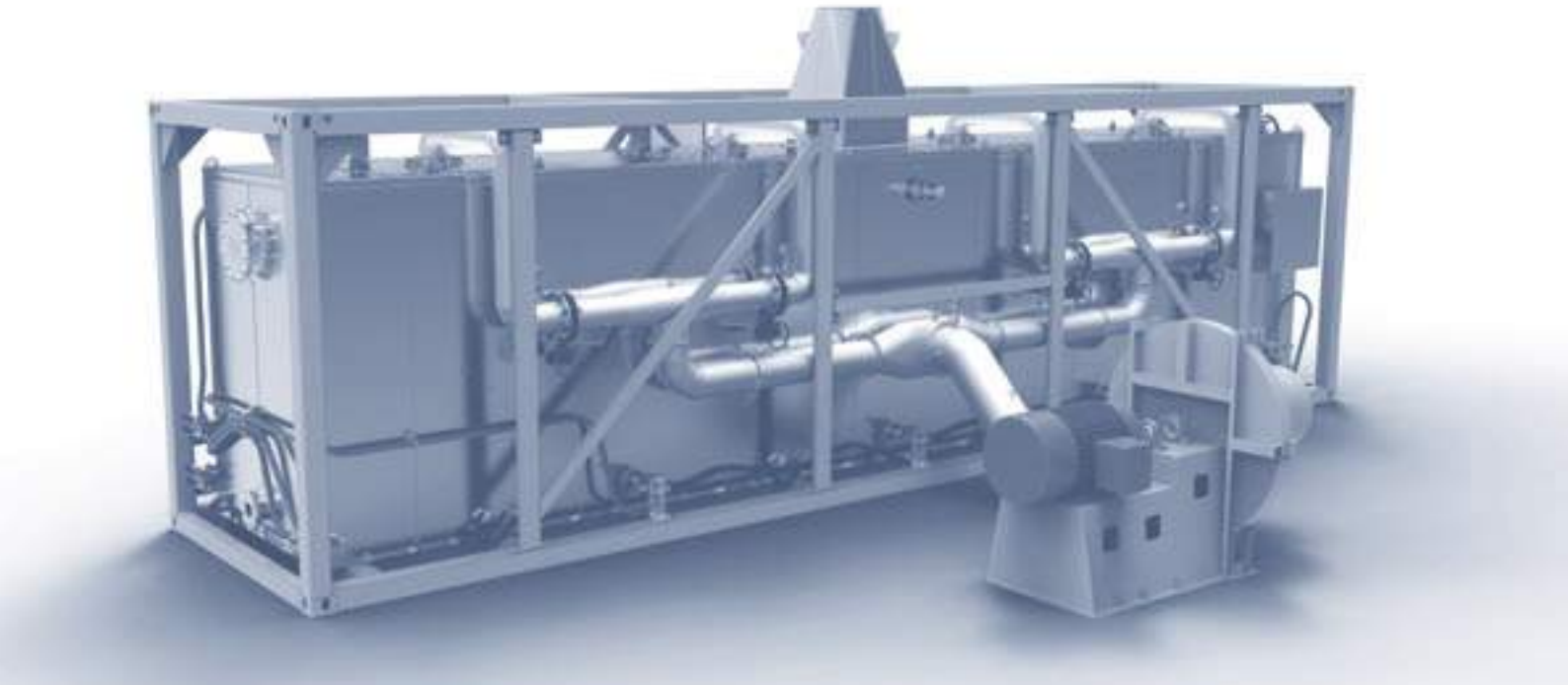
- Maximum degassing capability to below 10 ppm H_2S.
- Superior environmental performance.
- Continuous operation under negative pressure in a fully contained system.
- Limited manual labor or exposure to potential hazards.
- Low operating and maintenance cost.
- Efficient use of energy.

Reliable and efficient reduction of hydrogen sulfide

Molten sulphur is pumped through the degassing reactor where billions of tiny air bubbles transfer the H_2S gas from the molten liquid to the headspace of the sealed reactor tank.

