



Technical Manual

Edition 2007

Your Technology Specialist

simrit[®]

The information in this product catalog is based on the experience gained in decades of research on the development and manufacture of seals and components for vibration control in the Freudenberg group. It represents the current state of our knowledge.

The sealing effect of many products in the catalog is, however, not provided solely by the component. Indeed, in the specific application this effect depends on other parameters such as installation position and contact area, the pressure applied, operating temperature, media to be sealed, lubrication, vibration control-related effects and any ingress of dirt from the outside. This and other, unknown, factors in practical use can have a significant effect on the seals.

Against this background, general statements on the function of the products in the catalog are not possible. Information in this catalog only represents recommended values that are not correct in every application. We therefore recommend you to discuss your specific application with our advisory service. In cases with high or special loads, for example due to aggressive media, the seal should be selected in collaboration with us; here trials on reliability are often indispensable.

In the context of product optimisation we reserve the right to change, without prior notice, the product range, production sites, products and their manufacturing process as well as the information in this catalog.

All previous issues become invalid on publication of this issue of the catalog.

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Your Simrit Partner





Simmerring®



Fluid Power



Hydraulic Accumulator



O-Rings



Lederer

Liquid Silicon Products



Special Sealing Products



Vibration Control

Simrit, Your Technology Specialist for Seals and Vibration Control

With its comprehensive product range of seals and vibration control and large number of services, Simrit provides a performance package unique in the market for almost every application. To the market well known product groups, such as Simmerring®, Merkel, Integral Accumulator, ISC O-Ring and Lederer, as well as special sealing products and vibration control, constitute the world's largest product range for all applications for general industry. Our leading expertise in materials is the essential success factor which maintains our continuous technological advantage.

As part of the Freudenberg Group, we draw upon established research, development and production expertise within the group. The close co-operation between Simrit in Europe and America with our Japanese partner NOK provides you with consistent quality standards for all local market requirements. Simrit Service Centres in all industrial markets supports more than 100,000 customers on-site.

The Simrit service package at a glance:

- **World's largest product range**

Comprehensive solutions from a single source

- **Continuous innovations**

Technological prominence for the competitive advantage of our customers

- **Unique expertise in materials and high quality standards**

Leading know-how for safe and cost-effective applications

- **A huge number of integrated services**

Support from development up to continuous product deployment

- **Globality**

Global expertise with the knowledge of local market requirements

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Leading Technologies for Sophisticated Solutions



Dear Reader,

This first issue of the Simrit Technical Manual outlines our technological expertise, gained over decades of experience regarding all aspects of seal and vibration control technology, in a concisely laid out reference book.

Complementary to the 5 Simrit product catalogs, in which you can find 26,000 catalog items, this reference book encompasses valuable technical fundamentals of materials as well as applications and design types on through to FEM simulation processes for Simmerrings and rotary seals, seals for fluid power, O-rings and static seals, special sealing products and for vibration control.

This Technical Manual serves design engineers, developers and researchers, just as well as universities and other technically oriented institutions, as a lexicon for all topics regarding the properties of elastomer materials, engineering product designs or the selection and identification of relevant operating conditions for seals and vibration control-related products. It is based on the established technical fundamentals of the Simrit catalog, which has been completely revised and expanded according to the newest findings of our worldwide research centres. Numerous diagrams, photographic documentation and elaborate 3D-models of application examples vividly explain deployment factors and dimensioning.

A DVD with all 5 available Simrit product catalogs, the Technical Manual, 3D-CAD geometries, FEM simulations and much more, completes the wide range of information of this reference work.

We are certain that the Technical Manual will make a valuable contribution towards resolving your seal and vibration control-related issues. If you require more detailed information, then please contact your Simrit customer support specialist or a Simrit Preferred Distributor in your area.

Benefits and functions of the Technical Manual:

- Technological fundamentals of all seal and vibration control-related products, based on decades of experience
- Explicit descriptions and explanations of the elastomer materials
- Detailed technical tables and diagrams for scientific exploration of specific topical aspects
- Numerous illustrations
- DVD with all 5 product catalogs, the Technical Manual, 3D-CAD geometries, FEM simulations, etc.
- Quick look up table

Please don't hesitate to let us know your suggestions for supplements and extensions for future editions of the Technical Manual. We are grateful for every bit of advice on how we can improve this element of our service to you.

I would like to truly thank you for your confidence in Simrit, and look forward to a continued cooperative partnership.

Sincerely,



Dr. Jan Gupta
Simrit Europe

Methods and procedures of our research centres

Simrit accompanies you with its technological expertise from the development stage on through to ongoing product usage.



The optimum – right from the beginning

Based on a material model developed by us, which describes the reality much better than the conventional standard models, we can calculate and simulate the behaviour of our materials and our products with extreme accuracy. Combined with our statistical know-how, for every process segment of product development we find the optimum solution for

- Material
- Tool design
- Manufacturing process and part design

Your benefits:

- Reduction of the development period
- Reduction of the development costs
- Increase in product quality



Quality management

Simrit materials must satisfy the highest demands when they are in use. In order to ensure this prior to their application, a broad range of test and analysis possibilities are available to us. Specifically, we examine:

- Mechanical characteristics – dynamically and statically
- Thermal characteristics
- Aging and service life
- Chemical resistance
- Friction and wear

The damage analysis

Occurrences of damage can provide valuable information for optimising products.

