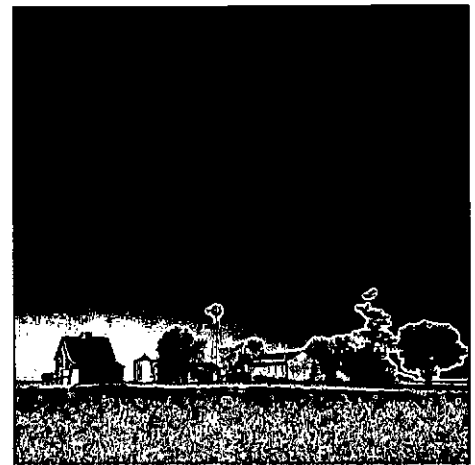
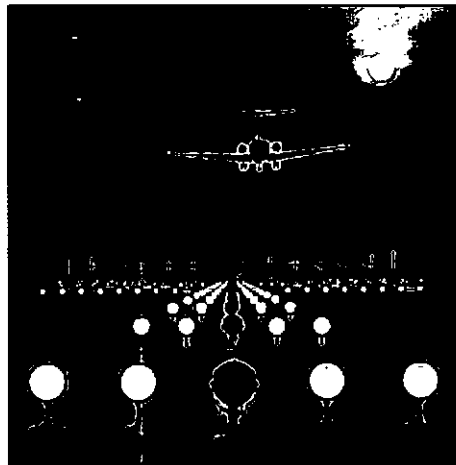
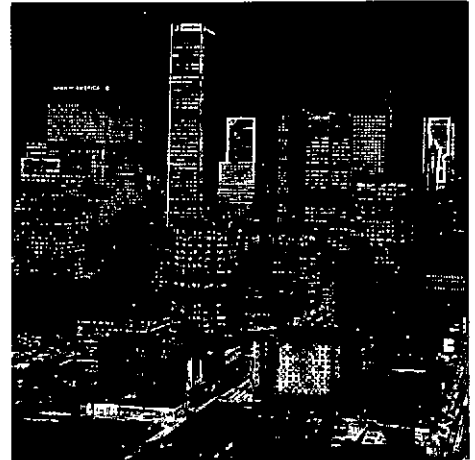


An
Engineers
Guide



to
Westinghouse
Transfer
Switch
Equipment





RELIABILITY AND QUALITY

The dedication to reliability and quality established by Westinghouse is not just a shallow corporate promise. Every single division within Westinghouse is charged with maintaining this same dedication throughout its operations. As a result, Westinghouse Transfer Switches are unsurpassed in quality and offer the assurance of positive, reliable performance. The Westinghouse switch is the only one on the market which, by design, is tested to **multiple** UL Standards (UL 1008, 1087 and 489).

Westinghouse, as an inaugural winner of the Malcolm Baldrige Quality Award, *does more than commit* to quality. We succeed in providing the highest quality products and services available.

The Malcolm Baldrige National Quality Award is an annual Award to recognize U.S. companies which excel in quality achievement and quality management.

Companies participating in the Award process submit applications which include completion of the Award Examination. The Examination is based upon quality criteria, created through a business-

government partnership. In responding to these criteria, applicants are expected to provide information and data on their quality processes and quality improvement. Information and data submitted must be adequate to demonstrate that the applicant's approaches could be replicated or adapted by other businesses.

The Award Examination is designed to serve not only as a reliable basis for making Awards, but also to permit a diagnosis of the applicant's overall quality management. All Award applicant's receive feedback reports prepared by teams of U.S. quality experts. The importance of just competing for the U.S. Government's Baldrige Award is so significant that Westinghouse has developed an internal award, the George Westinghouse Total Quality Award, which serves for us as a prelude to competing for the national award. In fact, a sister Westinghouse business won the inaugural Baldrige Award in 1988. This success has challenged other Westinghouse businesses, including Transfer Switches, to become the best in providing superior quality products. At Westinghouse, we're proud to say, "**You can be sure....if it's Westinghouse.**"

The Award promotes

- *Awareness of quality as an increasingly important element in competitiveness,*
- *Understanding of the requirements for quality excellence, and*
- *Sharing of information*

This engineers guide to Westinghouse Transfer Switches supplements our complete catalog section. It provides you with the necessary information needed to specify and apply our switches with confidence.

As a full line manufacturer of transfer switch equipment, Westinghouse employs the latest technology in distribution and control systems. We combine elements of our power breaker switching, solid state voltage/frequency sensing, RMS current sampling and IQ/IMPACC integrated communications technologies into the transfer switch product line.

Our goal at Westinghouse London, Kentucky is your total satisfaction in every respect. We guarantee that our products are safe, easy to maintain, and will provide years of reliable power switching performance. And they are backed by the best service available anywhere.

Here is a brief listing of installations that rely on Westinghouse transfer switch equipment.

**DISCOVER
WESTINGHOUSE
QUALITY**

Apple Computers, Inc.
Home Shopping Network
Presbyterian National Headquarters
Target Stores Headquarters
O'Hare Airport Communications Tower
Logan Field
First Boston Corporation
Northern Telecom
KYW-TV
Presbyterian Hospital
Farm Bureau
World Trade Center
Richmond Airport
I.R.S. Processing Center
MGM Grand Hotel
US Trust
Cedars Sinai Hospital
Kingdome Stadium
EG&G ERDA Nuclear Test Facility
Denver Federal Center
St. Mary's Hospital
Minora Hospital
Federal Office Building
St. Mark's Hospital
John Hancock Building
Tripler Medical Center
Fairbanks Memorial Hospital
Detroit Sewage Treatment Plant
The White House
St. Michael's Hospital
Kenmore Mercy Hospital
Jacksonville WWTP
NORAD Headquarters
Durham Sewerage Treatment Plant
Mountain Bell Telephone

Cupertino, CA
Tampa, FL
Louisville, KY
Minneapolis, MN
Chicago, IL
Boston, MA
Boston, MA
Raleigh, NC
Philadelphia, PA
Dallas, TX
Chicago, IL
New York, NY
Richmond, VA
Dallas, TX
Las Vegas, NV
New York, NY
Los Angeles, CA
Seattle, WA
Boise, ID
Denver, CO
Madison, WI
Kansas City, MO
New Orleans, LA
Salt Lake City, UT
Boston, MA
Honolulu, HI
Fairbanks, AK
Detroit, MI
Washington, DC
Milwaukee, WI
Buffalo, NY
Jacksonville, FL
Cheyenne Mountain, CO
Portland, OR
Phoenix, AZ

CBS/TV Gateway Tower Building
Sovran Bank Computer Center
WJZ-TV
Wiltshire Courtyard
Vandenburg AFB
NBC Data Center
Coachella Valley Water District
Los Angeles Department of Water & Power
Pacific Bell
McDonnell Douglas
LAX Airport
Chevron USA, Inc.
Rockwell
Automated Data Processing Headquarters
Miami International Airport
National Severe Weather Storm Labs
Detroit Correctional Facility
Memphis Light Gas & Water
Dyersburg WWTP
MCI
Champion International
Washington Post and Times
University of Texas
KALB-TV
IBM
Baptist Medical Center
ARCO Alaska
South County Hospital
Control Data Corporation
Crowley Medical Center
Boeing
Northwest Pipeline
Thomas Jefferson Hospital
Oxford Water Co.
VISA Corporation

St. Louis, MO
Norfolk, VA
Baltimore, MD
Los Angeles, CA
Vandenburg, CA
Newport Beach, CA
Riverside, CA
Los Angeles, CA
Los Angeles, CA
Long Beach, CA
Los Angeles, CA
El Segundo, CA
Seal Beach, CA
La Palma, CA
Miami, FL
Norman, OK
Detroit, MI
Memphis TN
Dyersburg, TN
Various Locations
Lufkin, TX
Washington, DC
Austin, TX
Alexandria, LA
Various Locations
Oklahoma City, OK
Anchorage, AK
Wakefield, RI
Harrisburg, PA
Spokane, WA
Seattle, WA
Laramie, WY
Philadelphia, PA
Millbury, MA
San Mateo, CA

**INTERNATIONAL
MARKETS
DEMAND THE
RELIABILITY
OF
WESTINGHOUSE
TRANSFER
SWITCHES**

Westinghouse Transfer Switches are the first choice for high switching duty applications in many countries outside of North America. In Central America, South America, the Carribean Basin, Southeast Asia, the Middle East and Africa, the Westinghouse Switch is the first choice for the most demanding applications.

For example, high switching duty due to frequent power outages is common in many countries. It is not unusual that due to either a power failure or rotating blackout, a transfer switch may be called upon to switch 8-10 times per day. When compared to the switching duty required in the United States, a weekly excercise period plus occassional power outages, it is apparent that the duty cycle required of the switching equipment must be significantly greater than that required in the U.S.

The Westinghouse switch has been designed and tested to meet the rigorous duty required in these applications.