A carefully defined volume of catalyst is then introduced, quickly reducing the hydrogen polysulfide molecules to gaseous H_2S, resulting in the degassing of both H_2S and H_2SX within the molten sulphur.

H_2S rich airflow exits the degassing reactor and is transferred via ducting to an appropriate effluent treatment system, while the degassed molten sulphur is transferred to downstream systems.



A practical and economical solution to the storage of large volumes of sulphur

Block pouring and melting
Fluctuations in global sulphur output and projections of future supply outstripping demand mean that sulphur producers face an increasing challenge of medium to long term storage of large volumes of sulphur.

In-depth expertise in large scale block pouring solutions
Block pouring offers a practical and economically viable solution to this, and our sulphur forming experts have extensive experience in the design of such systems.

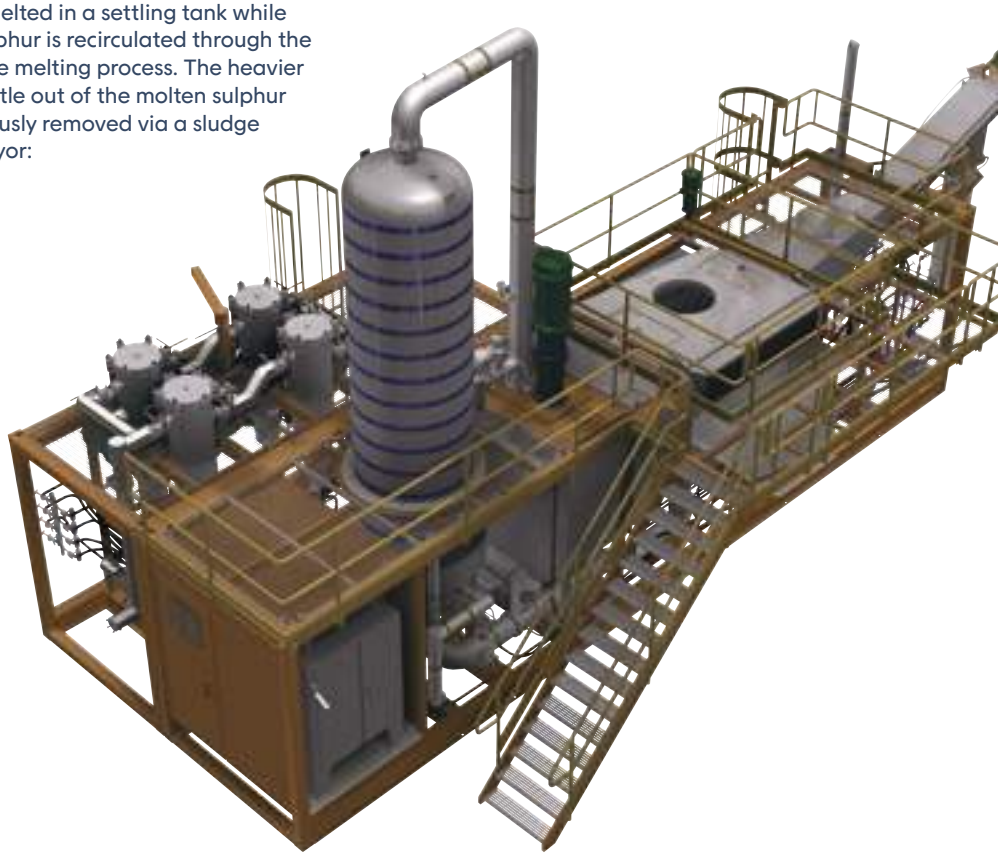
As well as supplying all necessary equipment – pouring towers, forms etc. – we can also provide a full consultancy service covering every aspect of the block pouring site, from safety and environmental compliance to pouring techniques and future melting considerations.

High performance, low maintenance sulphur remelters

IPCO sulphur melters are compact, skid-mounted units, offering predictable, high capacity throughput. Unlike conventional sulphur melters, IPCO melting technologies allow the effluent to be captured for treatment before anything is released to the environment.

