

# SPS-IPM Proposal for different scenarios

Gilles Le Godec





19 June 2013





Converter MDHW51634







Circuit name	Resistance value @20ºC (mΩ)	Differential Inductance value (mH)	Converter characteristics		
MDVW51732M	2470	1740			
MDVW51734	1235	870	Type NO7		
MDHW51633M	2470	1740	+-125V/+-125A		
MDVH51634	1235	870			







- One existing converter rated 125V/125A with two magnets in series
  - Current reference = Linear Ramp (tracking mode),
  - T\_rise = 656 ms,
  - Max requested current = 50A,
  - Total Load (magnet + cables) resistance  $@45^{\circ}C = 2.79\Omega$ ,



					Magnet											
Circuit	Nb of	R per	L per	Imax	position	Imatching	I max	P.C.	Cable	Irms	Cable	Cable	Load	Load	L di/dt	U Max
Name	magnets	Magnet	magnet	Magnet			requested	Loc.	total		section	R	R	L	dt=7s	with Rise time
						Projet	Projet									
	in Series	(20° C)				Scraping	Scraping		length	I_Max	Cu/ <u>Al</u>	Cu <u>Al</u>	45℃			0.656
		$[m\Omega]$	[mH]	[A]	[m]	[A]	[A]		[m]	x 0.58	[mm2]	$[m\Omega]$	$[m\Omega]$	[mH]	[V]	[V]
MDVW51732-34	2	1235	870			40	50	BA6	340	19.07	95	64	2787	1740	133	272

# $\rightarrow$ Umin = 272V for a converter which is rated 125V

This configuration is not relevant







- One existing converter rated 125V/125A with two magnets in series
  - Current reference = variable di/dt (max voltage is used, no control of the current during ramp up),
  - T\_rise\_max = 656 ms,
  - Total Load (magnet + cables) resistance @45°C = 2.79Ω,



- → Max current is ≈45A for Umax = 125V,
- → Rise time\_99% = 2.956 seconds

#### This configuration is not relevant







- One existing converter rated 125V/125A with two magnets in series
  - DC Mode of operation,
  - Total Load (magnet + cables) resistance  $@45^{\circ}C = 2.79\Omega$ ,
  - → Max current is  $\approx$  45A for Umax = 125V,

Is it acceptable?

→ DC mode of operation Is it acceptable?

1341086\_V1\_EPC\_A4





- One existing converter rated 125V/125A per magnet (equivalent to the present situation),
  - Current reference = variable di/dt (max voltage is used, no control of the current during ramp up),
  - Max requested current = 50A,
  - Total Load (magnet + cables) resistance @45°C = 2.79Ω,



→ Rise time = 0.517 second

This configuration is relevant with an interlock (DCCT + converter status)







- Two existing converters rated 125V/125A in a serial configuration (Master/slave) with two magnets in series,
  - Current reference = variable di/dt (max voltage is used, no control of the current during ramp up),
  - Max requested current = 50A,
  - Total Load (magnet + cables) resistance @45°C = 2.79Ω,





→ Rise time = 0.517 second

# This configuration is relevant







#### Scenario #5 – Master/Slave principle – Regulation

One current loop (Master converter) providing two Voltage references to the voltage sources





- One converter rated 240V/250A with two magnets in series,
  - Current reference = variable di/dt (max voltage is used, no control of the current during ramp up),
  - Total Load (magnet + cables) resistance  $@45^{\circ}C = 2.79\Omega$ ,
  - Max requested current = 50A,





→ Rise time = 0.551 second, Fall time = 295ms

# This configuration is relevant







Increasing the fall time will help to decrease the voltage swing: 1.75 second as per the present reference? .







Scenario	Comments	Price	Schedule		
#1: One existing converter rated 125V/125A with two magnets in series: <u>Cycling</u> <u>Mode</u>	No	-	-		
#2: One existing converter rated 125V/125A with two magnets in series: <u>Cycling</u> <u>Mode</u>	No	-			
#3: One existing converter rated with two magnets in series: <u>DC Mode</u>	Relevant, however Imax = 45A and DC Mode of operation acceptable?	0 CHF	Ready for 2014 start up		
#4: One existing converter rated per magnet + converter interlock	Relevant, Rise time = 517ms,	Interlock to be studied	Ready for 2014 start up		
#5: Two existing converters in a Master/Slave configuration	Relevant, Rise time = 517 ms,	< 10 kCHF	Ready for 2014 start up		
#6: New converter rated 240V/250A with two magnets in series: Cycling Mode	Relevant, Rise time = 551 ms,	[2 + 1] converters = 195 kCHF without installation costs (cabling, network, etc) DC cables have to be rated for 250A	Converters could be included in the HIE-ISOLDE package, however schedule is too tight for 2014 Start up.		







- Scenario #5 is the preferred one in terms of budget and schedule: the Master/Slave configuration will be implemented during LS1 with a cost <10kCHF for the modification of the converters (DC cabling modifications not included),
- □ This cost will be handled by the SPS operation code (EPC 68371),
- Layout of the converters in BA5: a slight modification is necessary for the serial configuration, the converters are adjacent. These modifications will be part of the EN/EL package for the circuit reconfiguration (magnets): budget estimation to be done.

ERD25/A5	MDHW	MDHW	MDVW	MDVW	
	51633M	51634	51732M	51734	BBI
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 Energy recovery: The fall time for the reference has to be increased if possible to 1.7 second to reduce the stress on the capacitors of the DC link.