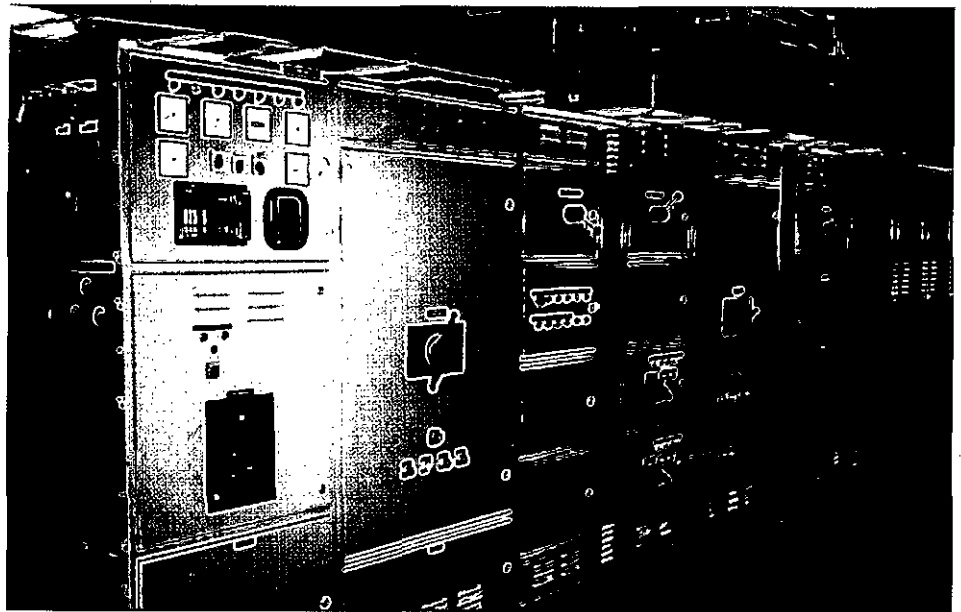
International consultants and engineers prefer the reliability and endurance designed into the Westinghouse Switch.

Westinghouse has installed switches of all ratings in each of the following countries.

Argentina
Brazil
Venezuela
Columbia
Guyana
Peru
Ecuador
Chile
Uruquay
Paraguay
Dominican Republic
Puerto Rico
Jamaica
Cost Rica
Honduras
El Salvador
Guatemala
Bahamas
Mexico
Nicauragua
Netherlands

Belgium
Belize
Saudia Arabia
Phillipines
Dubai
Singapore
Malaysia
Thailand
Guam
Saipan
Korea
India
Pakistan
Israel
Lebanon
Turkey
Syria
Egypt
Taiwan
Germany

Westinghouse backs up these installations with engineering service support in many parts of the world. The combination of a switch designed to meet demanding endurance standards, yet simple enough for user maintenance and trouble shooting, makes the Westinghouse switch ideal for high duty cycle applications.



International applications- Westinghouse Automatic Transfer Switches are installed at the Changi International Airport in Singapore. For control of the emergency power standby generators, these installations utilize 4 pole transfer switches that range in size from 1000-2500 Amperes.

Westinghouse incorporates the world's most advanced circuit switching technology into the power switching device of every transfer switch it produces. The expertise and technical backup assistance, offered by more than 150 engineers at our Technology and Quality Division in Pittsburgh, assures every user the highest quality transfer switch available.

Contact Assemblies

Completely enclosed main power contacts are of the self-wiping, high pressure design with silver tungsten composition. In addition, separate arcing contacts and Westinghouse developed AB Delon ® arc quenchers are utilized to assure rapid, complete quenching of the arc during transfer. Westinghouse requires that all contact assemblies meet not only UL 1008 standards, but also that they meet and exceed the more stringent short circuit test under UL 1087 and UL 489. This built-in reliability is a Westinghouse exclusive that virtually eliminates the need for periodic inspections and maintenance of contacts that is required by other transfer switch manufacturers.

Transfer Mechanism

Westinghouse transfer switches rated for continuous duty from 30-1000 amperes utilize a simple, reliable mechanism designed specifically for high-duty operations. A unidirectional gear motor is securely interconnected to the operating handles of the contact assemblies. There is no friction drive or clutch between the motor and the gear train to slip or come out of adjustment. Providing a positive break-before-make switching action, the transfer mechanism eliminates the possibility of both services being committed to the load simultaneously. On switches rated from 1200-4000 amperes, Westinghouse utilizes stored energy closing mechanisms with the capability of transfer in less than five electrical cycles. Contact transfer of all switches is accomplished in a true quick-break quick-make mode under either electrical or manual operations.

Mechanical Interlocking

The main power contacts for the Normal and Emergency/Standby Power Sources are mechanically interlocked to assure that both sources cannot be simultane-

ously closed on the load. In addition to the transfer mechanism on the 30-1000 ampere design, the switch is also supplied with a Walking-Beam interlock. 1200-4000 ampere switches are equipped with an advanced technology cable interlock.

Testing Procedures

Westinghouse has developed an extensive testing program to assure the quality and reliability of the transfer switch product it produces. In addition to full factory functional testing, a mini-life test consisting of 250 mechanical operations is conducted on one production unit each and every day. **And, production units are constantly undergoing a maxi-life test that requires operation to destruction of a single unit. These tests allow Westinghouse to fine tune the design and provide unmatched reliability in all transfer switch products.**

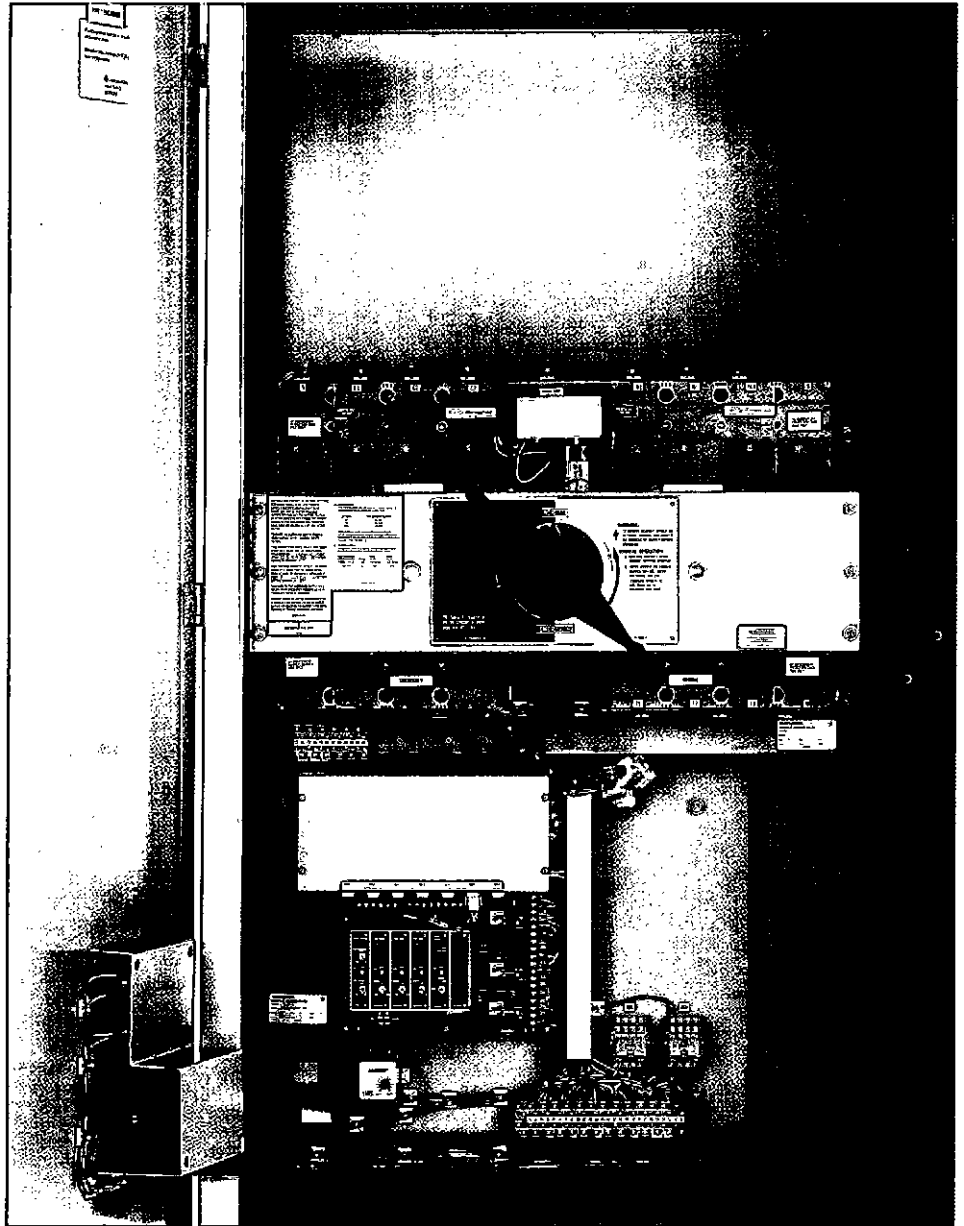
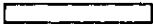
**POWER
SWITCHING
DEVICES:
THE RIGHT
CHOICE
FOR
RELIABILITY
AND LONG
LIFE**