Solid sulphur is melted in a settling tank while heated liquid sulphur is recirculated through the tank, aiding in the melting process. The heavier contaminants settle out of the molten sulphur and are continuously removed via a sludge extraction conveyor:

- Predictable, maximum throughput rates.
- Efficient use of energy.
- Reduced sulphur concentration in recovered contaminants.
- Low operating cost; low maintenance.
- Environmentally friendly.



Premium Rotoform solidification for small to medium capacity requirements

Our flagship Rotoform system – the only indirect solidification process on the market – offers unrivalled product uniformity, direct-from-the-melt pastillation and environmentally friendly operation. These, and a whole range of other qualities, have combined to make the IPCO Rotoform the world's favorite premium solidification process: more than 700 Rotoform units have been supplied for sulphur forming operations.

Throughout the years capacity demands have increased and we have responded by adding new designs and models to the Rotoform family to meet a full range of throughput requirements.

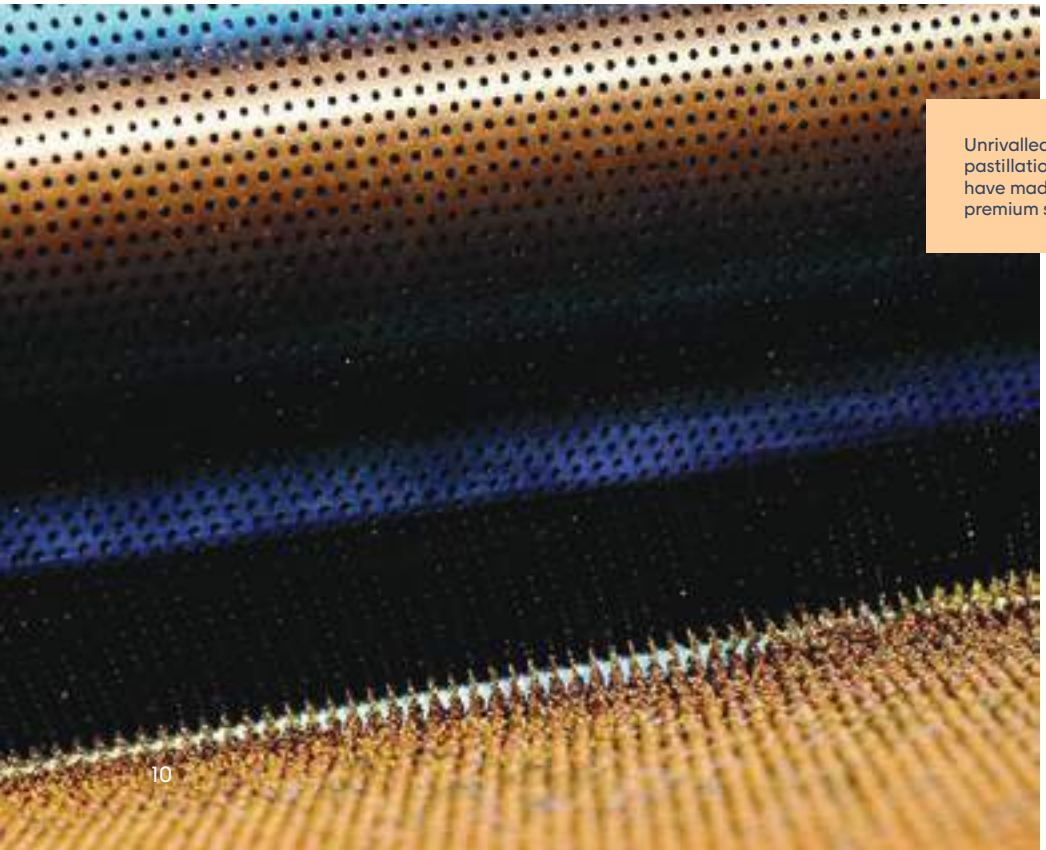
From melt to solid in a single step
The Rotoform consists of a heated, cylindrical stator and a perforated rotating shell that turns concentrically around the stator, depositing sulphur drops across the whole operating width of a continuously running steel belt. The circumferential speed of the Rotoform is synchronised with the speed of the belt, ensuring that drops are deposited accurately, consistently and without deformation.

