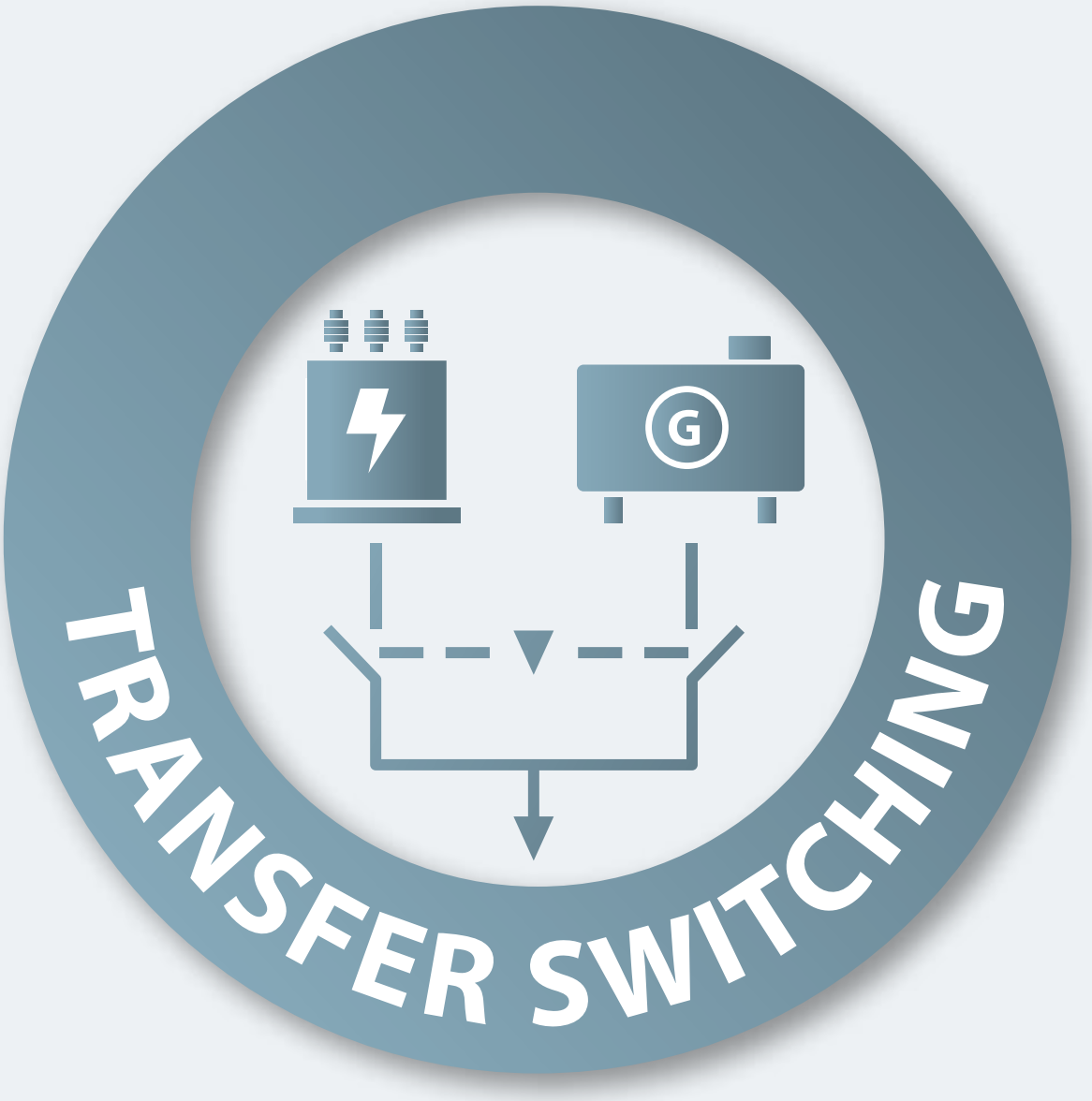
TECHNICAL NOTE

Typical single line diagrams for Transfer Switching Equipment



When **energy** matters

socomec
Innovative Power Solutions

Introduction

SITE 719 A

This document is intended to highlight typical single line diagrams to show how “purpose built” transfer switching equipment is implemented when compared to circuit breaker assemblies. The examples as shown have been selected specifically to go through some of the most frequently used installation requirements. The document also highlights ATS Bypass that is considered the ultimate solution for critical load applications.

Note

To ensure a safe transfer from the normal to the alternative supply, the preferred solutions selected and proposed below are based on IEC 60947-6-1 compliant Class PC TSE. This is further assured through TSE that includes a zero position (I - 0 - II), with factory assembled and tested mechanical interlocks that are specifically designed for open transition TSE applications.

