

DYNACOMP®

顶级无功功率补偿器

The Top-class Reactive Power Compensator

CNABB/SCS.040.6009G01 ed.5 02-06 02-2003

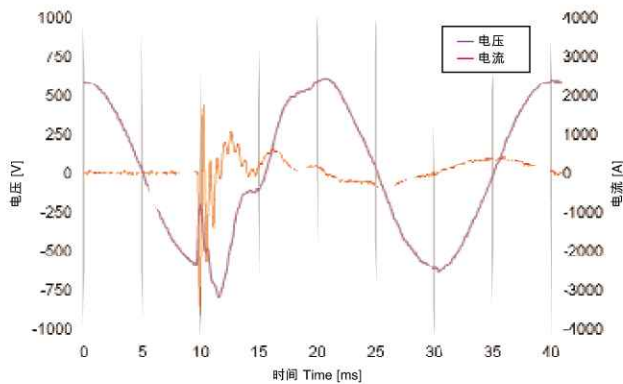


Dynacomp® 与电容器的机电切换比较

传统的电容器：机电式切换

切换时的瞬变现象

传统的电容组带有接触器，在需要无功功率的时候进行切换。但切换瞬间的精确性经常变动并且难以控制。并产生强大的瞬变电流。干扰网络，危及触头并增加电容器上的应力。电流峰值达到3640A，约为标称峰值304A的12倍。



使用接触器的转流电容柜切换的电流波形

反应时间长

传统的电容器使用机电方式切换，功率因数修正系统安装的是放电电阻。它是通过减少了电容器和电网之间的电压差，相应地减弱瞬变的强度。而电容器放电需要数秒的时间，这就大大地限制了系统的反应时间，而且还不能抑制瞬变。

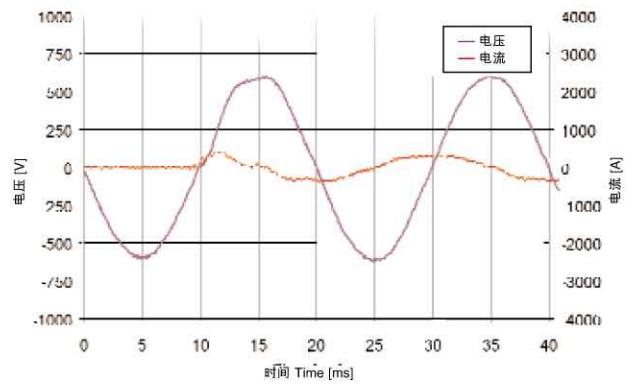
短暂的使用寿命

接触器的使用寿命短，需要经常更换。这种系统需要花费大量的维护精力。

Dynacomp®: 顶级的动态补偿器

切换时无瞬变现象

Dynacomp®是以电子切换装置而非接触器安装的。在要求切换时无瞬变现象的应用场合，它是最佳的选择。它不会干扰高敏感度的网络，也不会影响附近的设备。下图显示的是使用了Dynacomp®切换相同的无功功率。电流峰值仅为304A，相当于标称峰值。



使用Dynacomp®切换时的电流波形

反应时间短

Dynacomp®强大的控制和它的切换原理让功率因数修正的动态反应时间少于80毫秒，电压降的补偿时间少于20毫秒。如果外加一个外部信号，更可达到实时响应的效果。

长久的使用寿命

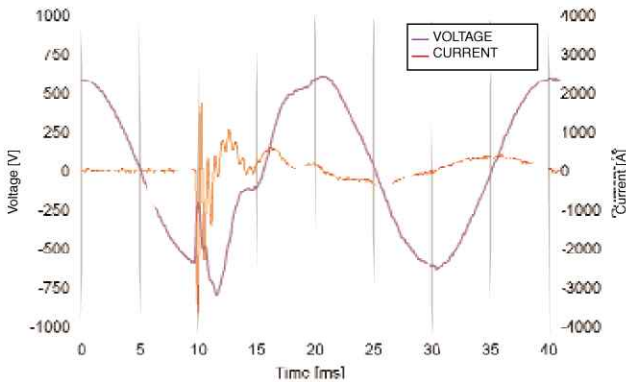
使用无瞬变的切换(无电弧、无活动部件)方式、并结合自我治疗的电容器，Dynacomp®可以保证非常长久的使用寿命，对切换的操作次数没有任何限制。