The belt is cooled by water sprayed on the underside and the resulting heat transfer results in rapid solidification of the product.

The sulphur droplets are then discharged as solid, hemispherical pastilles at the end of the cooling system. To eliminate the possibility of damage to the pastilles during discharge, a thin film of silicon-based release agent is sprayed onto the steel belt.

Pastilles to SUDIC premium product specification
The efficiency of this single step, liquid-to-solid process results in a product quality classified as 'premium' as defined by the Sulphur Development Institute of Canada (sudic) specifications (see page 7).

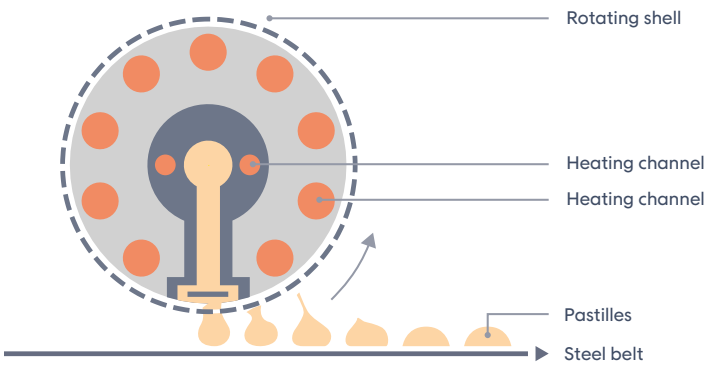
The uniform shape and size of Rotoform pastilles make them free-flowing for easy handling, while a predictable high bulk density is a major advantage in terms of storage and transportation.



Unrivalled product uniformity, direct-from-the-melt pastillation and environmentally friendly operation have made the IPCO Rotoform the world's favourite premium solidification process.

Discharge of sulphur pastilles from steel belt cooler.

Basic principle of Rotoform



Benefits include:

- Low friability, which minimizes product degradation and dust.
- High angle of repose, good flow characteristics.
- High purity and consistent quality.
- Low residual H_2S (<10 ppm).
- Low moisture content (the IPCO Rotoform process does not increase the moisture content).
- Unrivalled uniformity.

The Rotoform process also offers a number of environmental advantages:

- As the cooling water never comes into direct contact with the sulphur, there is no risk of cross contamination.
- Solidification takes less than 10 seconds so there is little time for H_2S to escape, resulting in very low emission values.
- Low levels of sulphur dust levels mean no need for exhaust air treatment.

Rotating drum technology for low cost, high capacity solidification

IPCO sulphur granulators are fully automated processes based on rotating drum technology. Our system is the highest capacity sulphur granulation unit on the market, and produces formed sulphur to SUDIC specifications (see page 7).

Seed or nuclei particles of solid sulphur are generated externally by freezing sprays of liquid sulphur in a water bath at controlled pressures to form the desired size range. These particles are then augured into a slowly rotating drum with appropriately placed flights attached to its inner surface. The flights create curtains of particles inside the drum as well as gently moving them towards the discharge end.

As the nuclei particles travel along the drum, they are progressively enlarged to the required size by means of sulphur sprayed from a bank of nozzles running the length of the drum.

The temperature in the drum is moderated by the evaporation of water from spray nozzles located inside the drum.

A fully automated sulphur granulation process with the highest capacity granulation unit available.

Low capex and opex for high capacity sulphur forming

IPCO sulphur granulators are supplied prefabricated for fast delivery and rapid installation, and their simple design, low maintenance requirements and continuous operation combine to deliver exceptional ROI:

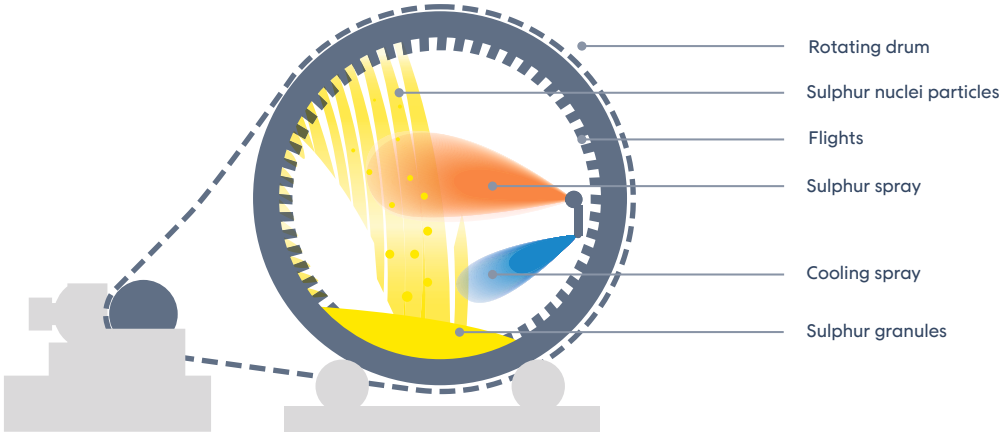
- Highest capacity granulation unit available in the industry.
- Uniform end product – external seed generation enables controlled variation of size distribution during operation.
- Small footprint.
- Minimal rotating equipment.
- Fast delivery, quick installation, low shipping costs.
- No sulphur 'pre-conditioning' required.
- Continuous operation – no need for routine shut down.
- No solid waste streams or liquid effluents.
- Low maintenance – horizontal 0° drum reduces stress.

Premium granular product to SUDIC specification

The spherical product meets the shape criteria and Stress Level I and II friability parameters of the SUDIC premium product specification.

The completely spherical shape – along with the repeated spraying and cooling of thin layers of molten sulphur on the surface of the granules as they pass through the granulator – accommodates the natural shrinkage of the product as it completes the transition from melt to solid, without weakening the product.

Basic principle of drum granulation



Reliable and safe downstream sulphur handling systems

From our small/mid-size capacity Rotoform pastillation system to the high capacity IPCO drum granulator, we have the systems to meet any sulphur granulation requirement, enabling the production of premium quality product suitable for subsequent handling. But refineries need more than this: once the sulphur has been formed, it has to be conveyed, stored and then bagged or bulk loaded.

And just as our name has become pre-eminent in solidification, we are also able to provide complete bulk material handling systems.

Our capabilities encompass everything from the supply of transfer conveyors and bucket elevators to bulk storage and loading systems.

Sulphur handling also requires the use of appropriate materials: if it comes into contact with water it will create sulphuric acid, leading to serious corrosion of conveyors, buildings, trucks, trains and ship holds. Our facility design and consultancy services will ensure that this risk is mitigated and your investment is protected.

We also ensure maximum productivity through proven equipment and process design, delivering handling systems with operational reliability in excess of 8 000 hours/year.

Safety & dust generation
One of the most important challenges when handling sulphur in a solid form is managing the risk of dust explosion. Solidification to sudic premium standard is an essential part of this as low friability means a significantly lower risk of dust generation, but equally important is the need for safety management to be designed into every stage of downstream handling.

Conveyor belts are protected against the build-up of static electricity and dust suppressants are applied at final transfer points. Bucket elevators are enclosed in dust-tight casings and provided with upward-facing explosion vents. The buckets themselves will be antistatic with rubber-coated steel carrying wires.

In terms of storage, closed silos or hoppers are supplied with roof venting and equipped with bursting discs. When sulphur pastilles are stacked and reclaimed indoors, metal supports in the building will be grounded and good natural or mechanical ventilation provided.

The same need for safety applies to loading processes, so the risk of dust formation is minimized at truck, rail and ship-loading facilities through the use of telescopic chutes with level sensors.

Complete, integrated engineering solutions
Ever increasing levels of production mean that refineries will not only have to process more sulphur but also find safe and efficient ways of storing, handling and loading the solidified material. Our experience across both areas means we are in a unique position to be able to design, construct, install and commission complete, integrated engineering solutions.

Our capabilities encompass everything from the supply of transfer conveyors and bucket elevators to bulk storage and loading systems.

From stacking and reclaiming to bagging and loading

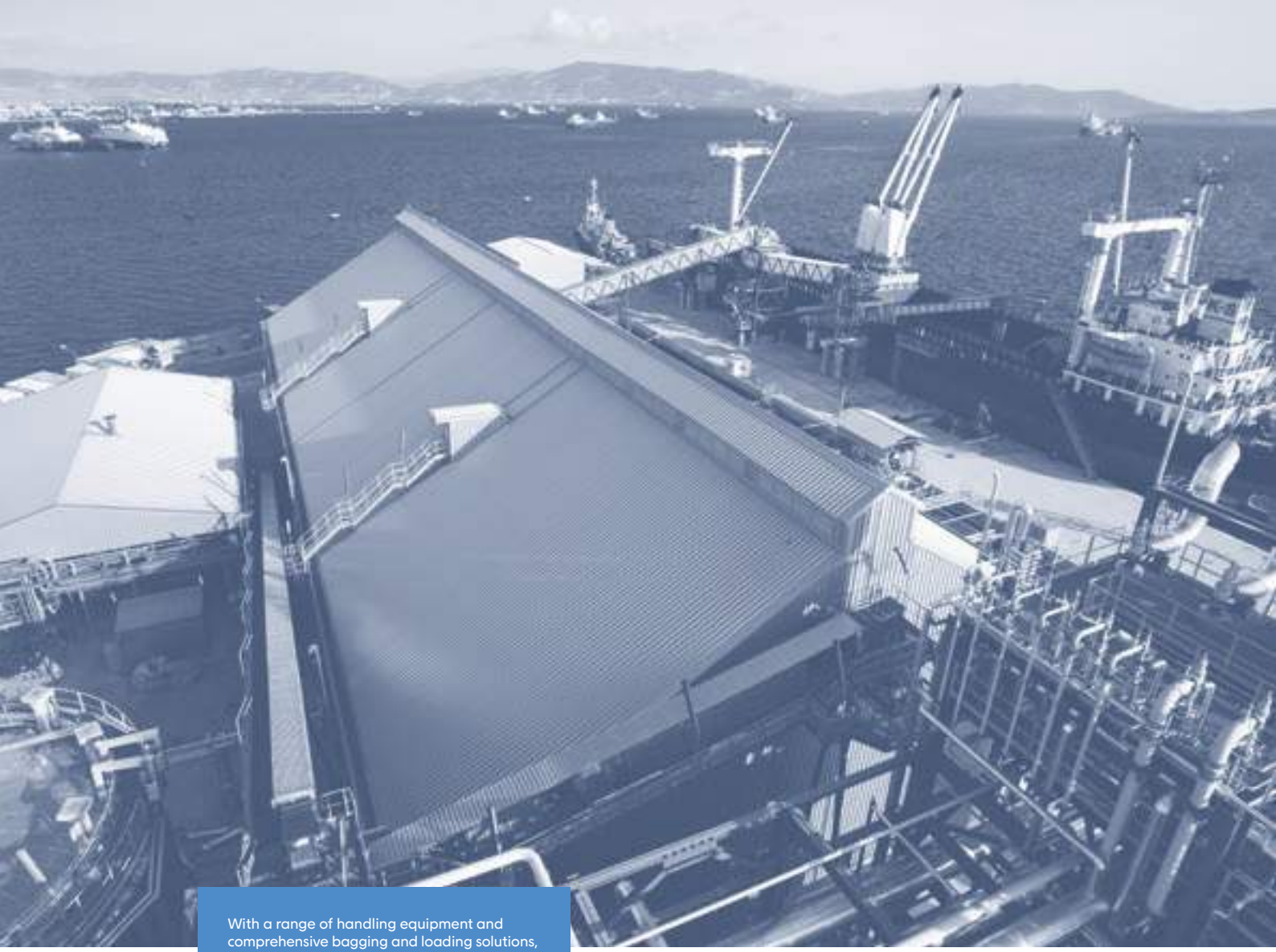
With handling equipment encompassing everything from conveyor components to rectangular/circular stackers and reclaimers, and a comprehensive range of bagging and loading solutions, we can deliver downstream solid sulphur handling plants for any requirement.

Covered / open stockpiles
Our custom-built stacking and reclaiming systems can be used to deliver stockpile solutions for any capacity or location. These can be circular or rectangular, indoor or outdoor, and the high angle of repose of sulphur pastilles (typically 28°) allows the development of high capacity stockpile solutions.

The use of luffable stacker booms keeps the boom tip as close to the stockpile as possible, minimising the drop height to reduce the risk of damaging the formed sulphur:
- Open or closed storage.
- Portal and semi-portal reclaimers.
- Simple hoppers and belt feeders, front end loaders.

Open silos
We can also design, manufacture and install storage silos with top loading / bottom reclamation equipment:
- Closed silos for small to medium capacity storage.
- Large capacity, concrete storage silos.
- Gentle handling of formed sulphur.
- Designed to highest safety standards.

Conveying
We can provide a full range of conveying and elevator solutions to suit all requirements and environments. We can also design systems with the minimum number of transfer points for clean and efficient operation:
- Wide belts to enable reduced velocity.
- Static-conductive conveyor belting.
- Dust-tight conveyor design with transfer skirts and enclosed transfer points.



With a range of handling equipment and comprehensive bagging and loading solutions, we deliver downstream solid sulphur handling plant for any requirement.

Chutes
All loading systems are equipped with chutes designed to deposit materials with the minimum amount of dust generation:
- Cascade chutes slow down material drop to minimize dust.
- Level sensors reduce drop distance.
- Dust skirts beneath chutes contain any remaining dust.

Truck loading
Our bulk materials handling team can design, manufacture and install truck-loading equipment to meet any requirement:
- Telescopic loaders with level sensors to reduce drop distance.
- Continuous truck loading.
- Single or multiple loading bays.

Rail loading
Rail loading systems can be designed to meet any requirement with solutions for continuous or stationary loading:
- Telescopic loaders with level sensors.
- Loading up to four rail cars at once.
- Continuous loading via pivotal arm.

Ship loading
We offer four types of systems for ship-loading: stationary, linear travelling, radial quadrant and mobile units.
- Telescopic loaders with level sensors.
- Telescoping, luffing, slewing and shuttling.
- Remote control units.

Bagging
We can supply complete bagging systems suitable for 50 kg bags or big bags (500 / 1 000 kg):
- Pre-weighers.
- Open mouth bagging, automatic closing.
- Metal detection.

Global after-sales support to protect your investment

As a company operating in every corner of the world, from the frozen Canadian north to the deserts of the Gulf states, from the tropical heat of South America and the Indian subcontinent to the remotest regions of Asia, we are able to provide customer support on a global basis.

We have invested heavily in an infrastructure that enables us to deliver service when and where it's needed, through local technicians backed up by a dedicated engineering team. We can also provide in-depth skills training for your in-house teams, ensuring optimum system productivity, a high quality end product and maximum return on investment.

And a network of regional offices and production centers means that IPCO expertise, advice and spare parts are never more than a phone call away.

We can work with your people to support planned maintenance programmes that will minimize the risk of costly downtime. We can work with them to develop and implement best practices that ensure maximum plant efficiency and full compliance with all relevant health & safety and environmental requirements.

In short we will provide a complete package of support services to ensure that your IPCO systems achieve maximum productivity at all times.

When you choose IPCO as your supplier, you're not only investing in precision engineered, sulphur processing and handling solutions.

You're also entering into what we hope will become a long-term partnership! One that we will support through many decades' experience in meeting the needs of the world's oil and gas refineries:

- Global capability.
- Trained, equipped and qualified engineers.
- Full system optimisation.
- Fast, cost effective commissioning.
- Transfer of know-how to in-house personnel.
- Tested under production conditions.
- Full technical service.
- Life-cycle concepts including maintenance contracts or even planned operations.

As a company operating in every corner of the world, we are able to provide customer support on a truly global basis.

SULPHUR PROCESSING AND WORLD LEADER

08-2019