Information Note
No. 1622 –October 2022

# COBRA Bailout System: Bailout Duration Times

Members' attention is brought to the recent Guidance Note issued by JFD relating to bailout duration times with partially depleted cylinder pressures.

For convenience, the Guidance Note has been attached overleaf as an appendix to this document, but it can also be found online at: https://www.jfdglobal.com/files/4716/6437/2404/DB500-PGN-21.pdf

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# COBRA Guidance Note

## Background

Users have identified that COBRA can provide industry, client & legislative (NORSOK, IMCA etc.) compliant bailout duration times even with partially depleted cylinder pressure and are seeking formal guidance on duration times at different charge pressures and depths.

## ISSUE

In order to make diving operations using COBRA more efficient, some users wish to reduce the frequency that COBRA sets are removed from the dive system for charging, but still need to remain within the relevant compliance requirements (NORSOK, IMCA etc.) for bailout duration. As the gas injection flowrate in COBRA changes with depth and gas composition, it is not straightforward to calculate set endurance, such as it is with open circuit bailout. Users have therefore requested formal guidance from JFD on this subject.

## SOLUTION

JFD have generated comprehensive duration tables for the COBRA variants with 2x 2L, 300 bar cylinders, and 2x 3L, 232 bar cylinders, which are attached at the end of this guidance note.

### Notes on use of Duration Tables

- The maximum stated duration for a COBRA set at depths shallower than 50m is 53 minutes, even if the gas duration exceeds this value. This is the scrubber duration at 50m. No scrubber testing has been done shallower than this. The scrubber duration at shallower depths will be longer, but this has not been quantified, so must be stated as 53 minutes.
- The stated durations account for lee-jet flow only. Depth changes whilst COBRA is activated will use additional gas to maintain loop volume. If the mouthpiece is removed from the diver's mouth for any reason (especially if the diver is vertical with his head up), this may cause the demand regulator to operate. This will cause the cylinder pressure to drop **extremely** quickly. Divers must vent any excess volume from the breathing loop in a **controlled** manner, from the nose or side of the mouth, as explained during their training course.
- These durations have been calculated from theoretical flowrates and have **not** been confirmed experimentally. For this reason, a safety factor has been included in the calculations.

# COBRA Guidance Note

- For this reason, users will notice that the experimentally derived durations given for 30m and 50m in guidance note DB500-PGN-10 are longer than stated in this table. These results were reported without any modification as they were physically tested.
- Flow calculations were performed using the least O2% permissible for the depth. This gives the highest lee-jet flowrate and therefore shortest duration.
- For clarity – COBRA lee-jet flowrate and therefore gas endurance do not depend on diver breathing rate. COBRA will maintain a breathable PO2 in the loop for all breathing rates up to 75 RMV. Scrubber duration has been stated after breathing at 62.5RMV for 10 minutes, with the remainder of the stated duration breathed at 40 RMV. PCO2 at stated duration was 5 mbar (0.5% surface equivalent).
- Users are reminded that that cylinder volume on COBRA is extremely small and any loss / venting of gas will cause a large drop in cylinder pressure.

Contact:

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# COBRA Guidance Note

## 2 x 2 Litre 300 Bar Cylinders

| COBRA Set Duration | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| cylinder pressure (bar) | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 | 300 |
| depth (m) | | | | | | | | | | | | | | | | | | | | | |
| 10 | 30 | 35 | 39 | 43 | 47 | 52 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| 20 | 22 | 25 | 28 | 32 | 35 | 38 | 41 | 44 | 47 | 50 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| 30 | 18 | 20 | 23 | 25 | 28 | 30 | 33 | 35 | 38 | 40 | 43 | 45 | 48 | 51 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| 40 | 15 | 17 | 20 | 22 | 24 | 26 | 28 | 31 | 33 | 35 | 37 | 40 | 42 | 44 | 46 | 48 | 51 | 53 | 53 | 53 | 53 |
| 50 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 | 33 | 35 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 |
| 60 | 12 | 14 | 15 | 17 | 19 | 21 | 23 | 24 | 26 | 28 | 30 | 32 | 33 | 35 | 37 | 39 | 41 | 42 | 44 | 46 | 48 |
| 70 | 11 | 12 | 14 | 16 | 17 | 19 | 20 | 22 | 24 | 25 | 27 | 29 | 30 | 32 | 34 | 35 | 37 | 39 | 40 | 42 | 44 |
| 80 | 10 | 12 | 14 | 15 | 17 | 19 | 20 | 22 | 24 | 25 | 27 | 29 | 30 | 32 | 34 | 35 | 37 | 39 | 40 | 42 | 44 |
| 90 | 9 | 11 | 13 | 14 | 16 | 17 | 19 | 20 | 22 | 23 | 25 | 26 | 28 | 29 | 31 | 33 | 34 | 36 | 37 | 39 | 40 |
| 100 | 9 | 10 | 11 | 13 | 14 | 16 | 17 | 19 | 20 | 21 | 23 | 24 | 26 | 27 | 29 | 30 | 31 | 33 | 34 | 36 | 37 |
| 110 | 8 | 9 | 11 | 12 | 13 | 15 | 16 | 18 | 19 | 20 | 22 | 23 | 24 | 26 | 27 | 28 | 30 | 31 | 32 | 34 | 35 |
| 120 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 17 | 18 | 19 | 20 | 22 | 23 | 24 | 26 | 27 | 28 | 30 | 31 | 32 | 33 |
| 130 | 7 | 8 | 10 | 11 | 12 | 13 | 15 | 16 | 17 | 18 | 19 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 29 | 31 | 32 |
| 140 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 29 | 30 |
| 150 | 6 | 7 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 17 | 19 | 20 | 21 | 22 | 23 | 25 | 26 | 27 | 28 | 29 |
| 160 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 24 | 25 | 26 | 27 | 28 |
| 170 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 26 | 27 |
| 180 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 190 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 200 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 210 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 20 | 21 | 22 | 23 |
| 220 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 230 | 4 | 5 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 17 | 18 | 19 | 20 | 21 | 22 |
| 240 | 4 | 5 | 6 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 20 | 21 |
| 250 | 4 | 5 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 16 | 17 | 18 | 19 | 20 | 21 |
| 260 | 3 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 13 | 13 | 14 | 15 | 16 | 17 | 18 | 18 | 19 | 20 |
| 270 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 15 | 15 | 16 | 17 | 18 | 19 | 20 |
| 280 | 3 | 4 | 5 | 6 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 13 | 14 | 15 | 16 | 17 | 17 | 18 | 19 |
| 290 | 3 | 4 | 5 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 12 | 13 | 14 | 15 | 15 | 16 | 17 | 18 | 19 |
| 300 | 3 | 4 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 14 | 14 | 15 | 16 | 17 | 17 | 18 |