Simrit conducts, with

- chemical
- physical
- microscopic

processes and well conceived methods, extensive damage analysis for determining causes and, based on this, makes recommendations for individual remedial action.



A step ahead

In order to secure our technological lead, we constantly introduce the newest research methods and techniques, such as

- Nuclear magnetic resonance
- Chemiluminescence
- Confocal laser microscopy with Raman spectroscopy
- Nanotechnology
- Sensor technology

This provides long-term benefits for you, as our growing knowledge of materials makes it possible with even greater focus to integrate special materials properties when manufacturing the various components.



Elastomers with Excellent Characteristics – the Basis of Innovative Solutions

Thorough know-how about materials for more than 60 years

Simrit has now been developing innovative branded products at the highest level for more than 60 years. With in-depth experience on materials, well-founded knowledge of processing and extensive product know-how, again and again we create ideal pre-conditions for your success. However, the quality of the elastomer material is decisive for the optimum operation of seals and components used in vibration control. Therefore, we are particularly proud of our pioneering role worldwide in this sector.

Deliberately targeted de-velopment of materials guarantees the highest possible quality and long life

More than 250 engineers and chemists worldwide are developing new materials every day for the highest possible functional requirements in joint development ventures with various research institutions plus leading manufacturers of polymers and chemicals. The materials we develop must fulfil the respective customer-specific requirements and withstand all the loadings feasible in their branch of industry – both with regard to temperature, pressure and resistance to media and in the presence of static or

dynamic loadings. The length of life of our products is constantly being improved by optimising our materials. Constant monitoring on the road to these products becoming mass production materials also guarantees you the highest possible quality.

The Individual Materials We have Developed are Leaders Worldwide

Uniquely wide range of standard materials

We produce more than a billion seals annually from a production volume of more than 15,000 tons. When considered as a whole, a range of material, which is unique in its quality and quantity, is available to you with more than 1,500 mixtures of 850 raw materials for your individual applications in seals and vibration control. A large proportion of these are standardised mixtures. Of course, our competent team of experts will advise and assist you fully – from the selection of the right materials via the test phase to the start of production.



Comprehensive performance package and much more

Materials manufactured individually to your wishes and requirements are unusually important in the comprehensive performance package from Simrit. The use of polymers, based on our own raw materials and tailored to your requirements, enables Simrit to develop high performance materials which satisfy the highest functional demands. We use our global materials database for the selection of application-specific materials, which groups together the know-how

of our experts, working worldwide, to form a network of top technological services which we can call on at any time. Finally, the appropriate material with the optimum characteristics for your application is manufactured using computer-controlled procedures, from the selection of the raw material to the compounding process. Of course, always adhering to the highest standards in quality and processing and complying with ecological guidelines – in the interests of your success and the environment.

Simrit Academy – Secure these Advantages for Your Success



The Simrit Academy offers you seminars which are tailored to your needs in terms of content and specialisation levels. There are numerous advantages for you.

A know-how advantage

You receive information from more than 20 qualified experts with regards to state of the art products and materials. Thus ensuring the correct selection of parts as well as smooth workflows in your production processes.

Individuality

Our seminar programme covers the needs of beginners and pros alike. The selection is extensive, allowing for a choice appropriate to the level of knowledge.

Practical relevance

Reinforcement of theoretical knowledge through practical exercises. At the same time we invite you to view our production and research facilities.

Productivity

With the knowledge that you have gained, you can increase your productivity by appropriately selecting the correct products and materials every time.

Languages

All attendance seminars are offered in both German and English. Simultaneous translation is available at every Innovations Forum.

Sustainability

For each Simrit Academy event, you will also receive comprehensive documentation to accompany the course information. Your participation is substantiated by DIN-ISO 9001 format seminar certificate.

Simrit Seminars

You visit our Academy on location in Weinheim and directly experience all materials and products yourself. In doing so, you can choose one of three different seminar categories.

Simrit Basic Seminar

Participants without previous technical knowledge can get to know the entire Simrit performance package.

Simrit Professional Seminar

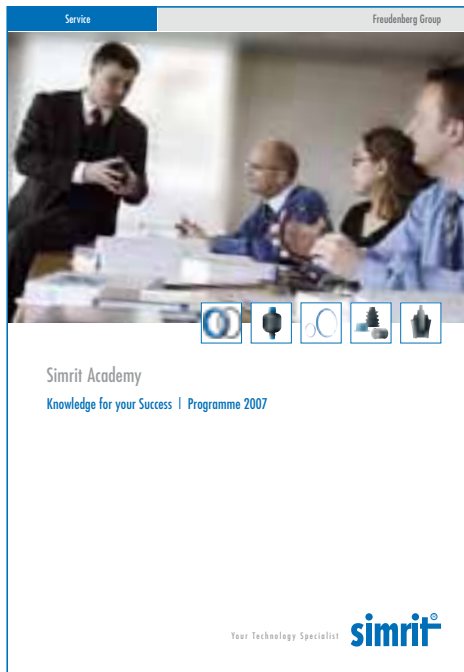
Become an expert on Simrit and obtain detailed knowledge about all products, processes and materials. Both in theory and in practice.

Simrit Seminar Special

The course contents are highly specialised and concentrate on conveying knowledge related to a specific product or material area.

Innovation Forum

Interested parties learn about all the new Simrit innovations in this lecture series, and can exchange knowledge and experience with panels of experts and with other participants.



Registration

You can easily register for Simrit seminars at www.simrit.com/academy. Additional detailed information on registering and on the seminars can be found in the Simrit Academy Programme 2007 brochure, which you can order or download from www.simrit.com.



Merkel Xpress – The 24 hour Express-Service for Seals, Guides and Pivoting Parts

When it has to be there in a hurry: Merkel Xpress from Simrit. Our service delivers the desired seal within 24 hours.

With Merkel Xpress from Simrit you can minimise your machine down-time – and therefore production costs. At the same time, you can reduce the number of spare parts you keep in stock. After all, if you can order it at any time, you don't need to keep it in stock. Ask us: you'll have your seal tomorrow.

The seal you need

Whatever you need at short notice, we can produce it within a few hours using state-of-the-art production technology. Tailor-made to suit your requirements, from single seals for prototypes through to mass production in economical batch sizes. Merkel Xpress saves you shaping costs and minimum order quantities – by using new materials and thanks to our high-speed production and delivery systems.

Merkel Xpress offers you:

- Delivery within 24 hours
- Seals of up to 4 metres in diameter
- From single seals to mass production
- Wide range of profiles
- Original Simrit materials and geometries
- Plus special designs and special materials
- Leading production know-how
- Continuous development of the product range

Tailor-made. Immediately. Economically. The Triple Advantage of Merkel Xpress

Materials

Polyurethane:

SQ-PU

SQ-HPU

Further materials:

- For low-temperature ranges (down to -50°C)
- Self-lubricating properties
- With FDA approval

Elastomers:

SQ-NBR

SQ-HNBR

SQ-FKM (fluorelastomer)

SQ-EPDM*

SQ-SIL*

* Also with FDA approval (food safe)

Plastomers:

SQ-POM

SQ-PA

Fluoroplastic (PTFE):

SQ-WFLON (white, virginal)

SQ-GFLON (with 15% glass fibre, 5% MoS₂)

SQ-BFLON (with 40% bronze, or 60%)

SQ-CFLON (25% carbon)

Further qualities on request.



A flexible production concept for every requirement

With the newest generation of special lathes and software solutions developed to precisely satisfy customer demands, we can produce every machine-manufactured seal possible, quickly and economically. More than 260 pre-programmed seal design types serve as a basis for our efficient and rapid manufacturing processes. In this regard we work with both special materials such as PEEK and FFKM, Original Simrit polyurethane and, of course, upon request

every other market-standard material for your specific application. The perfect solution for:

- Non-standard seal and machined-part spare parts for every manufacturer
- Rapidly required standard seals
- Small-volume series of special seals
- Samples
- Substitute seals
- End-of-life design types whose series production will not be restarted

Further information can be found at www.simrit.com.

Realise Your Objectives
Quickly with www.simrit.com



Simrit Online – more than just a facelift. Thanks to a smart Navigation System – developed exactly to your requirements – the information you are looking for can be found about products and services with just a few mouse clicks.

The new online presence from Simrit, with integrated Smart Navigation, offers you a particularly easy and quick work platform for your Internet research. There's no quicker way for you to achieve your objective of getting solid expertise for your planning. Whether you need product information, material data sheets or want to access 3D-CAD data – in the user-friendly Simrit database you are sure to quickly find what you are looking for.

3D-CAD data – Download added value

With the 3D Download Service from Simrit you can reliably create your designs with visual clarity for your seal or vibration control solution. Including all technical details in three-dimensional display quality.

The new Simrit eCatalog

Up to 100.000 items accessible online and available within 24 hours. The new eCatalog in the Simrit portal makes it possible. And the best thing about it: The Simrit Product Navigator guides you in the easiest and most straightforward manner directly to the optimum product for your application. Find – compare – select. Convince yourself.

mySimrit – the easy, exclusive offering for smart online users

Register once – benefit continuously. As a registered user of the mySimrit customer area, you benefit from the continuously expanding service advantages. From initial query through product availability to quick CAD downloads and even accessing current news, you receive true added value for a minimum of registration effort. The best thing to do is test us today.



We speak your language:

As a worldwide leading technology specialist, of course we also make our Internet services available to you in your native language. Right from the start, our new online presence is represented in the national language of the most important industrial markets. And, we are continually expanding our portal for you.



Simrit on the Internet – your platform for successful business

- Smart navigation and full-text searches for rapid results
- An extensive eCatalog with more than 100.000 items
- Easy download function for 3D-CAD
- An overview of our brochure service by mouse click
- Availability query
- and much more