Dynacomp® vs Electromechanical switching of capacitors

Electromechanical switching of capacitors

Transients at switching

Conventional banks with contactors are switched on when reactive power is needed, but the precise instant of switching is variable and not controlled. This has the consequence that the switching of the capacitors results in a big transient. This transient disturbs the net, is dangerous for the contactors and increases the stress on the capacitors. The disturbance created in the voltage waveform could perturb sensitive equipment. This is shown on the figure below, where 86 kvar are switched on by contactors. The current reaches 3640 A peak, approximately twelve times the nominal 304 A peak, approximately twelve times the nominal 304 A peak.



Current waveform when switching a conventional bank with contactors (transient)

Slow response time

Electromechanically switched power factor correction systems are fitted with discharge resistors. This allows reducing the voltage difference between the capacitors and the network and consequently the magnitude of the transients. Discharging the capacitors takes several seconds and tremendously limits the response time of such system, without suppressing the transients.

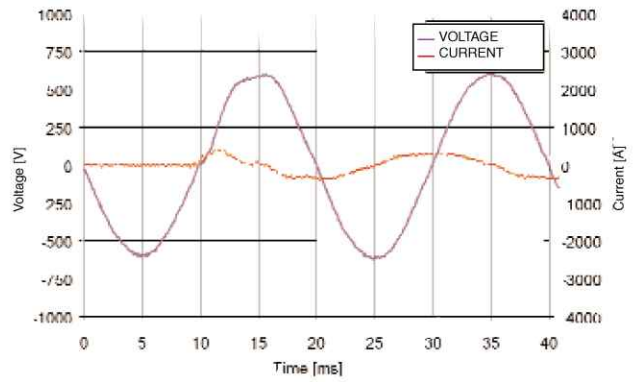
Limited life

Contactors have limited lifetimes and need to be replaced frequently. Such systems also require important maintenance efforts.

The Dynacomp®: the top-class dynamic compensator

Transient free switching

The Dynacomp®, fitted with electronic switches instead of contactors, is the perfect choice in applications where transient-free switching is required. It will not cause disturbances to sensitive networks or neighbouring equipment. The figure below shows the switching of the same step but with the static switch of the Dynacomp®. The current reaches only 304 A peak, i.e. the nominal value.



Current waveform when switching a Dynacomp®

Fast response time

The powerful control of the Dynacomp® and its switching concept allows dynamic response times less than 80ms for power factor correction, less than 20ms for voltage drops compensation and instantaneous if an external signal is available.

Long life

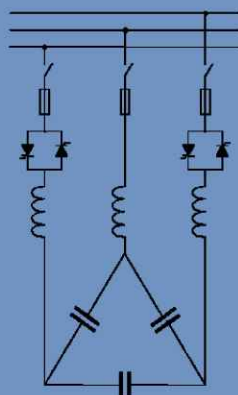
The transient free switching (with no electric arc, no moving parts) combined with the self healing capacitors used in the Dynacomp® guarantees a very long life of the system without any limitation in the number of switching operations.

Dynacomp®: 原理

Dynacomp®基本上以电容和电抗组成，由功率电子操控。图中显示了三相Dynacomp®的简单线路图。Dynacomp®可为低压设备提供至少690 V的标称电压补偿。

硅可控整流器会于电容电流的自然零交叉发动。因此，电容于电网投切时不会产生瞬变。这控制只容许完整的电流变换，所以Dynacomp®不会产生谐波。

Three phase Dynacomp® circuit



The Dynacomp® is basically a reactive power filter circuit (capacitors + reactors) switched on the network by solid state power electronics, without any moving part. A three-phase Dynacomp® circuit is represented below. The Dynacomp® can compensate low voltage equipment for nominal voltages up to at least 690V.

The thyristors are fired at the natural zero crossing of the capacitive current. As a result, capacitors are connected to the network without transients. The control is such that only complete alternations of the current are allowed. This insures that no harmonics are generated by the Dynacomp®.

Dynacomp®: 优点

- 无瞬变切换
- 快速切换 (≤ 1 周期)
- 可吸收谐波
- 结合了电容器和无功率控制器的技术
- ABB 半导体等级和现场经验
- ABB 微处理器基于 Dynacomp® 控制器
- ISO 9001 认证
- ISO 14001 认证

Dynacomp®: advantages

- Transient free switching
- Fast switching (≤ 1 cycle)
- Harmonics absorption
- Combination of ABB Capacitors and Reactive Power Control Technology
- ABB semiconductor rating and field experience
- ABB micro-processor based Dynacomp® Controller
- ISO 9001 certification
- ISO 14001 certification

Dynacomp®: 说明

Dynacomp®包括电容器、电抗器、动态切换装置和电子控制器。这些元件和一些辅助装置一起安装在一个柜体中。组成在工厂里组装和测试的系统。

Dynacomp®是一种为用户度身订造的系统，柜体的尺寸可以适合每一种特殊的场合，同时又兼顾元件的安排。系统若由多个柜体组成，柜体一般会安装在一个公共底座上。



Dynacomp®: description

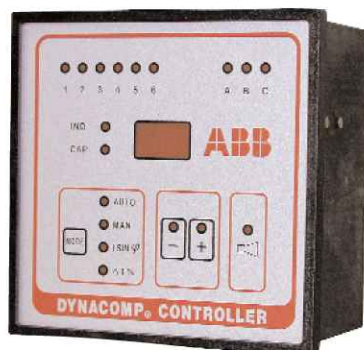
The Dynacomp® consists in capacitors, reactors, Dynaswitches and the electronic control. Those components are mounted in cubicles together with auxiliary apparatus and wiring to form a factory assembled and tested system.

The Dynacomp® is a tailor-made system and cubicles dimensions are adapted to each particular situation as well as the arrangement of components. Systems assembled in several cubicles are usually mounted on a common base.

Dynacomp® 控制器

基于微处理器，控制器可以有4种配置，适合有特别需要的客户：

- 精确的功率因数补偿
 - 闭合回路控制
- 最少的反应时间 (取决于应用条件)
 - 外部触发装置
 - 开放回路控制
 - 外部触发装置 + 开放回路控制



Dynacomp® controller

Micro-processor based, it is available under 4 configurations designed to meet the specific needs of the customer :

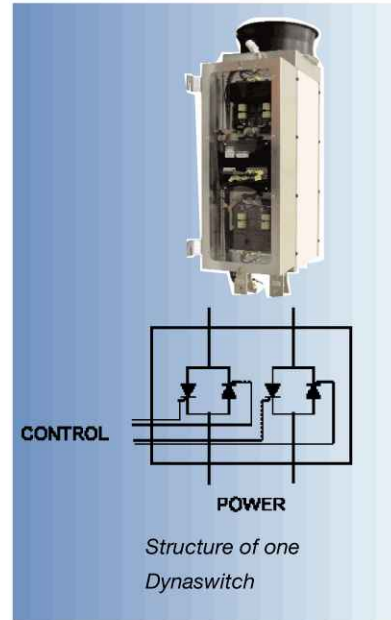
- For accurate power factor compensation :
 - Closed loop control
- For minimum response time (depending on the applications) :
 - External trigger
 - Open loop control
 - External trigger + open loop control

动态切换装置

- 动态切换装置是Dynacomp®的电子式切换装置，控制电容器与电网的连接。
- 动态切换装置是由2个AC可控硅流晶体管组成，包括一对方向相反的高功率半导体晶体管（高压盆型），它们控制着电流的通路。
- 因为只允许整个电流周期，动态切换装置的原理并不像传统的AC半导体闸流晶体管那样，需要选择晶体管的触发脉冲来调节电流。它所引起的是传统机械中断装置的作用，可以让用户清楚地选择闭合瞬时。好处是避免瞬变现象。使用了半导体晶体管，分断瞬时发生在电流过零点。
- 动态切换装置同样自身装置有散热器，可以确保半导体的正常工作温度。整个系统均由高速分断保险丝保护。动态切换装置根据要求可以安装或不安装散热风扇。

Dynaswitches

- The Dynaswitch is the electronic switch of the Dynacomp® controlling the connection of the capacitors to the network.
- The Dynaswitch is composed of two AC thyristor valves, consisting of back-to-back connected pairs of high power thyristors (high voltage disc type), governing the passage of current.
- As only full alternations of current are allowed, the Dynaswitch does not act as a classical AC thyristor valve for which the firing pulses of the thyristors are chosen to modulate the current. It plays the role of a classical mechanical interrupter, with the possibility to choose explicitly the closing instant. The interest is to avoid transients. The opening instant occurs at zero crossing of the current, as thyristors are used.
- The Dynaswitch is also equipped with its own cooling device, ensuring a normal working temperature for the semiconductors. All the system is protected by very high speed fuses. Dynaswitches are fitted or not with a cooling fan according to specific requirements.



电抗

Dynacomp®本身不需要电抗，但可串联上电抗用于有谐波的工作环境。电抗可保护电容不被高频电流破坏和可令Dynacomp®产生部份的滤波作用。

电抗是由铁芯、铜/铝线和铜接头组成。组件因真空超压处理的聚酯树脂和烘乾的原因而绝对绝缘。电抗是专为重工业工作环境而设计。

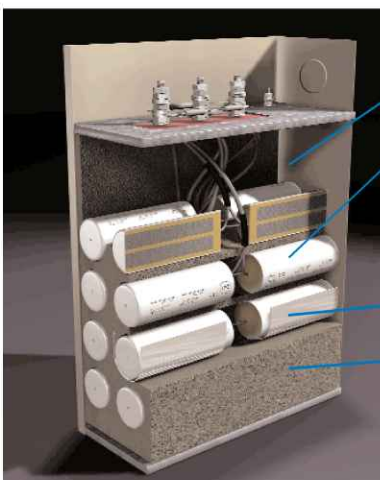


Reactors

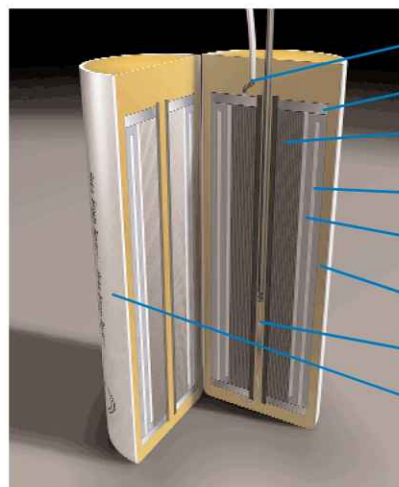
The capacitors may be series connected to reactors but this is not required by the Dynacomp® itself. It may be required by the application if harmonics are present on the network. In that case, the reactor offers major advantages to the system, such as the protection of the capacitors against high frequency currents and filtering properties.

Reactors are iron cored with copper or aluminium windings and copper terminals. Units are completely impregnated under vacuum and overpressure in a polyester resin and dried in furnace.

The reactors are also designed for heavy industrial environments.



- 重金属外壳
Heavy duty enclosure
- 电容器的成分：
- 再生电质
- 自我治疗
- 非常低的损耗
Capacitor element:
- dry dielectric
- self-healing
- very low losses
- 热平衡片（散热片）
Thermal equalizer
- 惰性无毒颗粒
Vermiculite



- 电线连接
Wire connection
- 金属头状物
Metal end spray
- 金属化聚丙烯薄膜（单独介绍）
In-house metallised polypropylene film (unique profile)
- 第二层箔片绕组
Secondary foil winding
- 双轴绳定位聚丙烯介电质
Biaxially oriented polypropylene dielectric
- 热固性封装材料
Thermo-setting encapsulation
- 保险丝
Fuse link
- 塑料外壳
Plastic case



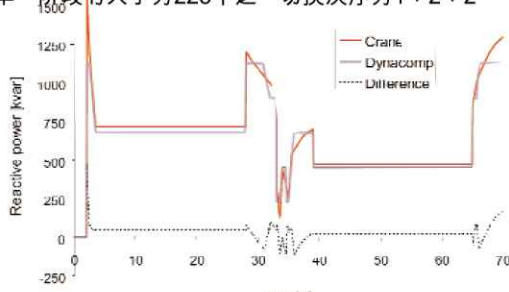
港口起重机

接触器切换式电容器组总是在切换时产生瞬变现象。如果在闭合的瞬间电容器和电网的电压相位相反，那么带电的电容器切换时会产生强烈的瞬变现象。这就是传统型的电容器组总是在切换之间(分/合)有(1分钟)延时的原因。延时让电容器通过放电电阻放电，但却限制了传统电容器组应用于需要频繁切换非常不稳定的负载。