# COBRA Guidance Note

## 2 x 3 Litre 232 Bar Cylinders

| COBAR Set Duration | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| cylinder pressure (bar) | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 |
| depth (m) | | | | | | | | | | | | | | |
| 10 | 47 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| 20 | 34 | 39 | 43 | 48 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| 30 | 27 | 31 | 35 | 38 | 42 | 46 | 50 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| 40 | 23 | 27 | 30 | 33 | 37 | 40 | 43 | 47 | 50 | 53 | 53 | 53 | 53 | 53 |
| 50 | 20 | 23 | 26 | 29 | 32 | 35 | 38 | 42 | 45 | 48 | 51 | 53 | 53 | 53 |
| 60 | 18 | 21 | 24 | 26 | 29 | 32 | 35 | 37 | 40 | 43 | 46 | 48 | 51 | 53 |
| 70 | 16 | 19 | 21 | 24 | 26 | 29 | 31 | 34 | 36 | 39 | 41 | 44 | 46 | 49 |
| 80 | 15 | 17 | 19 | 22 | 24 | 26 | 29 | 31 | 33 | 35 | 38 | 40 | 42 | 45 |
| 90 | 13 | 15 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 33 | 35 | 37 | 39 | 41 |
| 100 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 37 |
| 110 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 26 | 28 | 30 | 32 | 34 | 36 |
| 120 | 11 | 12 | 14 | 16 | 18 | 20 | 21 | 23 | 25 | 27 | 29 | 30 | 32 | 34 |
| 130 | 10 | 12 | 13 | 15 | 17 | 19 | 20 | 22 | 24 | 26 | 27 | 29 | 31 | 32 |
| 140 | 9 | 11 | 13 | 14 | 16 | 18 | 19 | 21 | 23 | 24 | 26 | 28 | 29 | 31 |
| 150 | 9 | 10 | 12 | 14 | 15 | 17 | 18 | 20 | 22 | 23 | 25 | 26 | 28 | 29 |
| 160 | 8 | 10 | 11 | 13 | 15 | 16 | 18 | 19 | 21 | 22 | 24 | 25 | 27 | 28 |
| 170 | 8 | 9 | 11 | 12 | 14 | 15 | 17 | 18 | 20 | 21 | 23 | 24 | 26 | 27 |
| 180 | 8 | 9 | 10 | 12 | 13 | 15 | 16 | 18 | 19 | 20 | 22 | 23 | 25 | 26 |
| 190 | 7 | 8 | 10 | 11 | 13 | 14 | 15 | 17 | 18 | 20 | 21 | 22 | 24 | 25 |
| 200 | 7 | 8 | 9 | 11 | 12 | 13 | 15 | 16 | 17 | 19 | 20 | 22 | 23 | 24 |
| 210 | 6 | 8 | 9 | 10 | 12 | 13 | 14 | 16 | 17 | 18 | 19 | 21 | 22 | 23 |
| 220 | 6 | 7 | 9 | 10 | 11 | 12 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 23 |
| 230 | 6 | 7 | 8 | 10 | 11 | 12 | 13 | 14 | 16 | 17 | 18 | 19 | 21 | 22 |
| 240 | 6 | 7 | 8 | 9 | 10 | 12 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 |
| 250 | 5 | 6 | 8 | 9 | 10 | 11 | 12 | 14 | 15 | 16 | 17 | 18 | 19 | 21 |
| 260 | 5 | 6 | 7 | 8 | 10 | 11 | 12 | 13 | 14 | 15 | 17 | 18 | 19 | 20 |
| 270 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 280 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 17 | 18 | 19 |
| 290 | 4 | 5 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 300 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |