Calculating tickness of the CU cables for the driving lamp instalation.

Dane:

Voltage	**U**	12	[V]		Pattern for current intensity - **pattern A**				
CU resistance	$\mathbf{R_{cu}}$	17,5	[μΩ]						
Current Intensity [LR]	**I**	9,17	[A]	- from pattern A	I=P/U	so:	I [LR]=	9,17	[A]
Current Intensity [Warn]	**I**	8,33	[A]	- from pattern A			I [Warn] =	8,33	[A]
Allowable voltage drop	**△U**	3%	[V]						
Power of the lamp [LR]	**P**	110	[W]	(both lamps on the same wire)					
Power of the lamp [Warn]	**P**	100	[W]						
Cable's lenght	**L**	8	[m]						

Both conditions should be fulfil:

1. ***Thermic condition:***

In the monophase installations density of the current shouldn't be more than 15A/mm2

2. ***Allowable voltage drop condiotion:***

Resistanse of the load: R_o=U/I so: R_o= 1,31 [Ω] Resistance on the cable lenght "L" can't be more than approved % from R_o, so ≤ 0,04 [Ω] [LR]

R_o= 1,44 [Ω] 0,04 [Ω] [Warn]

Wire cross-section from the pattern for maximum resistance:

R_{max} = (R_{cu}xL)/S

so:

S=(R_{cu}xL)/R_{max} = (17,5x10^{-3}[Ωm] x 10m)/0,13[Ωm]

S_{LR}= 3,56 [mm^2] [LR]

S_{WARN}= 3,241 [mm^2] [Warn]

Veryfication:

Cable with the cross-section x [mm^2] makes voltage drop:

Allovable voltage drop:

for **x**= **4 [mm^2]** △U=3%*12V △U= 0,36 [V]

R_{max} = (R_{cu}xL)/S	so:	R_{max}=	0,035 [Ω]	**- Fulfilled if there were no assumptions regarding max current**
Voltage drop for [LR]	△U=I*R_m so:	△U=	0,32 [V]	**- fulfilled** (3% from 12V makes 0,36V, so 0,32V < 0,36V)
Voltage drop for [Warn]	△U=I*R_m so:	△U=	0,29 [V]	**- fulfilled** (3% from 12V makes 0,36V, so 0,29V ≤ 0,36V)

4mm ^{2} ***cable is ok - both conditions are fulfil***

for **x**= **2,5 [mm^2]** △U=3%*12V △U= 0,36 [V]

R_{max} = (R_{cu}xL)/S	stąd:	R_{max}=	0,056 [Ω]	**- Fulfilled if there were no assumptions regarding max current**
Voltage drop for [LR]	△U=I*R_m so:	△U=	0,51 [V]	**- not fulfilled** (3% form 12V makes 0,36V, so 0,51V ≥ 0,36V)
Voltage drop for [Warn]	△U=I*R_m so:	△U=	0,47 [V]	**- not fulfilled** (3% form 12V makes 0,36V, so 0,47V ≥ 0,36V)