Dynacomp® 的切换无需电容器放电，所以 Dynacomp® 可以应用于任何频繁波动负载的功率补偿。

图1所示的Dynacomp®安装在港口起重机上的例子。在起重机的工作周期中，显示时间轴上所要求的无功功率。

在周期中，起重机需要不同数值的补偿功率。整个起重机周期持续约1分钟。很明显，传统型的电容器组难以胜任这种操作：周期太短，所要求的补偿功率太大。由Dynacomp®提供的无功功率和损失的千乏同样在图形中显示出来。Dynacomp®间断性地提供无功功率，阶段的大小为225千乏，切换次序为1：2：2。



港口起重机的应用
Harbour crane applications

Harbour crane

Contactors switched banks always produce transients when switched. Switching of charged capacitor results in large transients when the capacitor and network voltages are in phase opposition at the closing instant. This is why conventional banks always have delays (~1 minute) between switching on/off the capacitors. This delay permits the discharge of the capacitors through the discharge resistors, but limits the utilisation of conventional capacitor banks for rapidly fluctuating loads requiring frequent switchings.

As the switching of the Dynacomp® does not require the discharge of the capacitors, the utilisation of the Dynacomp® for the compensation of any load with rapid variations is possible.

The figure 1 represents an example of a Dynacomp® installed on a crane in a harbour. The working cycle of the crane is shown as the required reactive power versus time.

During its cycle, the crane requires variable amounts of reactive power. The whole crane cycle lasts about one minute. Obviously, compensation with conventional banks is not possible for that operation: the cycle is too short and the required reactive power is too large. The amount of reactive power supplied by the Dynacomp® and the missing kvar appears also on the graph. The Dynacomp® provides the reactive power in discrete steps. The step size is 225 kvar with a 1:2:2 switching sequence.



电焊机

下图中，切换上了4段150千乏的功率来补偿210千乏的单相电焊机。为了得到实时的响应时间，还使用了外部信号(电压降补偿)。

这些图形清楚地显示出由于电焊机的原因引起的，电压降全面减弱。从而避免了对一些敏感度高的设备如PLC、电脑、照明系统等的干扰。

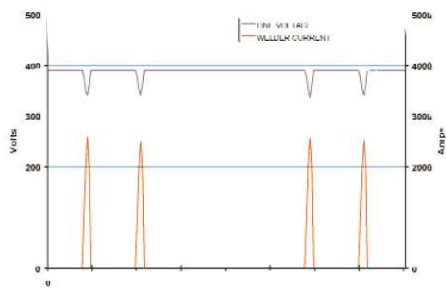
除了有这样的益处之外，电焊机由于点焊参数的减低而提高了工作质量，做同样的工作而耗费更少的能源。

Welding machine

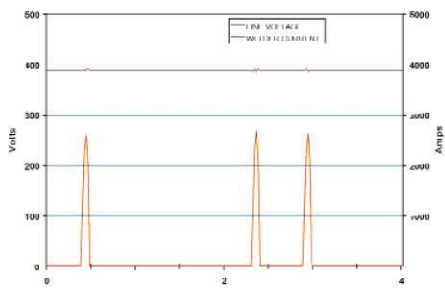
On the figures below, 4 steps of 150 kvar are switched on for the compensation of a 210 kVA single phase welder with the use of an external signal for instantaneous response time (voltage drop compensation).

These figures show clearly that the voltage drop due to the welding machine is totally reduced. Perturbation to sensitive devices like PLC, computers, lighting, ... are avoided.

In addition to this positive effect, the quality of the welding was changed in such a way that a reduction of the welding parameters has been possible, lowering the power consumption for the same production, that too with a better quality of the final product.



没有 Dynacomp®
Without Dynacomp®



装有 Dynacomp®
With Dynacomp®

电机的启动

由于电机启动时需要巨大的无功功率，从而导致了在低压侧和高压侧不愿意见到的电压降。

下图所示，投切换上了5段250千乏的功率来补偿一个375千伏安的电冰箱压缩机。

在高压侧的电压降会对周边的公司产生影响。

Dynacomp®的解决方法可以让高压侧的电压降限制在供电公司限定的范围。

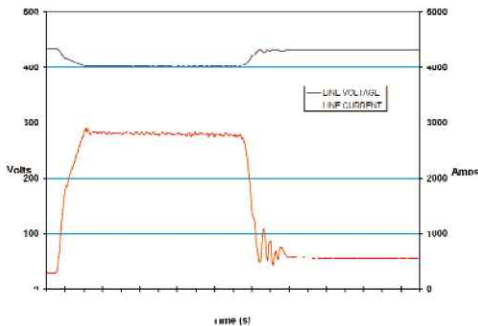
Motor start

The high reactive power demand during a motor start creates undesired voltage drop on low voltage side as well as on high voltage side.