Glossary

ATSE	Automatic Transfer Switching Equipment
CL	Critical Load
G	Generator
MTSE	Manually Operated Transfer Switching Equipment
NCL	Non Critical Loads
P	Protection
S	Supply
TSE	Transfer Switching Equipment
T	Transformer

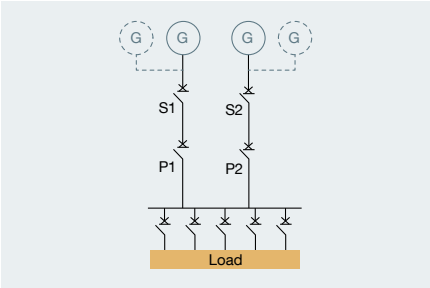
Contents

Transfer between 2 sources and 1 busbar

S1 = S2: Mains/Mains or Mains/Gen

In this case we assume that the normal and alternative supplies (S1 and S2) have the same kVA rating and therefore we do not need to load shed before initiating a transfer.

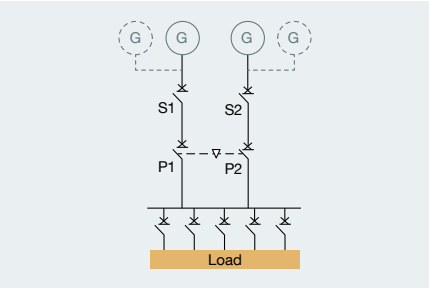
Note
According to IEC 60364, for cable runs of > 3 m, overload and short-circuit protection must be provided at the output of the supply that feeds the downstream circuit.



WP 054 A GB

Basic

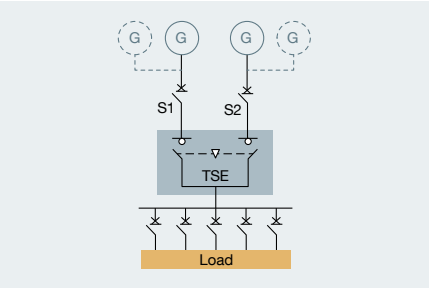
- Risk of closing P1/P2 onto unsynchronised supplies.
- Risk of selectivity issues with breakers in series.



WP 055 A GB

Improved

- Mechanical interlocks are a first improvement.
- Risk of selectivity issues with breakers in series remain a potential issue.



WP 056 A GB

Preferred solution

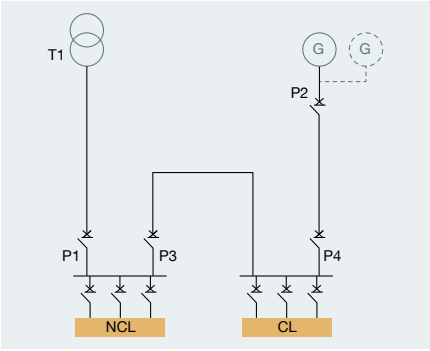
- Separate protection and transfer switch functions.
- Designed to withstand short circuit and eliminate the risk of selectivity issues.

Transfer between 2 sources and 2 busbars (Split Busbar)

S1 > S2: Mains/Gen

This case relates to applications where the normal supply (S1) is greater than the alternative genset supply (S2) therefore we would need to load shed before initiating a transfer to the backup source.

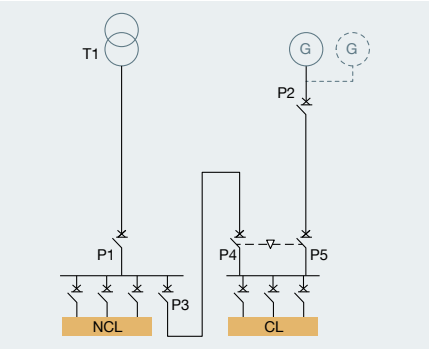
Note
Sources are typically 1 transformer and 1 or more gensets whilst the split busbar together with the associated switching device serves to load shed the non-critical loads, (NCL) from the critical loads (CL).



WP 057 A GB

Basic

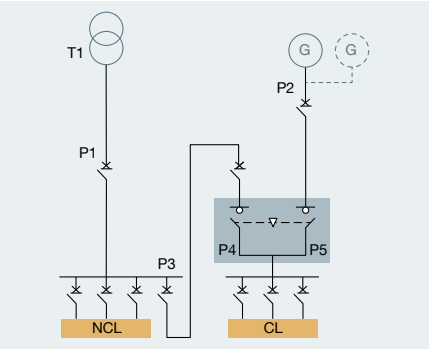
- Risk of closing P1, P2 and P3 together resulting in the potential coupling of unsynchronised supplies.



WP 058 A GB

Improved

- Mechanical interlocks add safety and avoid the risk of coupling the transformer and genset supplies.
- On the other hand we still risk having selectivity issues between P3 and P4 as well as between P2 and P5.



WP 059 A GB

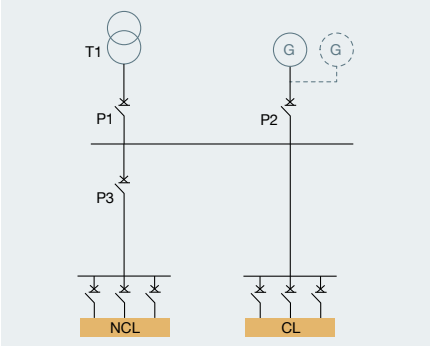
Preferred solution

- Purpose built, factory tested TSE with fully integrated mechanical interlocks.
- Separate protection and transfer switching functions guaranteed by Class PC TSE.
- No selectivity issues.

Transfer between 2 sources and 2 busbars (Load Shedding the NCL)

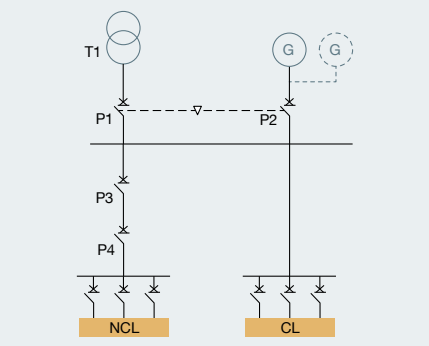
S1 > S2: Mains / Gen

This requirement is identical to the previous example above however the main busbar is not split and the solution is based on load shedding of the NCL distribution. Since the normal supply (S1) is greater than the alternative genset supply (S2) we would need to be sure to load shed before initiating the transfer. (To load shed P3, it is common to use a motorised device).



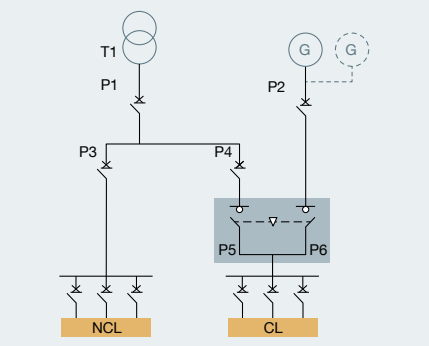
Basic

- Risk of closing P1, P2 and P3 together.
- Risk of overloading P3 by closing P2 and P3 together (or not opening P4) when running on the lower kVA alternate supply.



Improved

- Mechanical interlocks add safety to the system.
- We still risk overloading the genset by failing to load shed. (Not opening P3 before P2 is closed).
- Risk of selectivity issues between P3 and P4.

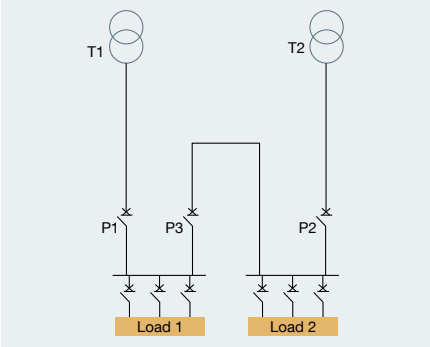


Preferred solution

- Purpose built TSE to guarantee that P1 and P2 are never closed together.
- Load shedding is assured through P5.
- Separate protection to withstand short circuit and eliminate the risk of issues due to selectivity.

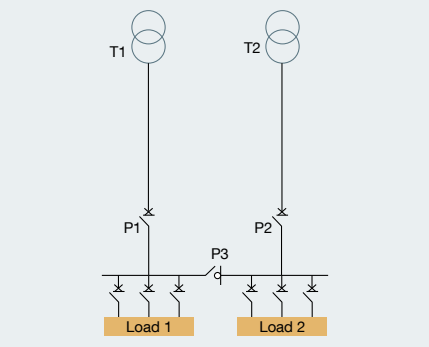
Transfer between 2 sources and 2 busbars (Split busbar with no priority load)

(S1 = S2: Mains / Mains)



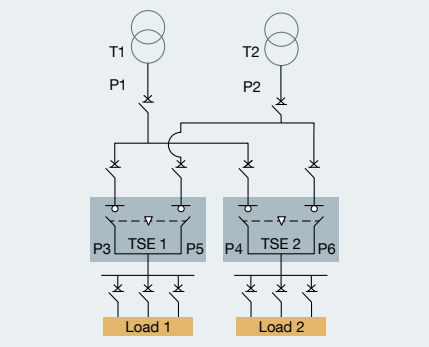
Basic

- Risk of closing T1 with T2 through P3.
- Although T1 and T2 main / main supplies may be synchronised, one should take care of the total short circuit capacity that may be supplied in case of closing P3 together with P1 and P2.



Improved

- Built in intertie switching system including a switch disconnector to tie in both busbars directly within the switchboard.
- We still may have a very high short circuit capacity available in case P1, P2 and P3 are closed together.



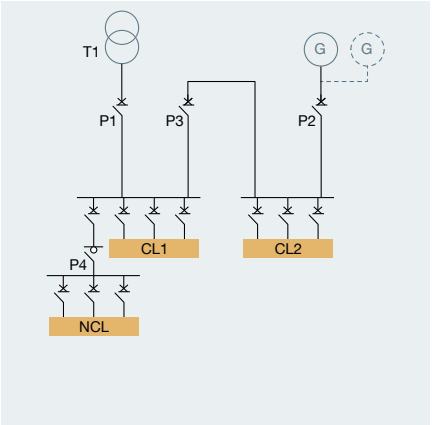
Preferred solution

- A clear separation between T1 and T2 guarantees that the short circuit capacity remains limited.
- Fully integrated mechanical interlocks that allow direct and cross fed redundancy.

Transfer between 2 sources and 3 busbars (Load Shedding the NCL)

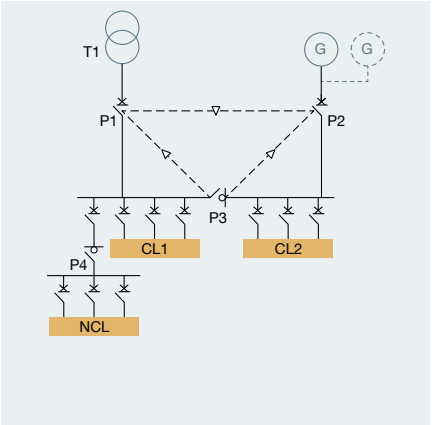
S1 > S2: Mains/Gen

This case applies to requirements where the normal and alternative source supplies (S1 and S2) are Mains/Genset with S1 kVA > S2 kVA. Since S2 is smaller in terms of kVA rating one would need to load shed the NCL before running CL1 and CL2 on the Genset.



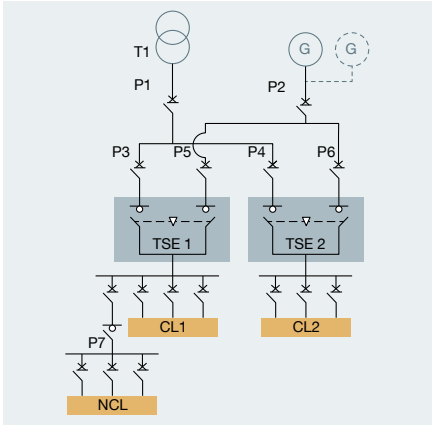
Basic

- Risk of connecting two unsynchronised supplies by closing P1, P2 and P3 together.
- Load shedding of NCL obtained through P4.



Improved

- Built in intertie system with mechanical interlocks prevents coupling the two unsynchronised supplies.
- A single point of failure can leave all CL without supply.



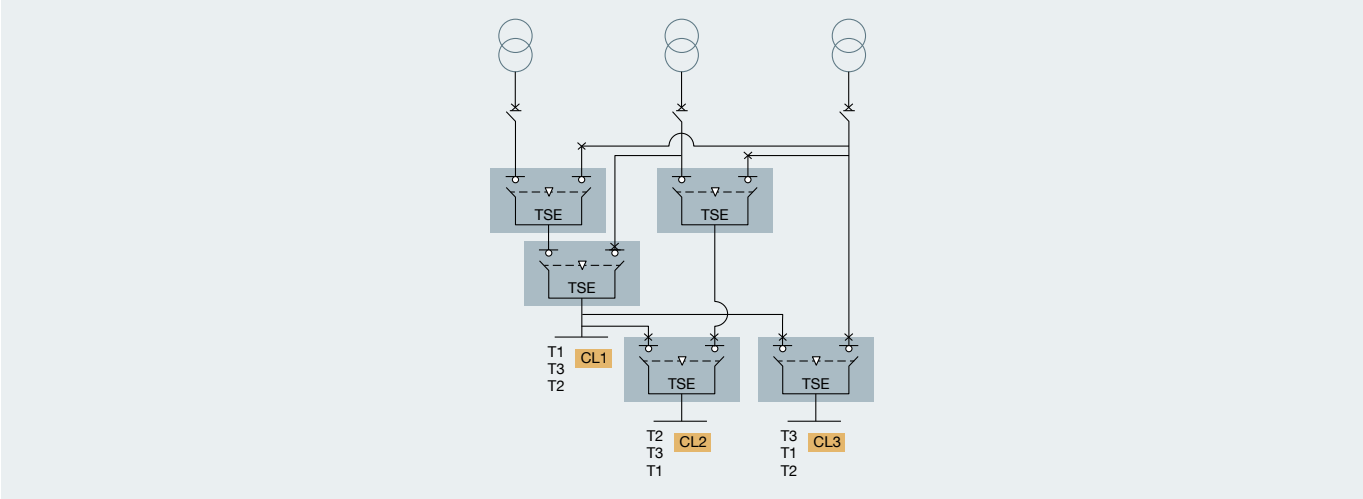
Preferred solution

- Fully integrated mechanical interlocks that allow direct and cross fed redundancy.
- Separate protection and transfer switching functions.

Transfer between 3 sources and 3 busbars

(S1=S2=S3)

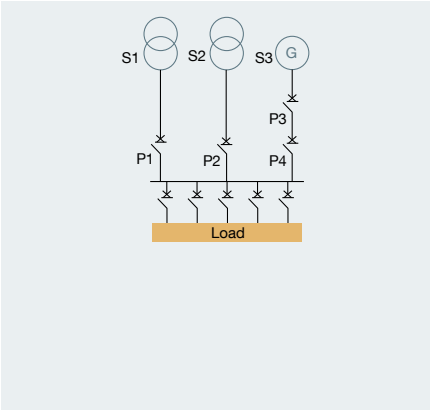
This case shows as an example the multiple priority combinations that can be set on the TSE with 2 alternative source supplies that already have their own loads . Since all transformers are the same inm terms of kVA rating (S1 = S2 = S3), each one of them should be able to supply the totallity of the loads. All TSE can be configured to follow different transfer timings and priorities to avoid unnecessary transfers.



Transfer between 3 sources and 1 busbar

S1 = S2 = S3: Mains / Mains / Gen

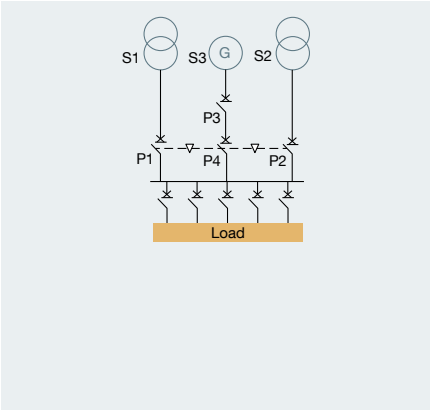
Applies to systems where source supplies S1, S2 and S3 are of the same kVA ratings.



WP 069 A GB

Basic

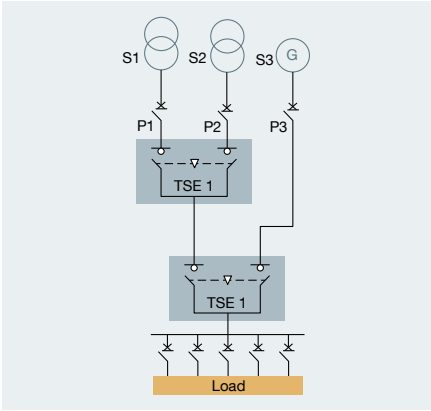
- Risk of connecting two unsynchronised supplies by closing P1 or P2 and P3/4 together.
- Risk of closing S1 and S2 together indefinitely can cause protection and short circuit capacity issues.



WP 070 A GB

Improved

- Including mechanical interlocks prevents the closing of S1/S2 and S4 simultaneously.
- S1 and S2 can still be closed together with the risk of a short circuit capacity that is too high.



WP 071 A GB

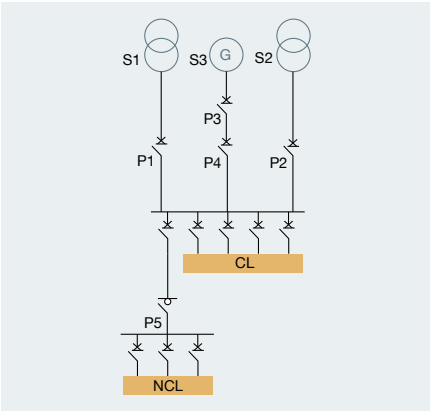
Preferred solution

- Fully integrated mechanical interlocks that allow direct and cross fed redundancy.
- Separate protection and transfer switching functions
- No risk of closing the genset with any of the main supplies.