Westinghouse Electric Corporation ATS Quality Assurance Certificate		
Shop Order _____ Serial No. _____ Catalog No. _____		
TEST / INSPECTION DESCRIPTION		
NO.	INSPECTIONS	√ = OKAY
1	Verify catalog no., nameplates & wiring diagram	1
2	Verify options are to customer order	2
3	Check enclosure type & number	3
4	Verify that paint and wiring are of good quality	4
5	Check that all wiring connections are tight	5
6	Verify that transformer taps conform to system voltage frequency	6
TESTS		
Insulation Check — 2200 Volts for 3 Seconds		
7	Transformer primaries & secondaries to ground	7
8	Motor windings to ground	8
Systems Check — Switch in Vertical Position		
9	Cycle units 50 times by alternatively removing normal and emergency power sources	9
10	Verify correct input to voltage sensing relay	10
11	Verify contact closure in each position	11
12	Check auxiliary switches in each position	12
13	Check mechanical interlock for proper adjustment	13
14	Check timing of operating mechanism	14
15	Verify that operating mechanism does not overtravel or bind	15
16	Manually operate unit to verify breakers will reset	16
17	Verify switch transfer from normal to emergency with loss of phase voltage or voltage drop below 70%	17
18	Verify switch transfer back to normal when voltage reaches 90% of specified rating	18
_____/_____/_____ Tester		_____/_____/_____ Date



Westinghouse thoroughly tests every transfer switch that we build. The tests performed are verified by the tester and results are shipped with each switch.

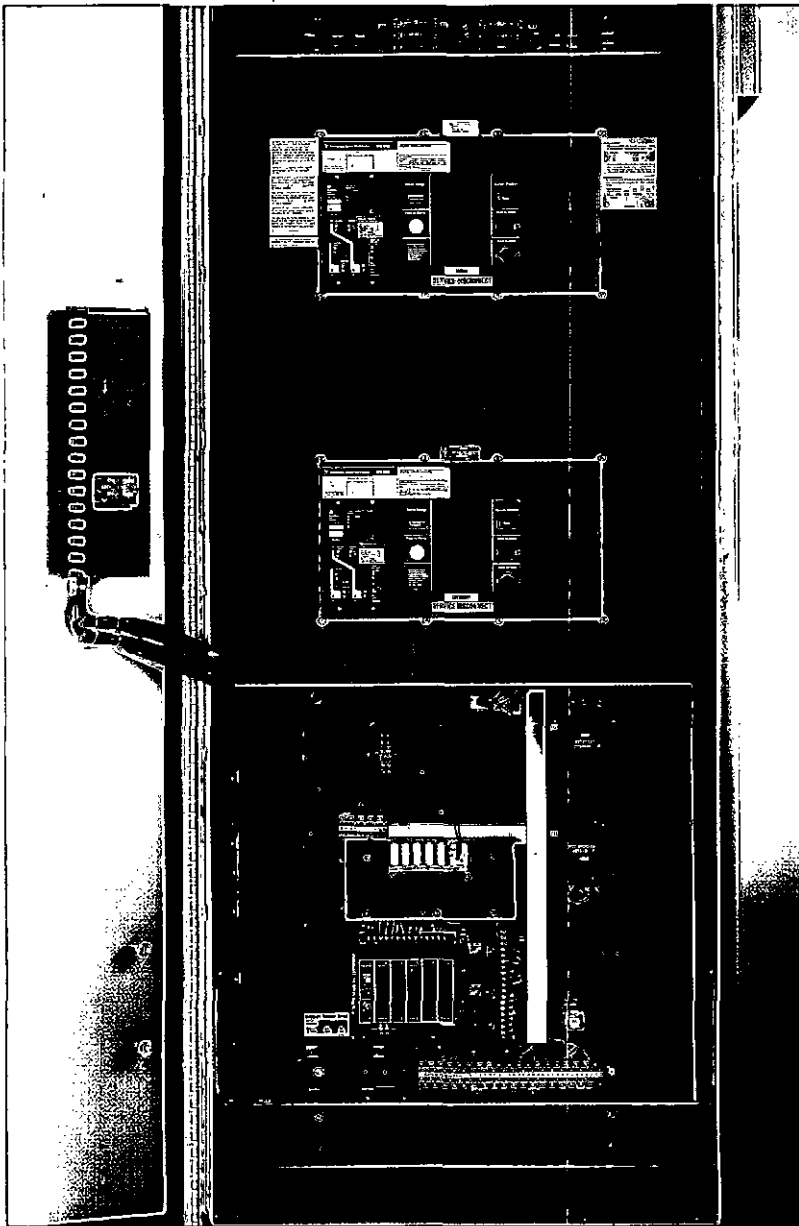
**SOLID STATE
LOGIC
TRANSFER
SWITCH**



Type ATSBM Automatic Transfer Switch

- UL 1008 listed
- Mechanically held
- Single, unidirectional motor operated switching mechanisms
- High withstand closing and interrupting ratings
- Fully rated fourth pole
- Logic tested in accordance with ANSI/IEEE C37.90 for voltage surge withstand capability
- Modular, close-differential sensing logic
- Easy plug-in voltage selection
- Delayed transition timer for switching of inductive loads
- 100% rated-high dielectric strength
- Quick-make/Quick-break mechanism-safe manual operation under load
- Available as:
 - Type A without intergral overcurrent protection
 - Type B with intergral overcurrent protection

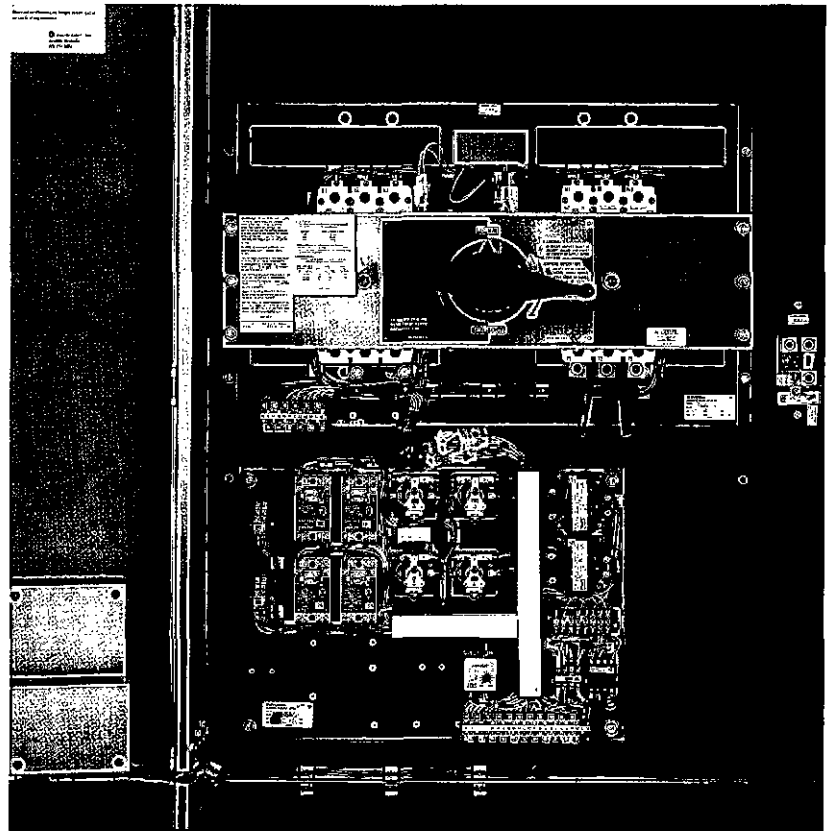
**SPB SYSTEMS
POWER
TRANSFER
SWITCHES**



Type ATSRM Automatic Transfer Switch

- UL 1008 listed 1200-4000A
- Inherent double throw design
- Very high withstand ratings
- Coordinates easily with upstream power breakers
- Accepts Westinghouse Digitrip RMS trip units
- Easily installed into motor control centers, switchboards and switchgear
- True 4 pole design safely isolates the neutral to eliminate nuisance tripping of ground fault protection systems
- Safe manual operation under load
- Side or rear access for easy installation
- Stored energy mechanism provides fast switching time
- Delayed transition timer for switching of inductive loads

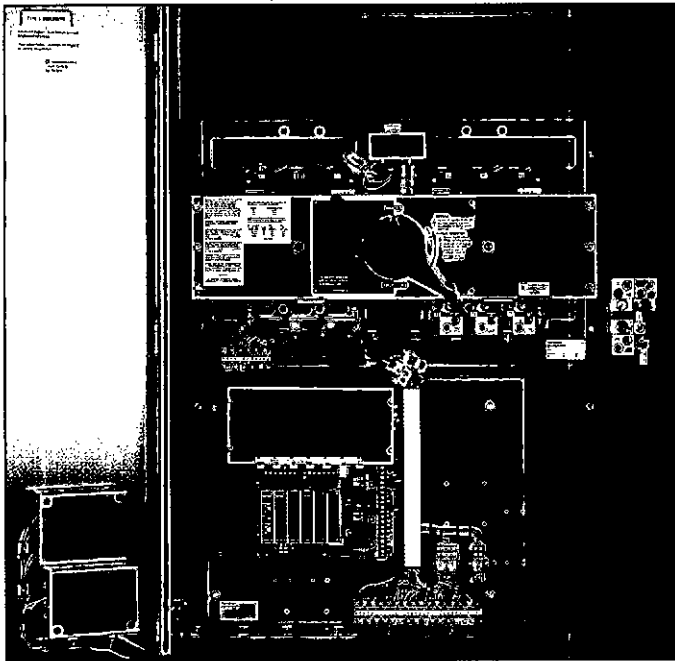
**RELAY LOGIC
TRANSFER
SWITCHES**



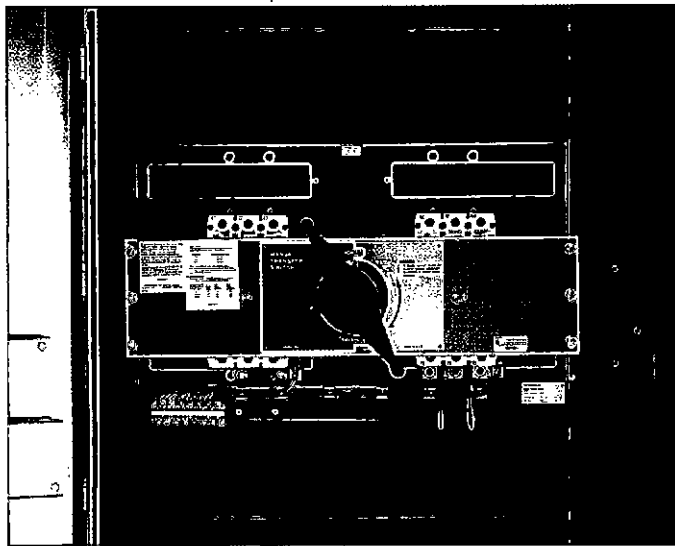
Type ATSBP Automatic Transfer Switch

- UL 1008 listed 30-1000 A
- Reliable, easy to maintain relay logic
- Totally enclosed contact assemblies suitable for harsh environments
- Single, unidirectional motor operated switching mechanism
- Fully rated fourth pole
- Delayed transition timer, allowing safe switching of inductive loads
- Triple interlocked, reliable operating mechanism (see endurance capabilities of Westinghouse switches)
- Multiple option packages

NON AUTOMATIC TRANSFER SWITCHES



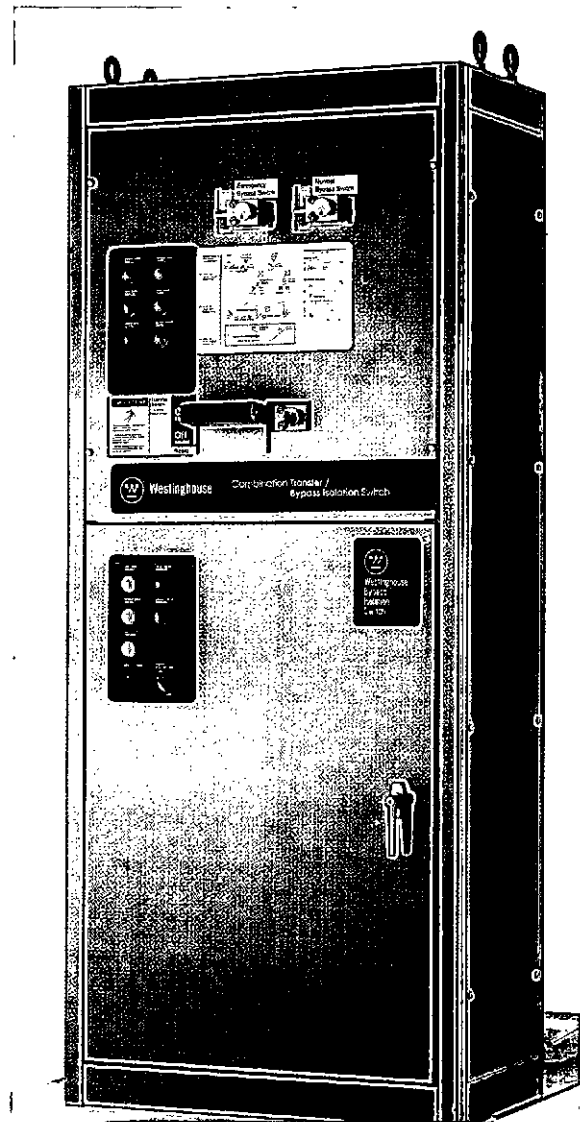
Type MTSBM Non-Automatic Transfer Switch



Type MTSSM Manual Transfer Switch

- UL 1008 listed -100% rated
- Positive mechanical interlocking
- Inherent double throw operation
- Common load connection
- Auxiliary contacts (2A/2B) for each source
- High withstand ratings
- Quick-make, quick-break mechanism
- Safe manual operation under load
- Electrically or manually operated

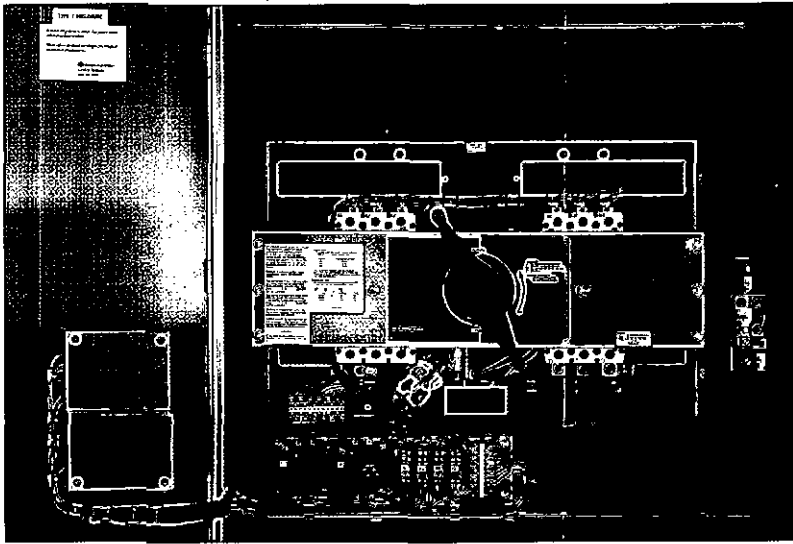
BYPASS ISOLATION TRANSFER SWITCHES



Type ATSB1 Bypass Isolation Transfer Switch

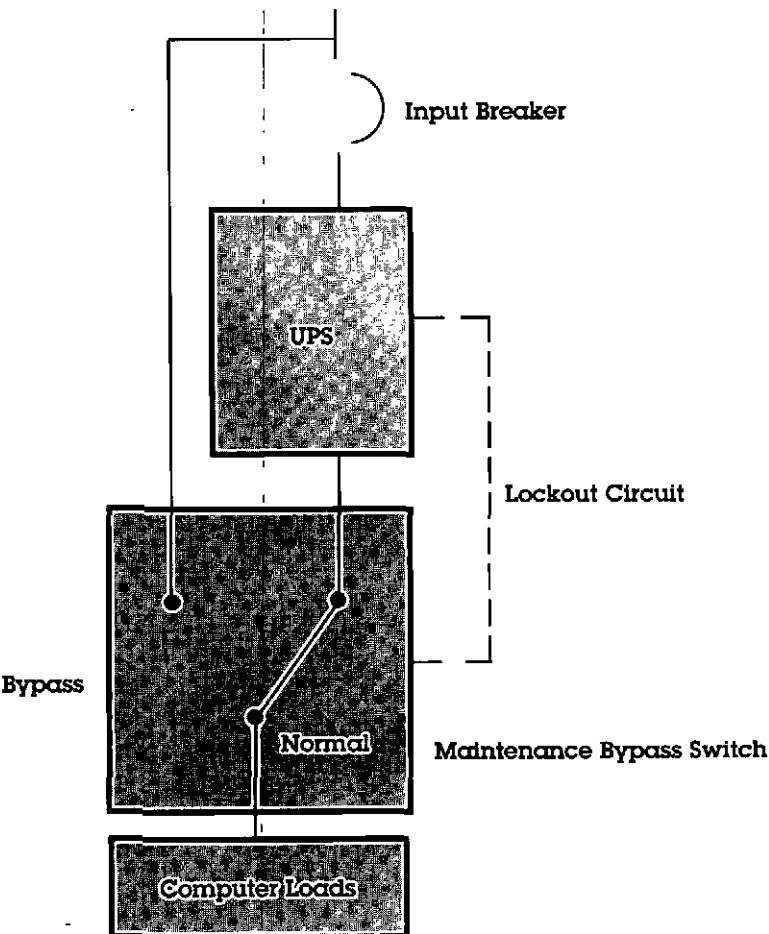
- UL 1008 listed - 100% rated
- Load break isolation before bypass
- Dual source bypass design
- Simple and reliable isolation and bypass mechanism
- Drawout logic circuitry on units/ 150-1000 A
- Utilizes self protecting molded case switches with built in alarm circuits to quickly identify a fault condition
- Dead front and barriered design enhances safe operation
- Ability to energize and test controls while transfer switch is disconnected for maintenance
- Available with or without overcurrent protection

**UPS MAINTENANCE
BYPASS
SWITCH**

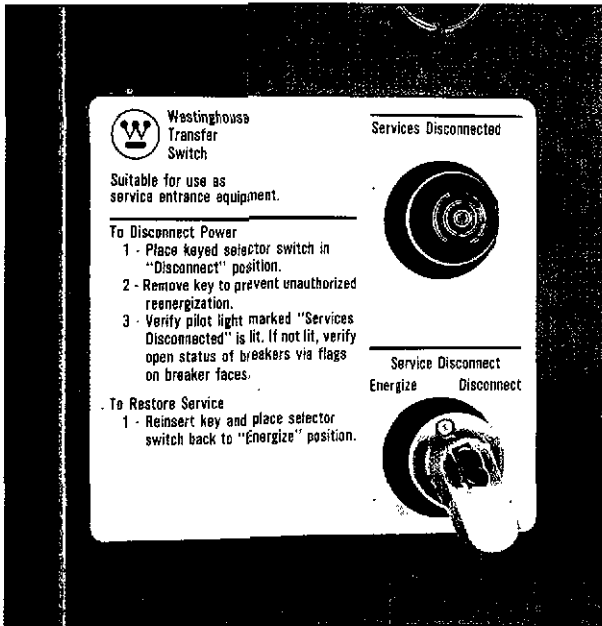


Type MBS Maintenance Bypass Switch

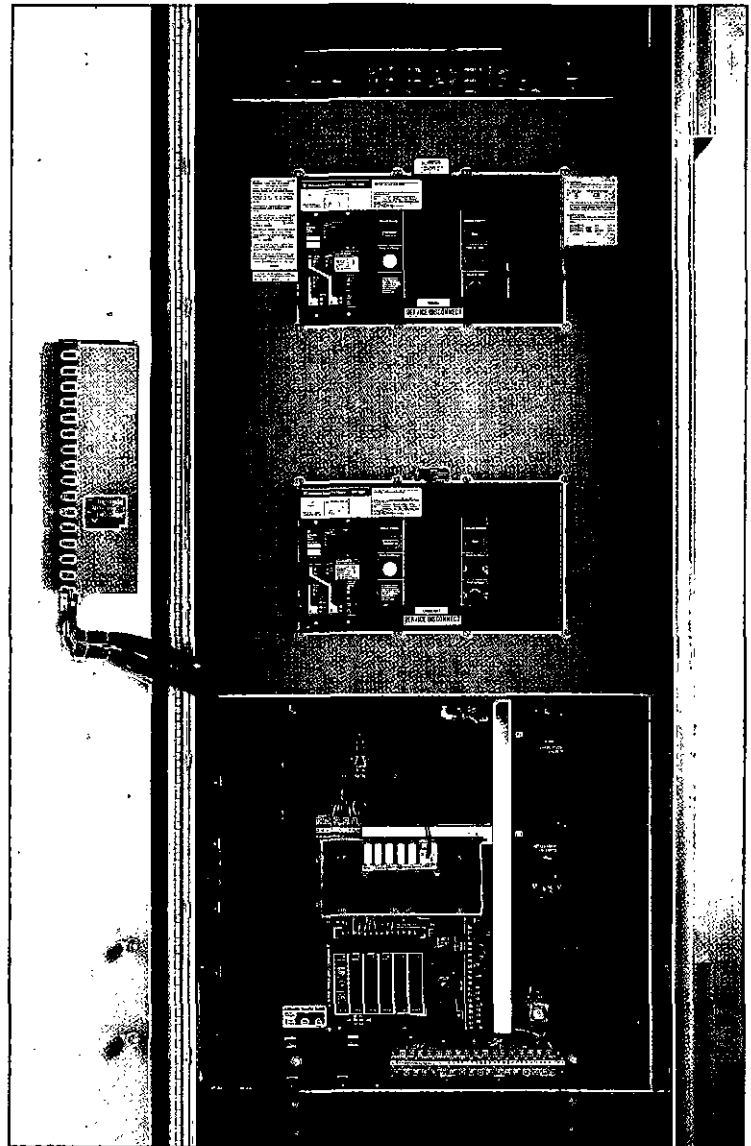
- Specially designed to bypass UPS Systems
- Closed transition make before break operation
- Lockout relay allows UPS to authorize operation
- Manually initiated electrical operation
- 100% rated
- Used on UPS systems - 208v - 350kva
480v - 750kva
- Available with or without integral over current protection
- Visual indication of position and lockout enabled



SERVICE ENTRANCE TRANSFER SWITCHES



Service disconnect and lock-out instructions



Service Entrance Transfer Switch

- UL 1008 listed 100 - 4000 A
 - Lockable externally mounted service disconnect switch
 - Control power for disconnect is "voted" from the available source
 - Visual indication of service disconnect
 - Saves space and dollars
 - Overcurrent protection with trip lockouts are standard
 - Thermal magnetic trip units 100 - 1000 A
 - RMS sensing trip units 1200 - 4000 A
 - Fully rated fourth pole
 - Ground fault sensing systems available (required by code on distribution systems above 1000 A)
 - Disconnect neutral bar assembly is standard. On four pole units neutral is disconnected simultaneously to phase conductors
 - Same physical sizes as standard transfer switches
 - Also available as non-automatic transfer switches
- Features**
- 100% rated
 - Common load bus
 - Positive mechanical interlocking
 - Auxiliary contacts (2A/2B) for both sources
 - Electrically or manually operated
 - Safe manual operation underload
 - Quick-make, quick-break switching
 - High withstand closing and interrupting ratings

Westinghouse transfer switches (ATS) utilize a unique power switching panel design that permits the addition of integral overcurrent protection within the transfer switch main contact assemblies. *Many specific savings can be realized by incorporating this overcurrent protection option into the ATS: **Users may reduce initial equipment costs, cut installation time and increase system reliability*** — common goals for everyone involved with placing electrical distribution equipment in service.

How it Works in a Typical System

A typical standby power system uses an engine generator as the emergency back-up power supply (**Figure 1**). A separately mounted circuit breaker on the standby generator side is required to provide protection for the ATS and the interconnecting cables extending to the load circuits. (**Figure 2**) shows the same standby power system with the optional circuit protection function integrated into the transfer switch.

This arrangement offers several distinct advantages:

- It eliminates the separate engine generator circuit breaker and its enclosure. This represents a substantial initial equipment cost saving because the price of adding integral overcurrent protection to the ATS is only a fraction of the cost of a complete separate breaker.
- Eliminating the separate breaker reduces the number of power cable interconnections, thereby reducing installation time and associated labor costs.
- Fewer power connections mean greater power circuit integrity and reduced maintenance requirements.
- Less space is required because adding the overcurrent protection to the ATS does not increase the enclosure size. This space savings can be significant on larger rated standby systems.
- Reducing the number of components and interconnections increases the installation's endurance and performance.

In many applications, integral overcurrent protection can also be added to the ATS normal side power contacts, further improving the cost efficiency and reliability of the standby system.

Westinghouse can offer circuit protection incorporated into the main contacts of both sides of a UL - listed, service equipment rated ATS.

Such devices can be equipped with a wide selection of circuit breakers offering such user functions as:

- Conventional thermal/magnetic trip elements
- Solid state trip logic
- Microprocessor-based trip logic with true RMS sensing
- Integral ground fault sensing logic
- High withstand breakers
- Stored energy insulated case power circuit breakers
- And a virtually limitless number of other functions.

Adds Functions, Eliminates Devices

Integral overcurrent protection allows transfer switches to serve as the service equipment devices. **Users often want standby emergency power for the entire load of a given installation. Typical examples include wastewater treatment facilities, pumping stations and telecommunication relaying stations where all connected load circuits are critical to service continuity.**

Where such complete protection against commercial power interruption is required, the ATS must be as close to the point of service entrance as possible. Conventional ATS equipment would normally be installed immediately downstream of the service disconnect devices of the utility and standby power supplies. An ATS with an optional service equipment rating allows the user to eliminate these separate upstream devices and their respective power interconnections and install the ATS directly at the point of service entrance (**Figure 3**).

Criteria for Service Application

To be suitable for service equipment application a device must meet three criteria:

1. It should have integral overcurrent protection in order to provide short circuit and overload protection for downstream cable and equipment. Adding an overcurrent trip device to the main power contact assemblies accommodates this function easily. Some designs require two separate overcurrent devices (breakers or fuses) be installed upstream of their ATS in a common enclosure.
2. The user must be able to turn the

device off, disconnecting all load circuits. This external disconnect provision can be via true manual operation or via manually initiated electrical operation. The Westinghouse switch however, not only disconnects all load conductors per the NEC Article 230, but includes provisions for positively locking the power contacts in the disconnect position. This ensures operating personnel safety in the event of downstream maintenance activity.

3. The service equipment device must provide visual indication of whether it is opened or closed.

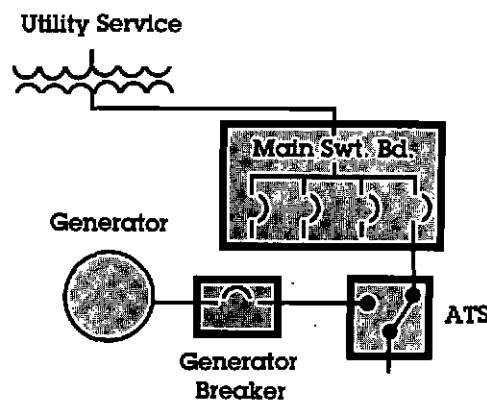


Figure 1: In this typical ATS application, a separately mounted circuit breaker protects the ATS and the load circuit cables.

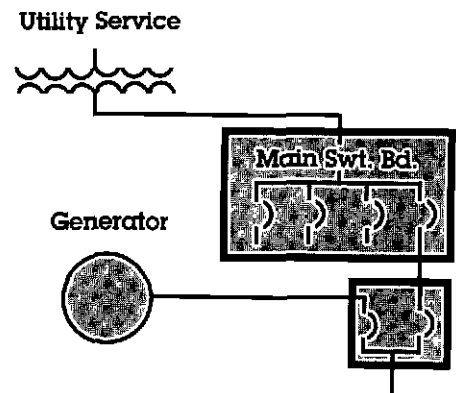


Figure 2: This application uses an ATS which incorporates the optional circuit protection function, eliminating the engine generator circuit breaker and providing several other advantages.

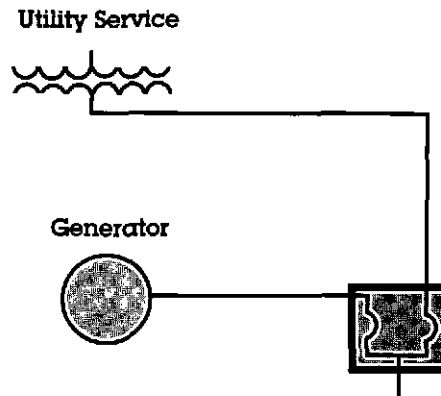


Figure 3: An ATS with an optional service equipment rating may be installed directly at the point of service entrance, and allow the user to eliminate the service disconnect devices of the utility and standby power supplies.

The National Electric Code specifies, in Article 517 for health care facilities and Article 700 for emergency systems, the elements of design and application of transfer switch equipment pertaining to "Essential Electrical Systems".

Westinghouse has been designing and building transfer switching equipment for emergency and essential electrical systems for more than (30) years. *Facilities worldwide rely on the sure transfer of power provided by Westinghouse switches.*

With Westinghouse transfer switches reliability is further enhanced because we specifically design and build switching equipment to comply with three applicable Underwriter Laboratories, Inc. standards for safety.

UL INC. - Standards for Safety

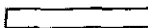
- UL 1008 - Transfer Switch Equipment
- UL 1087 - Molded Case Switches
- UL 489 - Molded Case Circuit Breakers

Westinghouse switches must comply with the design standards and testing parameters outlined in each of these standards. Below is a brief comparison of the overload, endurance withstand and interrupting testing requirements called out in each of the standards.

Overload Tests

All tests performed at six (6) times rated current - numbers reflect number of operations at overload.

**EMERGENCY
POWER
SYSTEMS DEMAND
THE RELIABILITY
BUILT INTO
WESTINGHOUSE
SWITCHING
EQUIPMENT**



AMP RATING	UL 1008	UL 1087	UL 489
30 - 1600 A	50	50	50
1601 - 2500 A	25	25	25
2501 - 6000 A	30	28*	28

Endurance Tests

UL 1008 Test specifies one half of operations at 100% of full load current and one half at 200% of full load current and

without current. UL 1087 and UL 489 tests specify an additional number of operations with current and without current.

Number of Operations

AMP RATING	UL 1008		UL 1087/UL 489	
	With Current	Without Current	With Current	Without Current
0 - 100	6000	—	6000	4000
101 - 225	6000	—	4000	4000
226 - 300	6000	—	1000	5000
301 - 400	4000	—	1000	5000
401 - 600	2000	1000	1000	5000
601 - 800	2000	1000	500	3000
801 - 1600	1500	1500	500	2000
1601 - 2500	1000	2000	500	2000
2501 and above	1000	2000	400	1100

Short Circuit Current Withstand and Closing Tests

AMP RATINGS	UL1008		UL 1087 - 489	
	Test Current (AMP)	Number of Tests	Test Current (AMP)	Number of Tests
0 - 100	5,000	2	10,000	7
101 - 400	10,000	2	10,000	7
401 - 800	20 x FLA	2	10,000	7
801 - 1200	20 x FLA	2	14,000	7
1201 - 1600	20 x FLA	2	20,000	8
1601 - 2000	20 x FLA	2	25,000	8
2001 - 2500	20 x FLA	2	30,000	8
2501 - 3000	20 x FLA	2	35,000	8
3001 - 4000	20 x FLA	2	45,000	8

Interrupting Test and Contact Opening Tests

UL 1008 specifies that a transfer switch intended for use with fuses and marked for use with ground fault protection that is electrically operated or that has an

electrical tripping mechanism, shall be capable of being operated electrically to break levels of current. The current is identified in the following chart. UL 1087 and UL 489 specifies minimum short circuit current interruption ratings.

AMP RATING	UL 1008 (2)		UL 1087 - 489	
	Test Current (AMP)	Number of Operations	Test Current (AMP)	Number of Operations
0- 100	1000	3	10,000	7
101 - 800	1,000 - 8,000	3	10,000	7
801 - 1200	8,000 - 12,000	3	14,000	7
1201 - 1600	12,000 - 16,000	3	20,000	8
1601 - 2000	16,000 - 20,000	3	25,000	8
2001 - 2500	20,000 - 25,000	3	30,000	8
2501 - 3000	25,000 - 30,000	3	35,000	8
3001 - 4000	30,000 - 40,000	3	45,000	8

(2) Interrupting current is 10 x full load AMPS switch.

These charts identify the minimum acceptable standards for transfer switch equipment. It has always been Westinghouse's design philosophy to far exceed these minimum acceptable ratings.

Westinghouse switches are designed and built to the combination of UL 1008, UL 1087 and UL 489 assuring the system designer of the highest level of reliability available.

Applying Westinghouse Transfer Switches makes the engineer's job of coordinating upstream protection simple and fast. The following charts provide the information required to coordinate a Westinghouse Transfer Switch with either:

1. Fully rated upstream circuit protection
2. Series rated upstream protection with specific Westinghouse breakers
3. Fuses

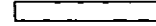
There are three short circuit conditions under which a transfer switch may function.

1. Withstand a downstream fault
2. Close to a fault
3. Open on a faulted current

For example, a fault occurring immediately downstream of the switch would normally be cleared by the protective device immediately upstream of the switch. On systems that use upstream power breakers with a short time delay, or on a system that uses fuses where the fault is of a value not high enough to instantaneously open the circuit, the switch could initiate a transfer due to the reduced line voltage precipitated by the faulted line. Westinghouse Transfer Switches are ideally suited for these applications.

SYSTEMS

COORDINATION WITH UPSTREAM OVERCURRENT PROTECTION



Withstand, Closing and Interrupting Ratings for Westinghouse Transfer Switch Equipment

When Protected by an Upstream Circuit Breaker

TRANSFER SWITCH (Amperes)	240v	480v	600v
100	100 K.A.	65 K.A.	25 K.A.
150	100 K.A.	65 K.A.	25 K.A.
225	100 K.A.	65 K.A.	25 K.A.
300	100 K.A.	65 K.A.	25 K.A.
400	65 K.A.	35 K.A.	25 K.A.
600	65 K.A.	50 K.A.*	25 K.A.
800	65 K.A.	50 K.A.*	25 K.A.
1000	65 K.A.	50 K.A.*	25 K.A.
1200	100 K.A.	100 K.A.	85 K.A.
1600	100 K.A.	100 K.A.	85 K.A.
2000	100 K.A.	100 K.A.	85 K.A.
2500	100 K.A.	100 K.A.	85 K.A.
3000	100 K.A.	100 K.A.	85 K.A.
4000	100 K.A.	100 K.A.	85 K.A.

*4 pole switches rated at 35 k.a. at 480 v

To obtain the maximum withstand closing and interrupting ratings shown, an upstream protective device of an equivalent interrupting rating must be used.

Any circuit breaker with interrupting ratings up to those shown in the chart will protect the transfer switch. When you specify a Type B switch, integral overcurrent protection is included in the switch, no upstream device is needed to obtain the ratings shown.

The engineer should be aware of the interrupting as well as withstand and closing capability of the switch in order to make an accurate comparison of complete short circuit ratings.

Westinghouse Switches with their common withstand, closing and interrupting ratings make it easy to coordinate protection for all three ratings.

**Coordinated Withstand, Closing and Interrupting Rating
for Westinghouse Transfer Switch Equipment**

Series Rated Protection

208-240VAC TRANSFER SWITCH RATING	SERIES EQUIPMENT RATING- KA SYMMETRICAL AMPERES			
	65	85	100	200
30-100	HLC		HFD HJD	FDC LA-P (1) FCL JDC KDC
150-300	HLC		HJD HKD NB Tripac (2)	FDC, LA-P (1) JDC LCL KDC
400	HLC		HKD HLD NB Tripac (2)	
600	HLC HMC		HLD NB Tripac (3)	
800-1000	HMC, PB-P (4) HNC RD			
1200-1600	DS (5)		SPB (5)	
1600-3000	DS (5) 1600-2000A	DS (5) 2500-3000A	SPB (5)	
4000			SPB (5) DS (5)	

- (1) With P08 Limiter
- (2) With P12 Limiter
- (3) With P20 Limiter
- (4) With PR20 Limiter
- (5) Can coordinate with a Power Breaker shorttime rating for up to 30 cycles (1200-3000A-50KA) (4000A-85KA)**

480VAC TRANSFER SWITCH RATING	SERIES EQUIPMENT RATING- KA SYMMETRICAL AMPERES						
	35	50	65	85	100	150	200
30-100			HFD HJD HKD		FDC JDC KDC	FCL LCL	FB Tripac (1)
150-300			HFD HJD HKD		FDC JDC KDC	FLC LCL	LA Tripac (2)
400	HLC	HMC			NB Tripac (3)		
600	HLC	HMC			NB Tripac (4)		
800-1000		HNC RD			PB Tripac (5,6)		
1200-1600		DS (7)			SPB (7) PC		DSL (7) PB Tripac (6)
1600-3000			DS (7)		SPB (7) PC		DSL (7)
4000				DS (7)	SPB (7)		DSL (2)

- (1) With P06 Limiter
- (2) With P10 Limiter
- (3) With P12 Limiter
- (4) With PR20 Limiter
- (5) With PR20 Limiter
- (6) With PR20 Limiter
- (7) Can coordinate with Power Breakers short time rating for up to 30 cycles (1200-3000A-50KA) (4000A-85KA)**

**Withstand, Closing and Interrupting Ratings for
Westinghouse Transfer Switch Equipment**

When Protected by an Upstream Fuse

TRANSFER SWITCH RATING (Amperes)	Fuse Type	Maximum Ratings at 600v	
		Current Rating	Interrupting Rating
30-100	J,T	200 (1)	200 K.A.
150	J,T	400 (1)(2)	200 K.A.
225	J,T	400 (1)(2)	200 K.A.
300	J,T	400 (1)(2)	200 K.A.
400	J,T	600	200 K.A.
400	R	600	100 K.A.
600	L	1200	100 K.A.
600	L	800	200 K.A.
800	L	1200	100 K.A.
800	L	1600	200 K.A.
1000	L	1600	200 K.A.
1200	L	2000	200 K.A.
1600	L	3000	200 K.A.
2000	L	3000	200 K.A.
2500	L	4000	200 K.A.
3000	L	4000	200 K.A.
4000	L	5000	200 K.A.

(1) Can also utilize class R fuse which provides 100 KAIC at 600v.

(2) A Class J or T 600A maximum rated fuse can be used on systems of up to 100 K.A. available fault current.

**GROUNDING
AND GROUND
FAULT
PROTECTION
OF EMERGENCY
POWER AND
ESSENTIAL LOAD
SYSTEMS**

Westinghouse manufactures a complete line of three pole and four pole switches that offer the system designer the flexibility to design either a separately derived or nonseparately derived system.

Separately Derived

The 1990 NEC defines a separately derived system as "wiring system whose power is derived from a generator, transformer or converter windings and has no direct electrical connection, including a solidly connected grounded circuit conductor, to supply conductors originating in another system, if required to be grounded as called out in Article 250 - 5 (a) and (b) shall be grounded as specified in section 250 - 26".

FPN No. 1 stresses that an alternate A-C power source such as a generator is **not a separately derived system if the neutral is solidly interconnected to a service supplied system neutral.**

Westinghouse three pole transfer switches are designed to be used on systems which are *not* separately derived, that is where the neutrals of both the service and generator are solidly connected together and our four pole switches are designed for use on separately derived systems.

Three Pole Transfer Switch

In this system both neutrals are solidly connected. Under these conditions it is necessary to run an equipment grounding conductor from the service equipment to the three pole transfer switch and from the three pole switch to the generator.

For separately derived systems Westinghouse recommends a true four pole transfer switch. The code states that a full sized conductor be used as a bonding jumper (Section 250 - 26 (a)). For this reason and the fact that the fourth pole could see short circuits of a magnitude approaching that of the phase conductors, UL 1008 has stipulated that a four pole transfer switch has a fourth pole which passes the same test criteria as the phase conductor poles.

Westinghouse four pole switches are designed and built with a fully rated fourth pole - where the pole switching the neutral is capable of making, breaking and withstanding the same magnitude of currents as the other three poles.

When applying a transfer switch in conjunction with Ground Fault Protection on a separately derived system there is a requirement to use a four pole transfer switch. In this type of installation it is important to guarantee the simultaneous switching of the load conductors and the neutral. A Ground Fault Protection system could be adversely affected by either:

1. The neutral's remaining open, resulting in a severe voltage unbalance of the load or
2. Permanently connecting the neutral of both the normal and alternate load neutrals.

The Westinghouse design insures safe and separate switching by fully rated and mechanically interlocked true four pole switch design. Available 30 - 3000 Amps.

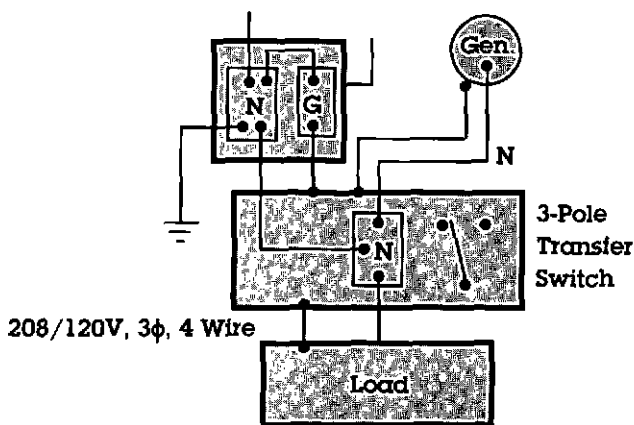


Figure 1: Non-separately derived system.

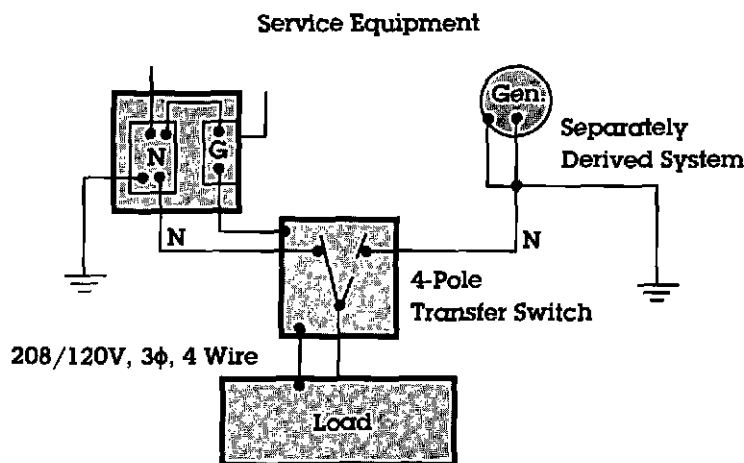
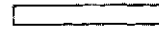


Figure 2: Separately derived system.

TRANSFERRING INDUCTIVE LOADS



Westinghouse insures the safe "bumpless" transfer of inductive loads by employing a simple timed transition from one source to the other. The Westinghouse Delayed Transition option is a low cost and reliable switching means that allows the residual voltage to decay to a safe switching level.

The IEEE /IAS Power Systems Protection Committee developed a report titled "Source Transfer and Reclosing Transients in Motors". Westinghouse participated in the research of the problems associated with reclosing transients and used this information to develop the Delayed Transition Timing Option.

In many industrial and commercial building applications the system designer must consider how to handle the situation where an inductive load may be separated briefly from its source of power.

Causes include:

1. Transfer to an alternate source
2. Circuit breaker trip and reclose cycle
3. Operator error

The problem arises when power is restored and the differences in magnitude and phase angle between the oncoming system voltage and the residual motor "back EMF" causes transient torques and currents which may be high enough to damage the motor or connected load.

The worst case condition of the systems being reconnected 180 degrees out of phase will theoretically yield peak currents of 30-40 times motor full load current with typical industrial motor and system parameters.

Since magnetic forces within and between the windings are proportional to the square of the current, it is apparent that a reclosing transient can cause severe mechanical stress on the windings.

These calculations are based on the assumption that the residual internal voltage of the motor, when disconnected, is close to the same value when it is reconnected. **Therefore the quicker the transfer to the alternate source the greater the potential for reclosing transients.** Actually an induction motor's field decays rapidly. By delaying transfer from between 30 - 120 cycles, the residual voltage is drastically reduced.

The Westinghouse Delayed Transition Option provides an adjustable time delay so that the system designer can adjust the "off time" to meet the systems requirements. Generally, a .5-5.0 second delay is sufficient.

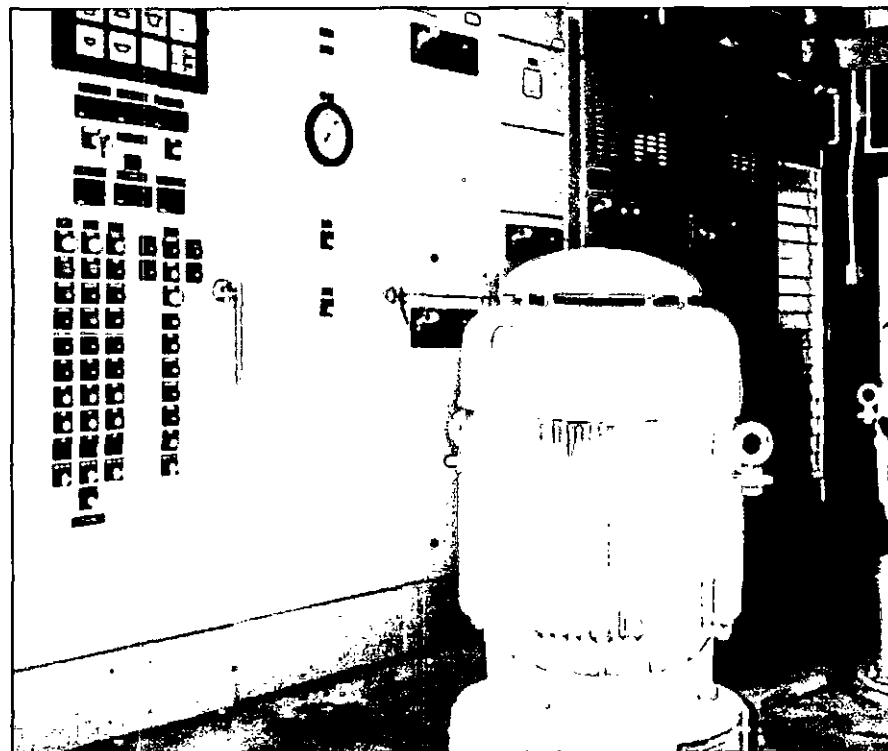
Westinghouse option 32A Delayed Transition offers adjustability from 0 - 120 seconds and is suitable for any type application.

The advantages of this type of transfer are:

1. The operation is totally independent of the frequency or phase angle of the normal or emergency sources of power.
2. There is no complicated electronic circuitry or inter-wiring between the sources which enhances reliability.

Summary

For applications where essential loads are inductive (motors or transformers) Delayed Transition Transfer is a simpler and more reliable method to provide a bumpless transfer of power. Tests have proved that when a transformer is disconnected the release of its stored energy generates a bump even when the two power sources are synchronized. Water and waste water treatment plants are typical applications which require a Delayed Transition Timer during transfer.



Motor circuits in a pump station

TYPICAL SPECIFICATION

100 - 4000 AMPERES

1.0 General

1.1 Furnish and install where indicated Transfer Switches having the Ratings, Features/Accessories, Enclosures, etc. indicated on the drawings or noted herein.

1.2 Transfer Switches and Features/Accessories shall be as manufactured by Westinghouse Electric Corporation.

2.0 Ratings

2.1 The Transfer Switches specified herein shall be 100% equipment rated for continuous duty as shown on the drawings and shall conform to the applicable requirements of UL1008 for emergency total system load. All Transfer Switches supplied shall bear the UL Label. All 3 phase 4 wire Transfer Switches used with ground fault equipment shall be the true 4 pole switched neutral type with all four poles for each source being fully rated and connected to a common shaft.

2.2 The Transfer Switch shall be rated for non-welding of contacts when used with the upstream overcurrent devices shown on the plans and with the available fault current specified herein.

2.3 The withstand and closing current ratings of the Transfer Switch shall be no less than those required to be compatible with the available system short circuit current and the type and rating of systems protective devices.

2.4 All main power contacts shall be rated for multiple fault interruption per UL 1087. On 4 pole equipment the neutral pole shall have identical withstand, closing and interrupting ratings as the main power contacts.

3.0 Construction

3.1 Transfer Switches specified herein shall consist of completely enclosed contact assemblies and a separate control logic panel. The contact assemblies shall be operated by a non-fused unidirectional motor operator or stored energy mechanisms, and be energized only momentarily during transfer providing inherently double throw switching action. Control power for all transfer operations shall be derived from the line side of the source to which the load is being transferred.

3.2 Transfer Switches shall be capable of being operated manually under full load conditions. Manual operation shall be accomplished via a permanently affixed manual operator or integrally mounted pushbutton operators located on the face of the contact assemblies. Removeable manual operating handles and handles which will move in the event electrical operators should suddenly become energized while performing a manual transfer operation are not acceptable. The manual operator shall provide the same contact-to-contact transfer time as provided under normal automatic operation to prevent possible flashovers from switching the main contacts slowly. In addition, provisions should be provided to allow disengagement of the electrical operator during manual operation.

3.3 Each Transfer Switch shall be positively interlocked mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation. A neutral position shall not be possible under normal electrical operation unless a Delayed Transition Timer accessory is required for switching highly inductive loads. Each transfer switch shall have a manual neutral position for load circuit maintenance. A Transfer Switch position indicator shall be visible from the front of the switch to show to which source the Transfer Switch is connected.

3.4 Inspection and replacement of all separate arcing contacts (moving and stationary) shall be possible from the front of the Transfer Switch.

3.5 A solid state sensing and control logic panel shall be separately mounted from the power switching portion of the Transfer Switch. The two sections shall be connected together by control cables with plug-in connectors. The control section shall be capable of being disconnected from the power section for maintenance purposes.

3.6 The logic circuit shall utilize solid state components mounted on printed circuit boards to accomplish proper operation, wherever practical, to perform functions such as timing, voltage and frequency monitoring. LED's shall be furnished to indicate the operation of

replacement of the complete solid state package. Plug-in modifications shall be available for field installation with retention of the UL label.

3.7 The Transfer Switch shall be equipped with a voltage selection plug making it suitable for operation on any voltage from 208 through 600 volts AC, 50 or 60 Hertz, by placing the voltage selection plug in the proper voltage receptacle. Covers shall be used to block off the unused receptacles.

3.8 Each Transfer Switch shall be supplied in the appropriate Enclosure as shown on the plans. The Enclosure shall be painted with the manufacturer's standard painting procedures to insure suitability for environmental conditions as referenced in the plans. The contractor's field wiring terminating within the Enclosure shall comply with NFPA 70. If wiring is not color coded, wires shall be permanently marked near the terminal at each end with the wire number shown on the approved shop drawings. Terminal blocks shall conform to NEMA ICS 4. Main Transfer Switch terminals shall be suitable for the termination of conductors shown on the plans.

4.0 Sequence of Operation

4.1 Upon loss of phase-to-phase voltage of the normal source to 70% of nominal, and after a time delay of .5 - 15 seconds (adjustable to meet conditions present) to override momentary dips and/or outages, a 10 ampere, 30VDC contact shall close to initiate starting of the Emergency/Standby Source power plant. Transfer to the Alternate Source shall take place immediately upon attainment of 90% of rated voltage and frequency of that source. For switches not involving engine generator sets as power plants, transfer shall occur after an adjustable time delay of 1 - 60 seconds to override momentary dips and outages.

4.2 When the Normal Source has been restored to 90% of rated voltage, and after a time delay adjustable from .2 - 30 minutes (to insure the integrity of the Normal Power Source), the load shall be retransferred to the Normal Source.

4.3 A time delay, adjustable .2 - 30 minutes, shall delay shutdown of the Emergency/Standby Power source after

retransfer to allow the generator to run unloaded for cool-down, after which the generator shall be automatically shut down.

4.4 If the Emergency/Standby power plant should fail while carrying the load, transfer to the Normal Power supply shall be made instantaneously upon restoration of the Normal Source to satisfactory conditions.

5.0 Features/Accessories

The following Features/Accessories shall be supplied:

5.1 Auto/Test Switch to provide test operation of the Transfer Switch by simulating a loss of the Normal Power Source.

5.2 Pilot lights to indicate to which source the load is connected.

5.3 Relay auxiliary contacts (2 N/O, 2 N/C) to indicate Transfer Switch position and integrity of each source.

5.4 Plant Exerciser Timer providing automatic test operation of the Emergency/Standby Power Source at pre-selected intervals (Adj. 0 - 168 hours in multiples of 15 minutes) at least once per week.

5.5 Hand held test kit for field testing and calibration of all plug-in timing and monitoring logic cards, as well as the output relays from the solid state logic panel.

6.0 Installation

6.1 Installation of all Transfer Switches specified herein shall be in accordance with all applicable codes, standards, and practices.

6.2 Installation of all Transfer Switches specified herein shall be in accordance with the recommendations of the manufacturer.

For more technical information and typical specifications see Technical Data 29-925.



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For application assistance call 1-800/354-2070 In Kentucky call 1-606/878-6100