



**CCO Ltd**

***Diving management studies  
Study No 13***

***Gap analysis between the  
NORMAM-15/DPC-2011  
and NORMAM-222/DPC  
saturation diving procedures***

*August 2025*



## 1 - Purpose

This document compares the original COMEX-based NORMAM-15/DPC-2011 saturation procedures, adopted and published by the Brazilian Navy Directorate of Ports and Coasts, and published in Portuguese and English in June 2011, with the new NORMAM-222/DPC procedures published in 2023 to supersede them, also available in Portuguese and English. The aim is to determine whether the new guidelines still conform to the initial COMEX procedures, whether additional reinforcements have been introduced to comply with the latest safety practices, and whether changes have been made that cause these new guidelines to no longer conform to the original decompression model.

It should be noted that these initial 2011 procedures were later used and reinforced by CCO Ltd in the Diving Management Study #5, *"Implement NORMAM-15/DPC-2011 Saturation Diving Procedures"*, published in 2019. The reasons for the reinforcements were that several improvements to diving procedures have been adopted in the industry since the creation and official publication of this table in 2011, necessitating the incorporation of these updates to keep this CCO Ltd study current. As it is the rule for such practice, it has been done without modifying the following key elements of the decompression procedure:

1. The compression rate to the "storage depth", stabilization stops, and stabilization periods before diving, which are calculated to manage phenomena such as compression arthralgia, narcosis, and High Pressure Nervous Syndrome (HPNS).
2. The maximum descent and ascent rates from and to the bell
3. The maximum excursion distances and the excursion rules associated with these distances.
4. The published diving profile rules (for example, the "V" profile NORSOK).
5. The final decompression process.
6. The recommended proportions of gas for each phase.

Therefore these reinforcements strictly adhere to the key elements of this original 2011 edition, except that the gas values for the descent and storage periods that were missing from the official document and were provided by Jean Pierre Imbert, who worked as the COMEX company diving manager when these procedures were created and can therefore be considered the lead author of the latest decompression procedures COMEX.

Note that the Brazilian authorities modified these NORMAM-15/DPC-2011 procedures in 2016 in a document published only in Portuguese, and that the lead author of the initial procedures and many scientists were not informed of these changes.

## 2 - Comparison method

The point-by-point comparison method on the next page, which involves writing the procedure steps into a column for the Normam 15/DPC-2011 and another for the Normam 222/DPC, with chapters and sections separated by sufficient space to avoid confusion, has been used to ensure that no details were missed.

As previously suggested, Normam-222 saturation procedures were compared only with those of the 2011 version of Normam-15, since the "Study #5 CCO Ltd" published in 2019, is based on them and does not incorporate the 1916's updates mentioned above.

Comments were added when differences were found and highlighted in blue to distinguish them from the official texts. Additionally, these initial findings were communicated to the Brazilian authorities for clarification. As the Brazilian authorities kindly responded, their explanations have been included in green in the relevant sections.

### 3 - Comparison and differences found

#### *Normam-15 / 2011*

##### **1104 - Saturation diving**

The saturation dives are divided into three depth ranges, considering the effects on the divers:

- a) Standard Saturation:  
Diving operations in which the life level, including the maximum excursion depth reached by the diver is equal to or less than 180m;
- b) Deep Saturation  
Diving operations in which the life level, including the maximum excursion depth reached by the diver is between 181 and 300m, including; and
- c) Exceptional Saturation  
Diving operations in which the life level, including the maximum excursion depth reached by the diver is between 300 and 350m.

#### *Normam 222*

##### **10.3 - Saturated dives**

Saturated dives are divided into three depth ranges, considering the effects on divers:

- a) Standard Saturation  
Diving operations in which the standard of living, including the maximum depth of excursion reached by the diver, is equal to or less than 180-meters, inclusive.
- b) Deep Saturation  
Diving operations in which the standard of living, including the maximum depth of excursion reached by the diver, is situated **between 180 and 300-hundred meters**, inclusive.
- c) Exceptional Saturation  
Diving operations in which the standard of living, including the maximum depth of excursion reached by the diver, is situated between three hundred and 350 meters.

##### ***Comment:***

*No difference noticeable regarding this section apart that the deep saturations are mentioned from 180 m instead of 181*

##### ***Answer Brazilian authorities:***

*The item will be adjusted in a future revision, where the depth of 181m will replace the current 180m.*

## ***Normam-15 / 2011***

### **1105 - Minimum procedures for standard saturation up to 180 m**

The compression and decompression tables should meet the following requirements:

#### ***a) Compression speed***

##### **I) Saturations at a depth of 100m**

From the surface to the depth of 100m, the maximum compression speed should be of up to one meter/minute.

##### **II) Saturations at a depth of up to 180m**

From the surface to the depth of 180m, the maximum compression speed should be of up to one meter/minute.

#### ***b) Duration of stabilization stops, in the initial compression***

##### **I) To depths since the surface up to 100m**

From the surface up to 100m - two hours at 100m or proportional time to the depth between the surface and 100m, calculated by the expression:

Stabilization time (min) =  $2 \times 60 \times \text{depth (m)} / 100$

##### **II) To depths between 100 and 180m**

In Saturations in depths between 100 and 180m, a stop to stabilize should be done for 2 hours at 100m and the arrival at the saturation depth, a stabilization stop, calculated by the expression: Stabilization time (min) =  $2 \times 60 \times (\text{depth (m)} - 100) / 100$

#### ***c) Pressurization speed and stabilization stops in intermediate compressions***

In intermediary compressions up to the depth of 180m the same pressurization speed should be met as if it were an initial standard pressurization.

In case the new saturation depth is higher than 180m, the pressurization speeds should be met according to the procedures for deep initial compression.

The stabilization period to be met after an intermediate compression depends on the amplitude of this pressurization, as follows:

I) Amplitude smaller than 30m - no stabilization is demanded and there will not be a stop at 200m in case of a transition from a Standard Saturation to a Deep Saturation.

II) Amplitude between 31 and 50m - two hours of stabilization when reaching the new saturation depth, not stopping at 200m in case of a transition from a Standard to a Deep Saturation.

III) Amplitude above 50m - use the same stabilization criteria of a deep saturation.

## ***Normam 222***

### **10.4 - Minimum procedures for saturation up to 180 m depth**

Compression and decompression tables must comply with the following requirements:

#### ***a) Compression speed***

From the surface to a depth of 180-meters, the maximum compression speed should be one meter/minute.

***Comment: This text groups the texts I and II of the initial procedure***

#### ***b) Duration of stabilization stops in initial compression***

I - for depths from the surface to one hundred meters:

- a two-hour stabilization stop must be observed at 100 meters or proportional time for depths between the surface and 100 meters, calculated by the expression:

Stabilization time (min) =  $2 \times 60 \text{ (min)} \times \text{depth (m)} / 100$

II - for depths between 100 and 180 meters:

- a two-hour stabilization stop must be made at 100 meters and, upon reaching saturation depth, a stabilization stop calculated using the following expression:

Stabilization time (min) =  $2 \times 60 \text{ (min)} \times (\text{depth (m)} - 100) / 100$

**- a two-hour stabilization stop must be completed at one hundred meters or proportional time for depths between the surface and one hundred meters, calculated by expression:**  
**Stabilization time (min) =  $2 \times 60 \text{ (min)} \times (\text{depth (m)} - 100 \text{ (m)}) / 100 \text{ (m)}$**

***Comment:***

*The text above (in black) is from the official document in Portuguese and conforms to the initial procedure (2011). However, the text above in red is from the English translation and is incorrect, as it omits the method of calculation for depths between the surface and 100 m.*

*Therefore, we must refer to the Portuguese version. Note that the English translation uses a different numbering of the items.*

***Answer Brazilian authorities:***

*The omission pointed out occurred due to a translation error, which inadvertently removed the text originally present in the Portuguese version of the document.*

#### ***c) Compression speed and stabilization stops at intermediate compressions***

In intermediate pressurizations up to a depth of 180 meters, the same compression speed should be maintained as if it were a standard initial pressurization.

If the new saturation depth is greater than 180 meters, the compression speeds must be complied with in accordance with the procedures for deep initial compression

The stabilization period to be observed after an intermediate compression depends on the amplitude of that pressurization, as established below:

I - amplitude less than thirty meters - no stabilization is required and there will be no stop at two hundred meters in the case of a transition from Standard Saturation to Deep Saturation;

II - amplitude between 31 and fifty meters - two hours of stabilization upon reaching the new saturation depth, with no stop at two hundred meters in the case of a transition from Standard Saturation to Deep Saturation; and



## ***Normam-15 / 2011***

### ***d) Excursions***

Excursions can be carried out, up and down, from the saturation depth (life level) in the up or down speed of 10m/min, with no duration restriction.  
The excursions are divided into normal and exceptional and are applied regardless of the depth in which the saturation is, as established in item 1108.

### ***e) Decompression***

The standard decompression speed and their specific procedures are applied regardless of the depth range in which the saturation is.  
Item 1109 presents the procedures and the speeds that should be met during decompression

### ***f) Maximum bottom time for divers in the diving bell and in the water***

- I - The divers cannot stay more than 8 hours in a 24 period in the water, between doing and undoing the bell/chamber, ensuring a resting period of 12 hours.
- II - The maximum period the divers can stay in water, within the seal-to-seal period above, is 6 hours.
- III - The diver who goes to the water can at his own discretion and with the authorization of his supervisor, be replaced by the emergency diver or have a resting period and one for calories recovery inside the diving bell. It is recommended that this period be of up to thirty minutes after half the time established in the previous item has been completed.

## ***Normam 222***

III - amplitude greater than fifty meters - use the same stabilization criteria as for deep saturation.

*Comment: This section conforms to the initial procedure published in 2011*

### ***d) Excursions***

Excursions may be made, up and down, from the saturation depth (life level) at a speed of ten meters per minute (10 m/min), with no duration restriction.  
Excursions are divided into normal and exceptional and are applied regardless of the **depth range** in which saturation is **located**, as established in item 1007.

***Comment:***

*This text from both versions roughly conforms to the initial 2011 procedure.*

### ***e) Decompression***

Standard decompression **speeds**, as well **as specific procedures**, are applied regardless of the depth range in which saturation **is located**.  
Item 1008 presents the procedures and speeds that must be followed during decompression.

***Comment:***

*This text from both versions roughly conforms to the initial 2011 procedure*

### ***f) Maximum bottom time for divers in the diving bell and in the water***

- I. The period of stay of divers in the **bell/water, between locking off the bell/chamber seal**, may not exceed eight hours per 24-hour period, guaranteed in this period an uninterrupted rest of twelve hours;
- II. The biological cycle of divers must be respected, understanding as such, maintaining rest periods, preferably at the same times of the day;**
- III. The period of stay of divers in the water, within the seal-to-seal period, is limited to six hours;
- IV. The diver who goes into the water may, at his/her discretion and with the respective supervisor's agreement, be replaced by the emergency diver, or have a period of rest and calorific recovery inside the bell. It is recommended that the period in question or for up to thirty minutes, after completing half the time established in sub-paragraph previous.

***Comment:***

*The texts above from both versions roughly conform to the initial 2011 procedure they reinforce, particularly by the addition of point II (in red).*

## ***Normam-15 / 2011***

### **1106 - Minimum procedures for saturation diving in depths between 181 and 300 meters**

The compression and decompression tables should meet the following requirements:

#### ***a) Compression speed***

- I - From the surface to the depth of 100m, the maximum compression speed should be of up to 2 minutes per meter(0,5m/m).
- II - From 100 to 200m, the maximum compression speed should be of up to 4 minutes per meter(0,25m/min).
- III - From 200 to 300m, the maximum compression speed should be of up to 6 minutes per meter(0,166m/min).

#### ***b) Duration of stabilization stops during the initial compression:***

- I - At the depth of 100m: Stop for stabilization for two hours.
- II - At the depth of 200m: Stop for stabilization for two hours.

#### ***c) Duration of stabilization stops after getting to the Life Level:***

- I - To depths between 181 and 240m: In saturations between 181 and 240m deep, a stop for stabilization should be done at the saturation depth for at least 6 hours.
- II - To depths between 241 and 300m: In saturations between 241 and 300m deep, a stop for stabilization should be done at the saturation depth for at least twelve hours.

#### ***d) Pressurization speed and stabilization stops in intermediate compressions***

In intermediate compressions up to 300m deep, the stabilization period to be met depends on the amplitude of this pressurization, as established below:

- I - Amplitude smaller than 30m - no stabilization required and there will not be a stop at 200m.
- II - Amplitude between 31 and 50m - two hours of stabilization when reaching a new saturation depth, and there will not be a stop at 200m; and
- III - Amplitude above 50m - use the same stabilization criteria of a deep saturation.

#### ***e) Excursions***

Excursions can be carried out, up and down, from the saturation depth (life level) in the up or down speed of 10m/min, with no time duration restriction, as long as it does not exceed 300m deep.

The excursions are divided into normal and exceptional and are applied regardless of the depth in which the saturation is, as established in item 1108.

## ***Normam 222***

### **10.5 - Minimum procedures for saturation diving in depths between 180 and 300 meters**

Compression and decompression tables must comply with the following requirements:

#### ***a) Compression speed.***

- I - From the surface to a depth of one hundred meters, the maximum compression speed it must be 0.5 meters/minute (two minutes per meter);
- II - From one hundred to two hundred meters, the maximum compression speed should be 0.25 meter/minute (four minutes per meter);
- III - From two hundred to three hundred meters, the maximum compression speed must be 0.166 meter/minute (six minutes per meter).

#### ***b) Duration of stabilization stops during initial compression.***

- I - At a depth of one hundred meters - stop to stabilize for two hours;
- II - At a depth of two hundred meters - stop for stabilization for two hours

#### ***c) Duration of stabilization stops after arrival at the standard of living.***

- I - For depths between 181 and 240-meters - make a stop for stabilization upon arrival at saturation depth, with a minimum duration of six hours;
- II - For depths between 241 and three hundred meters - at saturations between 241 and three hundred meters deep, a stop must be carried out to stabilize the reaching saturation depth lasting at least twelve hours.

#### ***d) Stabilization stops in intermediate compressions.***

In intermediate compressions up to a depth of three hundred meters the period of stabilization to be achieved depends on the amplitude of this pressurization, as established below:

- I - Depth less than thirty meters - no stabilization is required and there will be no stop two hundred meters away;
- II - Depth between 31 and fifty meters - two hours of stabilization upon reaching new saturation depth, with no stopping at two hundred meters; It is
- III - Depth greater than fifty meters - use the same stabilization criteria of an initial deep saturation.

#### ***e) Excursions***

Excursions can be made, up and down, from the depth of saturation (level of life) at the speed of ascent or descent of ten meters per minute, without duration restrictions, as long as the depth of three hundred meters.

Excursions are divided into normal and exceptional and are applied regardless of the depth range in which saturation is located, as established in item 1007.

#### ***Comment:***

*The texts in the sub-sections above (a to e) conform to those of the initial document. The only modifications are the wording.*

## ***Normam-15 / 2011***

### ***f) Decompression***

The standard decompression speed and the specific procedures are applied regardless of the depth range in which the saturation is.

Item 1109 presents the procedures and the speeds that should be met during decompression.

### ***g) Maximum bottom time for divers in the diving bell and in the water***

- I - The divers cannot stay more than 8 hours in a 24 period in the water, between undoing and redoing the bell/chamber, ensuring a resting period of 12 hours.
- II - The biological cycle of the divers should be respected, and that is understood as the resting period, preferably in the same time every day.
- III - The maximum period the divers can stay in water, within the seal-to-seal period above, is:
  - 6 hours in the range of 0 to 210m.
  - 5 hours in the range of 211 to 260m.
  - 4 hours in the range of 261 to 300m.
- IV - The diver who goes to the water can at his own discretion and with the authorization of his supervisor, be replaced by the emergency diver or have a resting period and one for calories recovery inside the diving bell. It is recommended that this period be of up to thirty minutes after half the time established in the previous item has been completed.

## ***Normam 222***

### ***f) Decompression***

Standard decompression speeds, as well as specific procedures, are applied regardless of the saturation depth range.

Item 1008 presents the procedures and speeds that must be followed in decompression

### ***g) Maximum bottom time of divers in the bell and in the water***

- I - The period the divers remain in the bell/water, between undoing and redoing the bell/chamber seal, cannot exceed eight hours per 24-hour period, guaranteed during this period an uninterrupted rest of twelve hours;
- II - The biological cycle of divers must be respected, understanding as such, maintaining rest periods, preferably at the same times of the day;
- III - The periods of stay of divers in the water, within the seal to seal, are limited to:
  - six hours in the range from zero to 210-meters;
  - five hours in the range of 211 to 260-meters; It is
  - four hours in the range of 261 to three hundred meters.
- IV- The diver who goes into the water will have the right, at his/her discretion and with the respective supervisor's agreement, be replaced by the emergency diver, or have a period of rest and caloric recovery inside the bell. It is recommended that the period in question be for up to thirty minutes, after completing half the time established in previous paragraph.