Transfer between 3 sources and 2 busbars (Load Shedding of NCL - Type 1)

S1 = S2 > S3: Mains / Mains / Gen

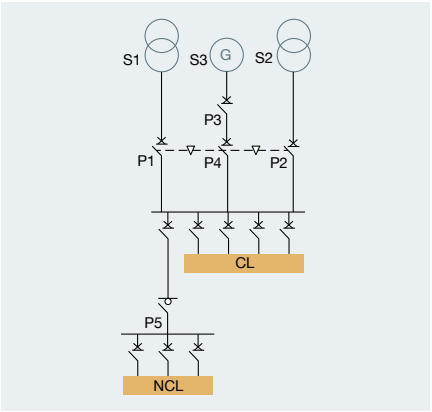
This case applies to cases where the normal and alternative supplies are 2x Mains and 1x Genset with different kVA ratings thereby includes the need to load shed NCL when on the Genset supply.



WP 072 A GB

Basic

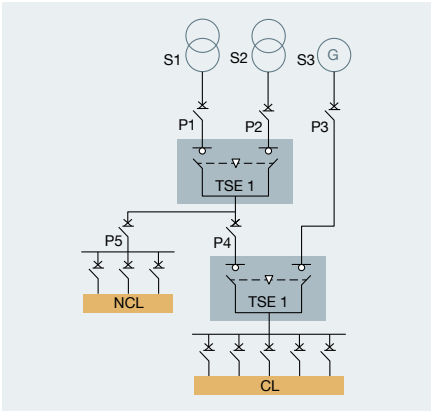
- Risk of connecting two unsynchronised supplies by closing P1/P2 and S3.
- Risk of closing S1 and S2 together indefinitely can cause protection and short circuit capacity issues.



WP 073 A GB

Improved

- Including mechanical interlocks on P4 is a 1st improvement.
- S1 and S2 can still be closed together with the risk for protection and a high short circuit capacity.



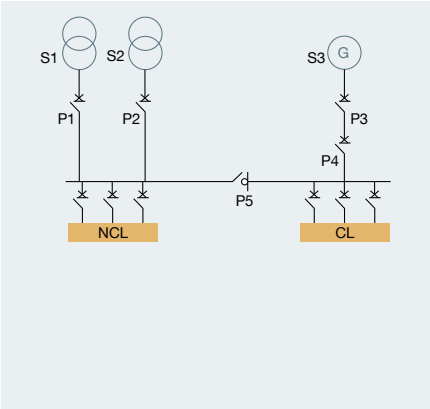
WP 077 A GB

Preferred solution

- Fully integrated mechanical interlocks that ensure to never close any 2 supplies together.
- Guaranteed load shedding when on the Genset supply.

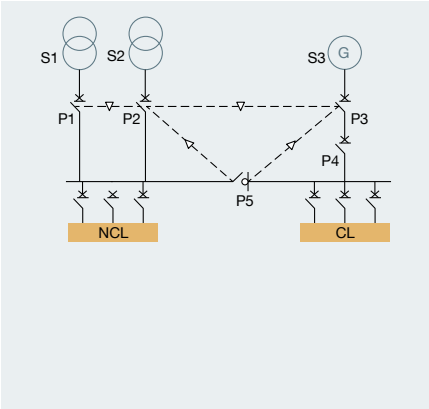
Transfer between 3 sources and 2 busbars (Alternative architecture - Type 2)

S1 = S2 > S3: Mains / Mains / Gen



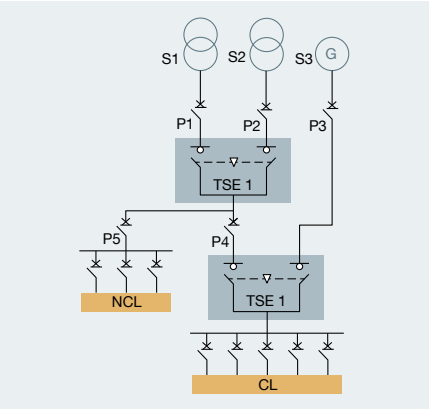
Basic

- Risk of connecting two unsynchronised supplies through P1 or P2 and P3/4/5.
- Risk of closing S1 and S2 together indefinitely can cause protection and short circuit capacity issues.



Improved

- Including mechanical interlocks prevents the closing of S1, S2 and S3/4 simultaneously.

