STOPPING POWER

Given a couple of questions relating to ND filters in the last few days I thought I should attempt to write something to unravel the confusion.

A 'standard' ND or **Neutral Density** filter is simply a semi-transparent piece of glass or resin that uniformly reduces a precise amount of light from reaching the camera sensor without affecting colour balance (or at least that's the theory, cheap filters can produce some unfortunate results)

A relatively low-power ND such as a 2 STOP will simply look like a grey filter whereas a higher power such as a 10 STOP ND will look almost opaque (back to that later).

A **STOP** is the term given for a halving of the available light. 1 STOP = ½ light.

If you recall our bath-tap analogy from our previous Basics discussion then you will realise that if we reduce the available light onto the sensor then it will simply take longer for us to achieve the normal level (ie non-filtered) level of exposure.

There are a number of potential uses for this trick, some more obvious than others, for the moment I will stick with the most obvious/simple rather than make the document even longer.

Perhaps the most confusing thing about the use of ND filters is their annotation in that for instance an ND8 *does not* as you might imagine (well I did) offer a reduction of 8 STOPS but actually 3.

Just to muddy the water a little further, you could also see the same filter labelled with it's optical density – in this instance ND 0.9 ! You will see from the table below that each 0.3 of optical density is 1 STOP.

Please bear in mind that more basic cameras will only work in whole stops whereas more advanced ones will allow you to set a custom function to determine whether it uses 1/3 stop steps or whole stop steps.

So, if a 1 STOP ND halves the light ie x ½ then a 3 STOP ND causes a reduction of

x $1 / 2^3$ = x 1/2x2x2 = 1/8 which explains why it is sometimes annotated ND8.

Something like a Lee “Big Stopper” offers 10 STOPS

x $1/2^{10}$ = 1/1024 (although annotated ND1000)

Strength (STOPS)	Density (annotation)	Exposure Factor
2	0.6	4 ($1/2^2$)
3	0.9	8 ($1/2^3$)
5	1.5	32 ($1/2^5$)
10	3	1,024 ($1/2^{10}$)
13	3.6	8,192 ($1/2^{13}$)

Given my own experimentation I feel that the lower power ND are likely to only be of use in already low-light conditions and, I am afraid, higher power ones start to cost a little money.
A Lee “Big Stopper” (10 STOP) will likely cost c. £150 whereas one from acclaimed alternate company SRB will cost £30 on ebay with free delivery. *Beware cheaper versions.*

I am sure that a reduction factor of 1,024 sounds massive but when you look at (as the Americans say) “The Math” it will become apparent that even that is not as you might have imagined.

Take for instance a situation where the non-filtered exposure time would be 1/250s

1/250 x 1,024 = 1,024/250 = (rounding) 4s

If you were to stack a 3 STOP and a 10 STOP then logically you would get 13 STOPS, and so

1/250 x 8192 = 8192/250 = (rounding) 32s

Of my own slowed water, my preference is for those with exposure times of c. 2 minutes - clearly suggesting that even with a lot of STOPping power you will need good conditions to achieve this.

Coniston Water

Don't forget that a polarising filter will generally produce a 2-3 STOP effect so if thinking about buying filters then perhaps a 10-STOP ND and a good polariser would make sense as that then can perform two tasks rather than just one. *Beware cheaper / **non digital** polarisers.*

3 STOP ND	“normal”	10 STOP ND	“normal”	13 STOP ND	“normal”
8	1	8	1/125	8	1/1000
15	2	15	1/60	15	1/500
30	4	30	1/30	30	1/250
60	8	60	1/15	60	1/125
120	15	120	1/8	120	1/60
240	30	240	1/4	240	1/30

The table shows the more likely required shutter speeds using 3,10, and 13 STOPS and what the normal or non-filtered exposure would need to be.

So, use “in the field” or more likely on the beach

The authors of most articles I have read seem to go about this in the least logical way possible, here is my own step by step version which may take a little getting used to but then should mean less time wasted later and less wear on your camera sensor.

DO NOT ATTACH your filter(s) yet.

1. Find and compose the scene you want to capture. You are likely to gain a more pleasing result if the scene includes an anchor point, ie some feature item that will NOT move, ie a rock..

This is where beaches are likely to be easier than for instance waterfalls, as the latter may well be surrounded by trees which could also move and cause unwanted blur.

It is easy to get carried away with a new idea and forget the basics such as composition - remember that ideally your horizon (assuming seascape) will be on a vertical third rather than the middle of your image, AND wherever possible your point of interest / anchor point will also be situated on a third or better still double-third.

Using your sturdy tripod, compose the image, set your focus and then switch your AF OFF – else you risk the camera not being able to 'see' through the ND and focus being lost.

2. Determine how long an exposure *you want* to show the movement, whilst my own preference might be for 1-2 minutes this will vary dependant upon the amount of movement in the scene etc.

Then either calculate or look up the corresponding 'normal' / non-filtered exposure.

3. Back to Basics again. Using Aperture priority, control your shutter speed by applying the correct settings to your ISO and Aperture (try to avoid the extreme most narrow aperture available due to the increased risk of diffraction).

As long-exposure images based on calculated figures can be a little dark, I find it is best to include a little positive exposure compensation at this stage – perhaps +2/3 to +1.
Once you have the correct combination of ISO, Aperture and Shutter – with practice you will likely also introduce Exposure Compensation – you can prepare your camera for actually taking the image.

4. Attach your ND filter(s) and your remote shutter button. Set your camera to “bulb” - on some cameras this is a stand-alone MODE whereas in others it is simply the very slowest shutter speed that can be selected, in which case you use full MANUAL MODE.

Ensure that you have not moved your camera since setting the focus, and that you have not taken so long in step 4 that light conditions have drastically changed.

5. Using your remote trigger, simply fire the camera for your required exposure time (ie that *you* chose in step 2)

6. If you did factor in EC (step 3) then you may now have an image that is closer to your required exposure than if you had not, otherwise you may find that your image is a little dark.
   In either case you may now have to make some educated fine-tuning and retake the image to get it correct. The more you apply the logic and “math” the less time you will spend frustratedly waiting for your camera and retaking images.