### ***Comment:***

*The texts in the sub-sections above (f & g) conform to those of the initial document. The only modifications are the wording.*



## *Normam-15 / 2011*

### **1107 - Minimum procedures for saturation diving in depths between 300 and 350 meters**

For dives in depths between 300 and 350m, the following requirements should be met:

#### **a) General procedures**

- I - The divers should have proved professional experience by means of their own records at LMR of at least 6000 hours of saturation in depths superior to 200m;
- II - proceed to the previous instruction for the execution of the diving involving the supervisors, saturation technicians, divers, RCV/ROV technicians, health professionals and others whose actions interfere in the dive;
- III - proceed to previous training for emergency situations, including the hyperbaric evacuation, with all the divers and support personnel;
- IV - use individual emergency equipment (BOS, SLS or similar) with autonomy of at least fifteen minutes, proceeding to specific training before each operation;
- V - limit the divers' umbilical to 33m, counted from the bell;
- VI - do not compress or decompress more than once without interrupting during the saturation period;
- VII - only operate within the depth range established in the schedule; and
- VIII - Use RCV/ROV follow-up; recorded sound and video shall be preserved after the operations are over for a minimum period of a year or **by the time considered necessary by DPC in case there is an accident.**

#### **b) Compression speed**

- I - From the surface to the depth of 100m, the maximum compression speed should be of up to two minutes per meter.
- II - From 100 to 200m, the maximum compression speed should be of up to four minutes per meter.
- III - From 200 to 300m, the maximum compression speed should be of up to six minutes per meter.
- IV - From 300 to 350m, the maximum compression speed should be of up to eight minutes per meter.

## *Normam 222*

### **10.6 - Minimum procedures for saturation diving in depths between 300 and 350 meters**

For diving at depths between three hundred and 350 meters, the following requirements:

#### **a) General procedures**

- I - Divers must have professional experience proven through own records in the LRM, of at least 6000 hours of saturation at depths greater than two hundred meters;
- II - Provide specific prior instruction for carrying out the diving operation involving supervisors, saturation technicians, divers, RCV/ROV technicians, health, and others whose actions may interfere with diving;
- III - Undergo prior training for emergency situations, including evacuation hyperbaric, with all divers and support personnel;
- IV - Use individual emergency equipment (SLS or similar) with autonomy of at least fifteen minutes and undergo specific training before each operation;
- V - Limit the length of divers' umbilical cords to 33-meters, counted from the bell;
- VI - Do not perform more than one uninterrupted compression and decompression during the total period of saturation;
- VII - Carry out operations only within the upper and lower depth limits established in planning;
- VIII - Use RCV/ROV monitoring and maintain sound and image records for a minimum period of one year from the end of operations **or for five years in case accident/incident occurrence.**

#### **Comment:**

*Most texts in the sub-section above use slightly different wording than the initial 2011 procedure, but they conform to it. The only exception is the minimum period to retain video-communication records in the event of an accident, which is now specified as 5 years, whereas it was previously at the discretion of the DPC (see in red).*

#### **Answer Brazilian authorities:**

*The change to a 5-year retention period for the recording history (audio and video) of operations was made to align the NORMAM with various Brazilian laws and regulations that establish a minimum 5-year document retention period, especially in areas such as labor, occupational health and safety, environmental protection, and tax compliance.*

#### **b) Compression speed.**

- I - From the surface to a depth of one hundred meters, the maximum compression speed it must be **0.5 meters/minute** (two minutes per meter);
- II - From one hundred to two hundred meters, the maximum compression speed should be **0.25 meter/minute** (four minutes per meter);
- III - From two hundred to three hundred meters, the maximum compression speed must be **0.166 meter/minute** (six minutes per meter); It is
- IV - From three hundred to 350 meters, the maximum compression speed must be **0.125 meter/minute** (eight minutes per meter).

**c) Duration of stabilization stops during the initial compression**

- I - At the depth of 100m: Stop for stabilization for two hours.
- II - At the depth of 200m: Stop for stabilization for two hours.
- III At the depth of 300m : Stop for stabilization for two hours.

**d) Duration of stabilization stops after getting to the Life Level**

In saturations between 300 and 350m deep, a stop for stabilization should be done at the saturation depth for at least twelve hours.

**e) Pressurization speed and stabilization stops in intermediate compressions**

Intermediate compressions should not be done in dives with life level between 300 and 350. However, if it is necessary for safety reasons, the same speed for pressurization and stabilization stop should be carried out as if it were an initial pressurization.

**f) Excursions**

Excursions can be carried out, up and down, from the saturation depth (life level) in the up or down speed of 10m/min, with no time restrictions as long as the depth of 350m is never exceeded.

The maximum distance of ascendant excursion is 25m, and there are not exceptional excursions.

**g) Decompression**

The standard decompression speed and their specific procedures are applied regardless of the depth range in which the saturation is.

Item 1109 presents the procedures and the speeds that should be met during decompression.

**h) Maximum bottom time for divers in the diving bell and in the water**

- I - The divers cannot stay more than six hours in the water, between undoing and redoing the bell/chamber, with three hours at most of effective work in a period of 24 hours, ensuring a resting period of sixteen hours.
- II - The biological cycle of the divers should be respected, and that is understood as the resting period, preferably in the same time every day.

**Comment:**

*The texts in this sub-section conform to those of the initial document. The only modifications are the addition of the distances per minute that were not specified in the initial 2011 edition (see in red)*

**c) Duration of stabilization stops during the initial compression**

- I - At a depth of one hundred meters - stop to stabilize for two hours;
- II - At a depth of two hundred meters - stop to stabilize for two hours;
- III - At a depth of three hundred meters - stop to stabilize for two hours.

**d) Duration of stabilization stops after arrival at Storage Depth.**

In saturations between three hundred and 350 meters deep, a stop for stabilization upon arrival at saturation depth lasting at least twelve hours.

**e) Pressurization speed and stabilization stops at intermediate compressions.**

For dives carried out at living levels between three hundred and 350 meters, intermediate compressions may be performed, however, if for safety reasons this is necessary, the same pressurization speed and duration of the stoppage must be observed. stabilization as if it were an initial pressurisation.

**f) Excursions**

Excursions can be made, up and down, from the depth of saturation (level of life) at the speed of ascent or descent of ten meters per minute, without duration restrictions, as long as a depth of 350 meters is never exceeded.

The maximum upward and downward excursion distance is 25 meters, note there are exceptional excursions.

**g) Decompression**

Standard decompression speeds, as well as specific procedures, are applied regardless of the depth range in which saturation is located.

Item 1008 presents the procedures and speeds that must be followed in decompression.

**h) Maximum bottom time of divers in the bell and in the water.**

- I - The period the divers remain in the bell/water, between leaving and returning to the bell/chamber, cannot exceed six hours, with a maximum of three hours of effective work in the water for each 24-hour period, guaranteeing uninterrupted rest during this period of sixteen hours;
- II - The biological cycle of divers must be respected, understanding as such, maintaining rest periods, preferably at the same times of the day.

**Comment:**

*The texts in the sub-sections displayed on this page (c, d, e, f, g, h) conform to those of the initial document Normam-15 rev. 2011.*

## 1108 - Excursion tables

### a) Excursions speed

Excursions can be carried out, up and down, from the saturation depth (life level) in the up or down speed of 10m/min, with no restrictions as to their duration.

### b) Types of excursion

The excursion will be considered Standard or Exceptional according to Table 11-01.

The exception excursions allow greater distances than standard excursions, but they are also associated to job restriction. These excursions should not be scheduled as routine.

They should be employed only in special or emergency situations.

Each saturated diver can only perform two exceptional excursions per saturation as a diver or bell guide.

**Table 11-01 - Standard and exceptional excursions**

Life Level (meters)	Standard Downward Excursions Distances	Standard Upward Excursions Distances	Exceptional Downward Excursions Distances	Exceptional Upward Excursions Distances
UP TO 10	N/A	N/A	N/A	N/A
10 to 17	3	2	N/A	N/A
18 to 22	4	4	N/A	N/A
23 to 29	5	5	10	N/A
30	6	6	12	N/A
31 to 39	7	7	14	14
40 to 59	8	8	16	16
60 to 79	9	9	18	18
80 to 99	10	10	20	20
100 to 119	11	11	22	22
120 to 139	12	12	24	24
140 to 179	13	13	26	26
180 to 270	15	15	30	30
270 to 285	15	15	30*	30*

\* From 270m the distance should be decreased in a way that no excursion exceeds the depth of 300m.

## 10.7 - Excursion tables

### a) Speed of excursions

Excursions can be made, up and down, from the depth of saturation (level of life), at a speed of ascent or descent of ten meters per minute, without restriction on duration.

### b) Types of excursions.

The excursion will be considered Standard or Exceptional, in accordance with Table 10.7.1. Exceptional tours allow for greater distances than standard tours, however, they are associated with employment restrictions. These excursions should not be planned as routine and should only be used in special or emergency situations.

Each saturated diver may only undertake two exceptional excursions per saturation, whether acting as a diver or as a bell guide.

**Table 10.7.1 - Standard and Exceptional Tour**

Storage Depth (metres)	Distances from Excursions Downward Standard	Distances from Excursions Ascending Standard	Distances from Excursions Downward Exceptional	Distances from Excursions Ascending Exceptional
0 - 10	N/A	N/A	N/A	N/A <i>OK</i>
10 - 17	3	2	N/A	N/A <i>OK</i>
18 - 22	4	4	N/A	N/A <i>OK</i>
23 - 29	5	5	10	N/A <i>OK</i>
30	6	6	12	N/A <i>OK</i>
31 - 39	7	7	14	14 <i>OK</i>
40 - 59	8	8	16	16 <i>OK</i>
60 - 79	9	9	18	18 <i>OK</i>
80 - 99	10	10	20	20 <i>OK</i>
100 - 119	11	11	22	22 <i>OK</i>
120 - 139	12	12	24	24 <i>OK</i>
140 - 179	13	13	26	26 <i>OK</i>
180 - 270	15	15	30	30 <i>OK</i>
270 - 285	15	15	30*	30* <i>OK</i>

\* From 270-meters onwards, the distance must be reduced so that no excursion exceeds a depth of 300-meters.

### Comment:

The texts and the table 10.7.1, in the sub-sections displayed on this page (a, & b) conform to those of the initial document Normam-15 rev. 2011.

## Normam-15 / 2011

### c) Stabilization periods for excursions

After an excursion the diver should observe a stabilization period before going on another excursion, according to the established on Table 11-02.

**Table 11-02 - Stabilization period**

Stabilization Period	After Standard Downward Excursion	After Standard Upward Excursion	After Exceptional Downward Excursion	After Exceptional Upward Excursion
Before Standard Downward Excursion	None	None	None	12 hours
Before Standard Upward Excursion	None	None	12 hours	12 hours
Before Exceptional Downward Excursion	None	None	48 hours	48 hours
Before Exceptional Upward Excursion	12 hours	None	48 hours	48 hours

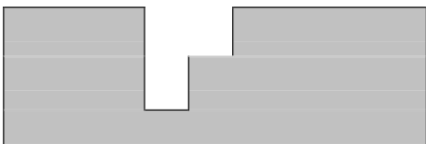
### d) Combinations allowed for excursions with no break

The following excursion combinations may be done according to the criteria established on Table 11-02:

I - Standard Downward Excursion followed by Exceptional Downward Excursion:  
Consider as: Exceptional Downward Excursion



II - Exceptional Downward Excursion followed by Standard Downward Excursion:  
Consider as: Exceptional Downward Excursion



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### c) Stabilization periods for excursions

After completing an excursion, the diver must observe a period of time to stabilization before undertaking another excursion, in accordance with what is established in Table 10.7.2., Whose first input argument is on the horizontal line ("After Excursion...") and the second argument is vertical ("Before Excursion...")

**Table 10.7.2 - Stabilization periods**

Period of Stabilization	After Excursion <b>Downward</b> Standard	After Excursion <b>Ascending</b> Standard	After Excursion <b>Downward</b> Exceptional	After Excursion <b>Ascending</b> Exceptional
Before excursion <b>Downward</b> Standard	None	None	None	12-Hours
Before Excursion <b>Ascending</b> Standard	None	None	12-Hours	12-Hours
Before Excursion <b>Downward</b> Exceptional	None	None	48-Hours	48-Hours
Before Excursion <b>Ascending</b> Exceptional	12-Hours	None	48-Hours	48-Hours

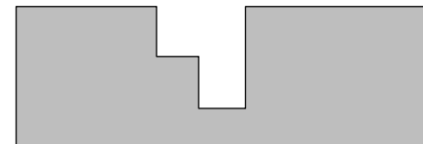
### Comment:

The texts and the table 10.7,2, in this sub-sections displayed conform to those of the initial document Normam-15 rev. 2011.

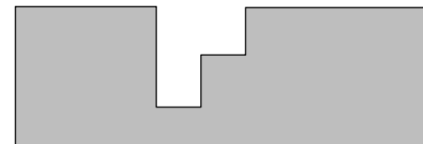
### d) Combinations allowed for excursions without break

The following combinations of excursions can be carried out, depending on the criteria established in Table 10.7.2.:

I - Standard Descending Excursion followed by an Exceptional Descending Excursion  
Consider as: Exceptional Descending Excursion



II - Exceptional Descending Excursion followed by a Standard Descending Excursion.  
Consider as: Exceptional Descending Excursion

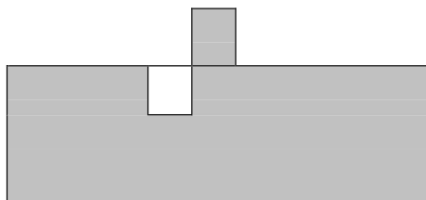


### Comment:

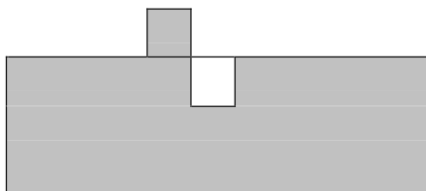
The texts and excursion combinations #I & II above conform to those of the Normam-15 2011.

### ***Normam-15 / 2011***

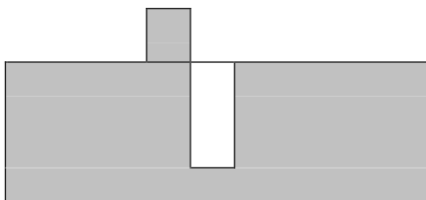
III - Standard Downward Excursion followed by Standard Upward Excursion  
Consider as: Standard Downward Excursion



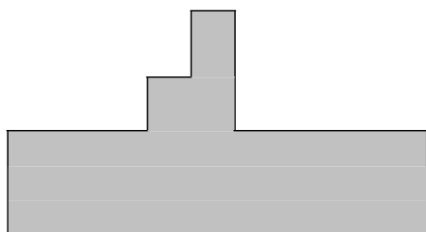
IV - Standard Upward Excursion followed by Standard Downward Excursion.  
Consider as: Standard Downward Excursion



V - Standard Upward Excursion followed by Exceptional Downward Excursion.  
Consider as: Exceptional Downward Excursion



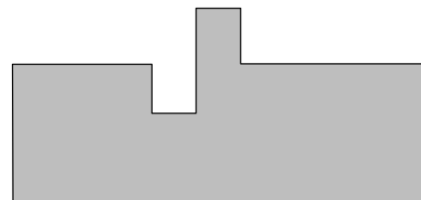
VI - Standard **Downward\*** Excursion followed by Exceptional Upward Excursion.  
Consider as: Exceptional Upward Excursion



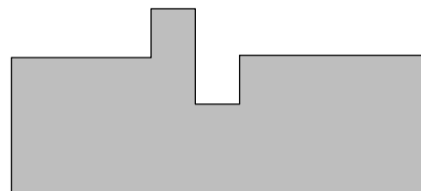
**Downward\*** : *This is a writing error that was detected and we corrected when we wrote the “CCO Ltd Diving Management Study #5; Implement Normam-15/DPC Saturation Diving Procedures*

### ***Normam 222***

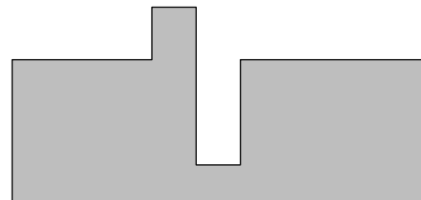
III - Standard Descending Excursion followed by Standard Ascending Excursion  
Consider as: Standard Descending tour



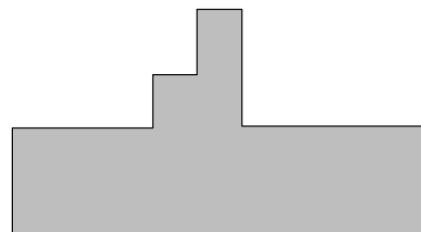
IV - Standard Ascending Excursion followed by Standard Descending Excursion.  
Consider as: Standard Descending tour



V - Standard Ascending Excursion followed by Exceptional Descending Excursion.  
Consider as: Exceptional Descending Tour



VI - Standard Ascending Excursion followed by Exceptional Ascending Excursion.  
Consider as: Exceptional Ascending Tour



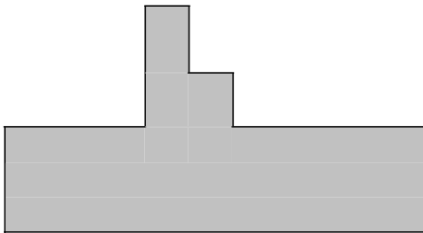
#### ***Comment:***

*The texts and excursion combinations #III to VI above conform to those of the Normam-15 2011, also considering that the relevant correction has been made to the wording of combination #VI. This correction was done in the Normam-15 2<sup>nd</sup> edition 2016*



### ***Normam-15 / 2011***

VII - Exception Upward Excursion followed by Standard Upward Excursion.  
Consider as: Exceptional Upward Excursion



#### ***e) Excursions after an intermediate decompression***

After intermediate decompression no stabilization period is required to do a downward excursion. However, to do an upward excursion it will be necessary to have a stabilization period equivalent to the decompression time up to the excursion depth.

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#### ***Comment:***

*The excursion combination #VII was removed from the official document in the Normam-15 2nd edition, published in 2016. There was and there is still no explanation on why this combination has been removed*

#### ***Answer Brazilian authorities:***

The absence of this subitem VII in NORMAM-15 (Rev 2 - 2016), as pointed out by you, was due to an editorial oversight at the time of publication, which had not been formally identified until now.

#### ***e) Excursions after an intermediate decompression***

After intermediate decompression, no period of decompression stabilization is required to make a downward excursion. However, to go on an excursion ascending, a period of stabilization equivalent to the time required for the decompression to excursion depth.

#### ***Comment:***

*The subsection above conforms to the one in the initial Normam 15 published in 2011*

## 1109 - Decompression

### a) Standard, Deep and Exceptional Saturation

The standard procedure for decompression is the same for standard, deep and exception saturations, and the speeds established for the different depth ranges should be met as applicable.

From the beginning of decompression **up to the depth in which the oxygen percentage in the chamber reaches 25%, the partial oxygen pressure of 0,48 and 0,5 bar should be kept.**

From this depth, the oxygen partial pressure should decrease so that the oxygen percentage in the respiratory mixture used in **the chamber be kept between 21 and 25%** due to the fire risk.

### b) Final and intermediate decompression

Depth range	Continuous speed	Going up through steps
From 350 to 20m	50 minutes/m	Go up 1m every 50 min
From 20m to the surface	90 minutes/m	Go up 1m every 1 h and 30 min

### c) Stabilization period before beginning decompression:

I - The decompression may initiate with an upward excursion, respecting the stabilization periods established on Table 11-02, before initiating this upward excursion; and

## 10.8 - Decompression

### a) Standard, Deep and Exceptional Saturation

The standard decompression procedure is the same for standard, deep, and exceptional saturations, and the speeds established for the different depth ranges must be complied with as applicable.

From the start of decompression **until the depth at which the oxygen percentage in the chamber reaches 21%, the partial pressure of oxygen should be maintained between 0.44 and 0.48 ATA.**

From that depth onwards, the partial pressure of oxygen must be reduced in order to maintain the percentage of oxygen in the breathing mixture used in **the chamber at 21%, due to the risk of fire.**

#### Comment:

*The changes above were previously made in the Normam-15 2nd edition in 2016. There was, and still is, no explanation for why these changes were made, as no reference document was provided in this edition. Therefore, we can consider that no change was made from the latest edition of the Normam-15 table as they were made before.*

*Note that the text above is a translation of the Portuguese version as the English one is less comprehensive*

#### Answer Brazilian authorities

*The amendment in NORMAM-15 (2nd Revision) aimed to follow item 15-23.6 of the US Navy Diving Manual (6th Revision), in force at the time. The technical adaptation adopted in Brazil specified the use of 21% O<sub>2</sub> as a reference for what is considered shallow depth, from which point oxygen control shifts from partial pressure to oxygen percentage, which must remain between 19% and 23%. Your observation is correct, as the final part of the text was incorrectly edited to state that the oxygen percentage must be maintained at 21%, when in fact it must remain within the range of 19% to 23%.*

#### Comment on the answer from the Brazilian authorities:

*No explanation has been provided as to why they changed the PPO<sub>2</sub> values, except that they referred to the US Navy procedures that are based on different protocols in terms of PPO<sub>2</sub> values and in terms of the organization of the ascent (stepped ascent for the USN and continuous one for the COMEX procedures).*

### b) Final and intermediate decompression

Depth range	Continuous ratio	Climb via steps
From 350 to 20m	50 minutes/m	Go up 1m every 50 min
From 20m to the surface	90 minutes/m	Go up 1m every 1 h and 30 min

### c) Stabilization period before starting decompression:

I. Decompression may begin with an upward excursion, respecting the stabilization periods established in Table 10.7.2., before starting this ascending excursion;

### ***Normam-15 / 2011***

- II - If the decompression starts from the life level through the compliance of the decompression speed established in the section b) above, the compliance with the stabilization period will not be mandatory.

### **1110 - Annual number of saturations**

#### ***a) Standard and Deep Saturation***

Using the Saturation Technique, the maximum one can stay under pressure is 28 days and the minimum interval between two saturations will be the same as the saturation time, and it cannot be below 14 days. The maximum time one can stay under saturation in a period of 12 consecutive months cannot be over 120 days.

#### ***b) Exceptional Saturation***

- I - The diver will only be allowed two saturations per year in this depth range, with a minimum interval of 6 months between them and as long as he has not done saturation deeper than 300m during this interval;
- II - In case the diver has already done a saturation between 300 and 350m, he can only perform another up to 300m after 4 months after the end of the previous saturation, and he cannot exceed 77 saturated days in the interval of 12 months, counting from the beginning of saturation between 300 and 350m; and
- III - The maximum period one can stay under pressure is 21 days.

### ***Normam 222***

- II. If decompression starts from the living level (Storage Depth) through compliance with the decompression speed established in paragraph b above, it will not be mandatory to comply with the stabilization period.