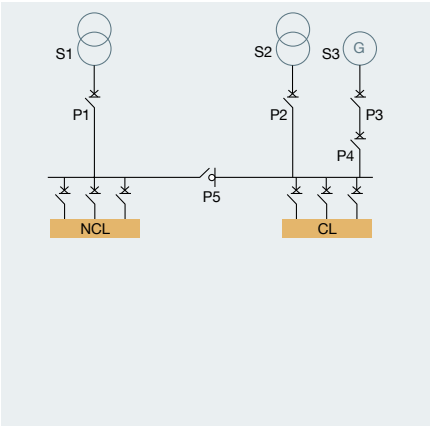


Preferred solution

- Fully integrated mechanical interlocks that allow direct and cross fed redundancy.
- Separate protection and transfer switching functions
- No risk of closing any 2 supplies together.

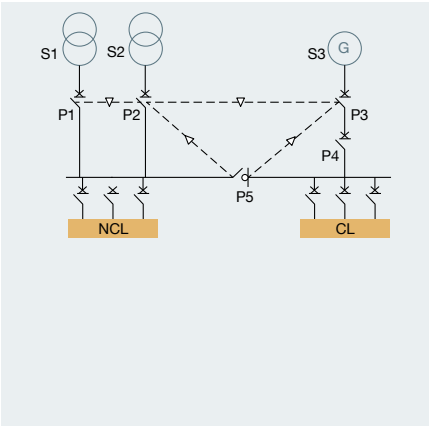
Transfer between 3 sources and 2 busbars (Alternative architecture - Type 3)

S1 = S2 > S3: Mains / Mains / Gen



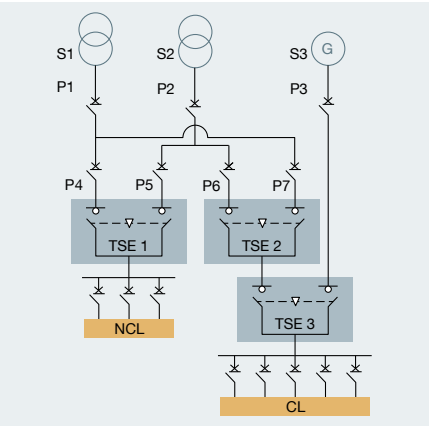
Basic

- Risk of connecting two unsynchronised S2 and S3.
- Risk of closing S1 and S2 together indefinitely can cause protection and short circuit capacity issues.



Improved

- Including mechanical interlocks prevents the closing of S1, S2 and S3/4 simultaneously.

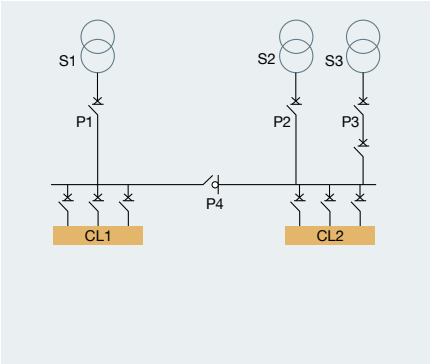


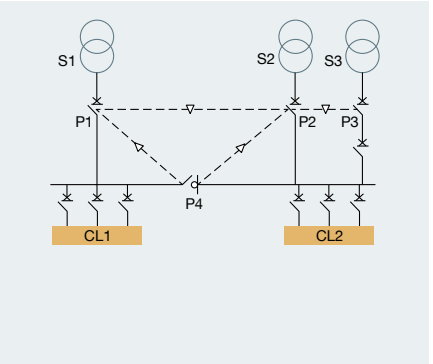
Preferred solution

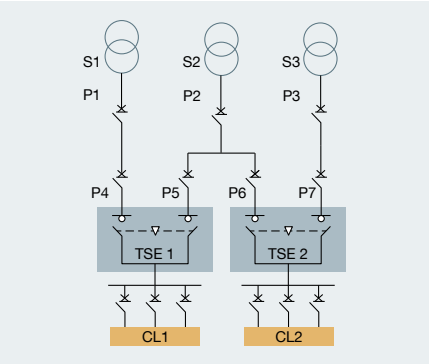
- Fully integrated mechanical interlocks that allow direct and cross fed redundancy.
- Separate protection and transfer switching functions.

Transfer between 3 sources and 2 busbars (Alternative architecture - Type 4)

kVA S2 > S1 and S2 > S3 - Mains/Mains/Mains







Basic

- Risk of closing S1, S2 and S3 together indefinitely can cause protection and short circuit capacity issues.

Improved

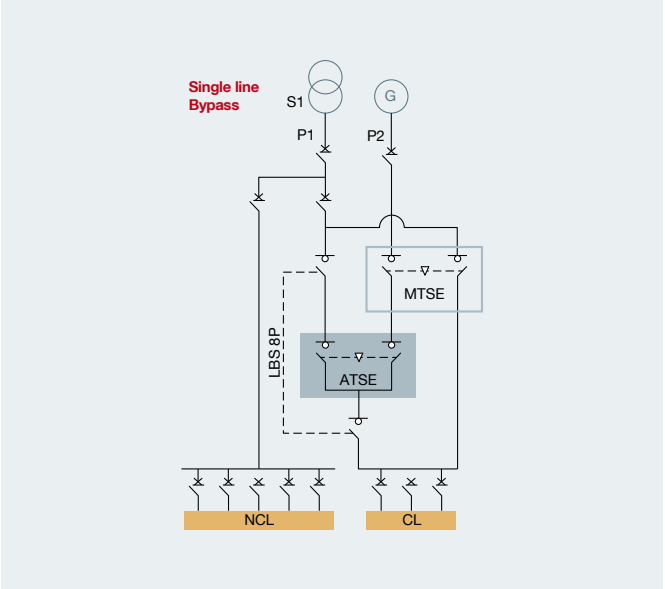
- Including mechanical interlocks prevents the closing of S1, S2 and S3/4 simultaneously.

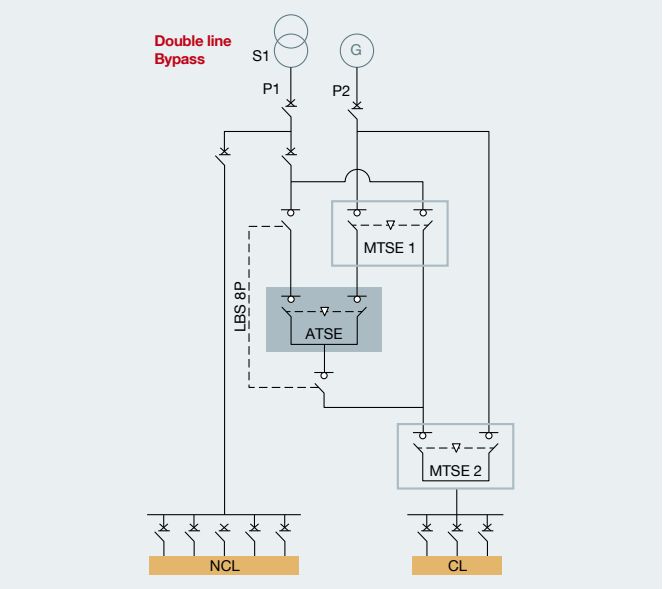
Preferred solution

- Fully integrated mechanical interlocks that allow direct and cross fed redundancy.
- Separate protection and transfer switching functions.

ATS Bypass Isolation - The ultimate solution for critical load applications

ATS Bypass isolation solutions are considered the ultimate TSE solution applied to critical load applications. The ATS Bypass isolation switch design as shown below allows TSE to be inspected and maintained with a minimum or no interruption of power supply to the load.





Socomec: our innovations supporting your energy performance

1 independent manufacturer

3,600 employees worldwide

10 % of sales revenue dedicated to R&D

400 experts dedicated to service provision

Your power management expert

POWER SWITCHING

POWER MONITORING

POWER CONVERSION

ENERGY STORAGE

EXPERT SERVICES

The specialist for critical applications

- Control, command of LV facilities
- Safety of persons and assets
- Measurement of electrical parameters
- Energy management
- Energy quality
- Energy availability
- Energy storage
- Prevention and repairs
- Measurement and analysis
- Optimisation
- Consultancy, commissioning and training

A worldwide presence

12 **production sites**
- France (x3)
- Italy (x2)
- Tunisia
- India
- China (x2)
- USA (x3)

28 **subsidiaries and commercial locations**
- Algeria • Australia • Belgium • China • Canada
- Dubai (United Arab Emirates) • France • Germany
- India • Indonesia • Italy • Ivory Coast • Netherlands
- Poland • Portugal • Romania • Serbia • Singapore
- Slovenia • South Africa • Spain • Switzerland
- Thailand • Tunisia • Turkey • UK • USA

80 **countries**
where our brand is distributed

HEAD OFFICE

SOCOMEC GROUP
SAS SOCOMEC capital 10 589 500 €
R.C.S. Strasbourg B 548 500 149
B.P. 60010 - 1, rue de Westhouse
F-67235 Benfeld Cedex
Tel. +33 3 88 57 41 41 - Fax +33 3 88 57 78 78
info.scp.isd@socomec.com

YOUR DISTRIBUTOR / PARTNER

www.socomec.com

ENERGY SPECIALIST SINCE 1922

socomec
Innovative Power Solutions

DOT 15013 - 06/17 - Photo: Martin Bernhart - Réalisation: Socomec