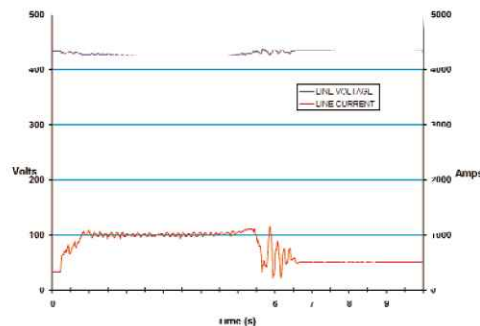
In the figures below, 5 steps of 250 kvar are switched on for the compensation of a 375 kVA motor of a high pressure refrigeration compressor.

The voltage drop on the high voltage side was creating problem in the neighbouring companies.

The Dynacomp® solution allowed to fulfill the voltage drop limit on the high voltage side imposed by the utility company.



没有 Dynacomp®
Without Dynacomp®



装有 Dynacomp®
With Dynacomp®

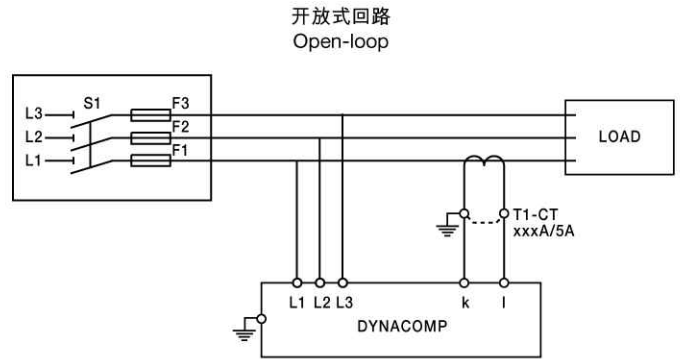
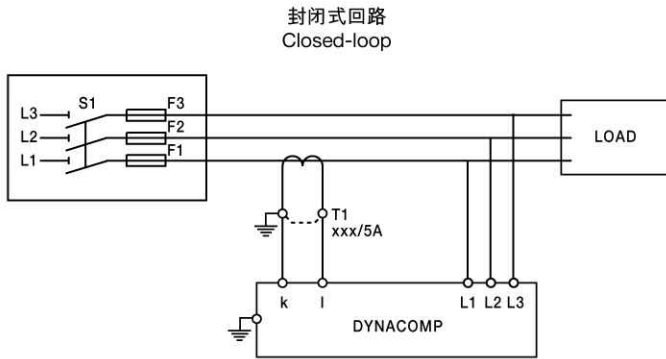
技术规范

额定电压	由 220 - 690V - 50Hz 或 60Hz， 三相或单相。
输出等级	每投切可高达 500 kvar。Dynacomp® 可完全按用户需要而作出适当的工作。
电容器	干式设计和自恢复功能。 根据 IEC 831 1和2设计标准。
标准	钢片。 颜色：RAL 7032。 保护等级：IP23。 根据 EN60439 标准。
环境温度	根据 IEC831 (-10°C/+40°C) 标准。
测量系统	微处理器是基于为平衡三相网络和单相网络系统。

Technical specifications

Rated voltage	From 220 to 690V - 50Hz or 60Hz, three or single-phase.
Output rating	Up to 500 kvar per step. The Dynacomp® is a totally tailor-made product adapted to each particular need.
Capacitors	Dry type self healing. Design according to IEC 831 1&2.
Standard cubicle	Steel sheet. Color RAL 7032. Protection IP23. According to EN60439.
Ambient temperature	According to IEC831 (-10°C/+40°C).
Measuring system	Micro-processor based system for balanced three-phase networks or single-phase networks.

连接线路图 Connection diagram



可提供单相系统，详情请查询ABB办事处低压部。

Single-phase systems are also available. Please consult us.



ABB (Hong Kong) Ltd.

低压部：
香港新界大埔
大埔工业邨大喜街3号
电话：(852) 2929 3838
传真：(852) 2929 3505

沈阳分公司：
中国辽宁省沈阳市 110001
和平区南京北街206号
沈阳假日大厦城市广场二座3-166室
电话：(024) 2334 1818
传真：(024) 2334 1306

青岛分公司：
中国山东省青岛市 266071
香港中路12号
丰合广场B区钻石楼310室
电话：(0532) 5026 396/97/98
传真：(0532) 5026 395

长沙办事处：
中国湖南省长沙市 410005
黄兴中路88号
平和堂商务楼12B01
电话：(0731) 2562 898
传真：(0731) 4445 519

南宁办事处：
中国广西省南宁市 530012
新民路34-18号
大明大厦10楼 D座
电话：(0771) 2827 123
传真：(0771) 2827 110

阿西亚·布朗·勃法瑞(中国)投资有限公司

北京总部：
中国北京市 100016
朝阳区酒仙桥路10号恒通大厦
电话：(010) 8456 6688
传真：(010) 8456 9907

长春办事处：
中国吉林省长春市 130061
西安大路16号
国际大厦A座7层709室
电话：(0431) 8926 821/23/25
传真：(0431) 8926 835

杭州办事处：
中国浙江省杭州市 310007
杭大路18号
黄龙世纪广场C区6楼0606, 0608室
电话：(0571) 8790 1355
传真：(0571) 8790 1151

成都分公司：
中国四川省成都市 610072
蜀都大道西端
温哥华广场28层C,D,E座
电话：(028) 8778 6688
传真：(028) 8774 4101/8779 5399

广州分公司：
中国广东省广州市 510075
天河北路183号
大都会广场21楼1-8及16室
电话：(020) 8755 8080
传真：(020) 8755 0172

天津办事处：
中国天津市 300141
中山路290号
万科中心办公大楼2505室
电话：(022) 2621 6488
传真：(022) 2621 6485

哈尔滨办事处：
中国黑龙江省哈尔滨市 150001
红军街26号
北亚大厦1001-2室
电话：(0451) 3605 460/465-66
传真：(0451) 3602 731

南京分公司：
中国江苏省南京市 210002
中山东路90号
华泰大厦18楼
电话：(025) 6645 645
传真：(025) 6645 338

重庆分公司：
中国重庆市 400060
南坪北路15号
重庆扬子江假日饭店2楼
电话：(023) 6282 6688
传真：(023) 6280 5369

深圳分公司：
中国深圳市 518033
福田区, 福虹路
世贸广场A座23楼2302-2304室
电话：(0755) 8367 9990
传真：(0755) 8367 6437

大连办事处：
中国辽宁省大连市 116011
西岗区中山路147号
森茂大厦12楼
电话：(0411) 3696 021 / 632
传真：(0411) 3603 380

上海分公司：
中国上海市 200002
延安东路100号
联谊大厦7楼
电话：(021) 6320 3333/6323 2032
传真：(021) 6320 1132/6323 2697

济南办事处：
中国山东省济南市 250011
泉城路17号
华能大厦8楼
电话：(0531) 6092 726
传真：(0531) 6092 724

昆明办事处：
中国云南省昆明市 650011
青年路399号
邦克饭店6楼601室
电话：(0871) 3158 188
传真：(0871) 3158 186

西安分公司：
中国陕西省西安市 710054
文艺路北口甲1号
鹏豪大厦801-2室
电话：(029) 7857 422/7861 766
传真：(029) 7857 423

武汉分公司：
中国湖北省武汉市 430079
武昌珞瑜路200-1号
东湖新技术开发区管理大楼7楼
电话：(027) 8740 7421/8749 1288
传真：(027) 8740 7426

郑州办事处：
中国河南省郑州市 450007
中原西路220号
裕达国际贸易中心A座2207室
电话：(0371) 7713 588
传真：(0371) 7713 873

福州分公司：
中国福建省福州市 350003
五四路158号
环球广场30层 B座
电话：(0591) 7858 224
传真：(0591) 7814 889

CNABB/SCS.040.6009G01 ed.5 02-06 02-2003

<http://www.abb.com>