#### ***Comment:***

*The sub-sections b and c above conform to those of the initial procedure.*

*It must be noticed that, except in an emergency, so accelerated decompression (abandon ship), the procedure that consists of an initial upward excursion is no longer recommended in the industry.*

### **10.9 - Annual number of saturations**

#### ***a) Standard and Deep Saturation***

Using the Saturation Technique, the maximum period of stay under pressure will be 28 days and the minimum interval between two saturations will be equal to the saturation time, this interval may be less than fourteen days. The maximum time spent under saturation in a period of twelve consecutive months cannot exceed 120 days.

#### ***b) Exceptional Saturation***

- I - The diver will only be allowed to perform two saturations per year in this range of depth, with a minimum interval of six months between each one and as long as there is no performed deep saturation (between 181 and 300-hundred meters) during this interval;
- II - If the diver has already completed a saturation between 300 and 350-meters, he only may carry out another saturation four months after the end of the previous saturation, not exceeding 77 saturated days within a twelve-month interval, counting from the beginning saturation at depths between three hundred and 350-meters;
- III - The maximum period of stay under pressure will be 21-days.

#### ***Comment:***

*The sub-sections a and b above conform to those of the initial Normam-15 procedure 2011.*

### ***Normam-15 / 2011***

#### **1111 - Employment of other tables and new procedures**

The requirements established in the current chapter do not restrict or prohibit the adoption of different tables and procedures.

The tables and diving procedures that are in accordance with the established in the current standard do not need to be submitted to the ratification by DPC. However, other tables and procedures that are not in accordance should be forwarded to DPC, followed by information related to the development, as well as a document that shows the consolidation of its safe application.

### ***Normam 222***

#### **10.10 - Use of other tables and new procedures**

The requirements established in this Chapter do not restrict or prohibit the adoption of distinct tables and procedures.

Diving tables and procedures that comply in accordance with the provisions of these Standards do not need to be subjected to analysis by the DPC, however, other tables and procedures that are not provided for must be forwarded to the DPC, accompanied by information relating to its development, as well as document that demonstrates the consolidation of your secure employment.

#### ***Comment:***

*The sub-sections a and b above conform to those of the initial Normam-15 procedure 2011.*

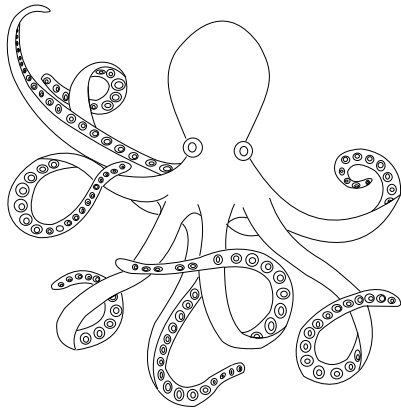
## 4 - Summary

The first point to note is that the English version should not be considered valid, as although it is 95% accurate, essential elements such as the calculation method for stabilization times between the surface and 100 m have been omitted, resulting in the formula for exposures between 100 and 180 m being provided for both types of exposures, contrary to the Portuguese version, which is correct on this point.

The second point is that this evaluation revealed that while most parts of the saturation procedures remain unchanged, the Brazilian authorities made the following modifications, resulting in these procedures no longer being compliant with the original ones published in 2011:

- The initial PPO<sub>2</sub> values during the decompression phase, initially between 0.48 and 0.5 bar, have been reduced to 0.44 and 0.48 ATA. These absolute atmosphere (ATA) values are those used by the US Navy in 2016 for the storage and ascent phases. Considering that a scientist would have used pascals or, alternatively, millibars, given that the table is written in metric units, I have concluded that this modification was not made by a person accustomed to decompression procedures. In addition, considering that recent procedures by Jean Pierre Imbert for reputed companies show that the value of 480–500 mb has been maintained with equivalent storage PPO<sub>2</sub> values to those he initially provided for the NORMAM-15/DPC-2011, and that the study *“Evaluation of North Sea saturation procedures through divers monitoring”*, available in the Diving and ROV Specialists database, shows that these tables yield very satisfactory results regarding oxygen and decompression stresses, there was no reason to modify this key element of the procedure. Additionally, the question can be raised about the safety performance expected from new decompression procedures that combine COMEX rates of ascent with lower PO<sub>2</sub> levels, designed for the ascent rates of the US Navy. It is essential to note that, by adopting this approach, the Brazilian authorities have introduced a new procedure that has not undergone scientific testing and may lead to both visible but unreported incidents and other issues that are not apparent to the naked eye, so that the fact that it has been in force for several years cannot be considered proof of efficiency. The fact that the Brazilian authorities have not responded to this finding can be seen as confirmation that no relevant studies have been conducted in accordance with the recommendations of the Declaration of Helsinki. This may be attributed to the lack of knowledge on the part of those who imposed this modification, who believed they were acting in the best interest. This raises questions about the selection of individuals appointed to draft such documents.
- The percentage of oxygen during the final phase of decompression is now limited to 21% instead of the initial 25%. The fact that in their response to my comment about the fact that the 23% value recommended by IMCA, previously included in the CCO Ltd Study #5, is balanced and appropriate, the Brazilian authorities stated that the part of the text recommending values between 19% and 23% was lost during the preparation of the final edition in 2016, demonstrates an issue with the quality control of their publications and their responsiveness, as this problem has been ongoing for nine years.
- The PPO<sub>2</sub> values for the compression and storage phases, which were missing in the initial official 2011 document despite being included in the initial COMEX procedures, are still missing in the NORMAM-222/DPC revision. The fact that the Brazilian authorities did not document any response to this finding is also linked to their quality control and responsiveness issues.
- The excursion combination #7, “Exceptional upward excursion followed by a standard upward excursion” (see section d, “Combinations allowed for excursions without break”), has disappeared from the document NORMAM-222/DPC. This is another demonstration of the document control and reactivity issues mentioned above, as the Brazilian authorities responded that they had not previously noticed it had been accidentally removed since the 2016 edition.





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