Neutral Citation Number: [2021] EWHC 1751 (TCC)

Case No: HT-2018-000046

IN THE HIGH COURT OF JUSTICE
QUEEN'S BENCH DIVISION
TECHNOLOGY AND CONSTRUCTION COURT

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 28/06/2021

Before :

MRS JUSTICE JOANNA SMITH

- -

Between :

DANA UK AXLE LTD	**Claimant**
- and –	
FREUDENBERG FST GMBH	**Defendant**

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- -

Geraint Webb QC and Harrison Denner (instructed by **Crowell & Moring**) for the **Claimant**
Luke Wygas (instructed by **Fladgate LLP**) for the **Defendant**

Hearing dates: 5, 6, 10, 11, 12, 13, 14, 19, 26 May 2021

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Approved Judgment

I direct that pursuant to CPR PD 39A para 6.1 no official shorthand note shall be taken of this Judgment and that copies of this version as handed down may be treated as authentic.

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Covid-19 Protocol: This judgment is to be handed down by the judge remotely by circulation to the parties' representatives by email and release to Bailii. The date for hand-down is deemed to be 28th June 2021.

Mrs Justice Joanna Smith:

Introduction

1. This claim arises out of the alleged premature failure of pinion seals (the "**Seals**") manufactured by the Defendant ("**FST**") and supplied to the Claimant ("**Dana**") during a period between about September 2013 to February 2016 (the "**Relevant Period**"). The Seals were fitted by Dana, a manufacturer and supplier of automotive parts, onto vehicle rear axles which Dana then supplied to Jaguar Land Rover ("**JLR**") for installation into various different vehicle models.

2. Pursuant to an order made at the Pre Trial Review on 26 March 2021, the trial was conducted remotely over 8 days with all witnesses giving evidence via video-link in accordance with an agreed protocol.

Background Facts

3. Dana was incorporated in England in 2007 and took over operations that had previously been carried out by Dana Spicer (Europe) Axles, also known as Dana Traction Technologies Europe ("**Dana Spicer**"). Dana Spicer had been involved in the manufacture of axles since 1995 when it acquired GKN Axles Limited and its relationship with FST dates back to that time.

4. FST is the supplier of several types of seals to sectors including automotive, heavy industry, agriculture and aerospace. It claims to be a market leader in sealing technologies.

5. In 2003, Dana Spicer contracted with Land Rover (now JLR) to supply front and rear drive axles for JLR's T5 programme, a new programme of vehicles developed by JLR (the "**T5 Programme**"). Front and rear drive axles connect the engine to the wheels of the vehicle and both require seals in their construction. In the context of this case, I am concerned only with seals that were supplied for installation in rear axles.

6. The Seals (which have a Dana part number E55551) are composed of an acrylic based polymer (ACM rubber), a metal insert and a metal garter spring (both typically steel). They encircle the pinion shaft (the "Shaft") as it exits the front of the differential in a rear drive unit ("RDU"). Their function is (i) to prevent lubricant fluid in the form of oil from leaking out of the vehicle differential (which is made up of several gears which require lubrication in order to function correctly) and (ii) to prevent, or at least (on FST's case) to minimise, ingress of external contaminants such as dirt, water and other debris. Dana's claim concerns the manufacture of the polymer component of the Seals.

7. Dana contracted the design and manufacture of Seals to FST; Dana was then responsible for the assembly of axle components, including fitting the Seals onto the Shafts.

8. The Seals are formed at FST's factory in Kecskemet, Hungary, by injection moulding. The polymer compound is created by FST in Weinheim, Germany, by mixing a base ACM polymer with other components in a large mixer. The mixed components are then made into strips to feed into an injection moulding machine, which applies high pressure to the strips in order to force them through a feed system (a flat disc through which the compound flows, referred to in this case as a "Cap") and then out, via a runner, into the mould (or cavity) in which the Seals are formed. Absent issues with mixing or design, the compound will fill the cavity uniformly and remain under the pressure applied by the injection moulding machine, taking heat from its surroundings until it vulcanises (or cures) such that the independent strips of polymer stitch together in a process called "cross-linking" and the compound becomes stiffer. Finally, the moulded compound is removed from the mould and placed into a purpose-built oven where it undergoes further heat treatment in a process called post-curing, designed to ensure that the cross-linking is complete. During the Relevant Period, FST was using two moulds ("Cavity 1" and "Cavity 2") to form the Seals.

9. Since 2004, FST has supplied approximately 10 million seals to Dana (including more than three million Seals) for use in RDUs, and continues to supply Seals today. It is FST's case that the terms of this continuing supply are governed by a contract (the "**2003 Contract**") formed on the basis of its standard terms and conditions (the "**FST Terms**") in 2003, which (it asserts) continued to apply throughout the Relevant Period. The FST Terms provide that the applicable law is the law of the Federal Republic of Germany and include a one-year limitation period.

10. Dana, on the other hand, asserts that, whilst a contract was indeed formed in 2003 for the supply of the Seals, the 2003 Contract was formed on Dana Spicer's standard terms and conditions (the "**2003 Dana Terms**") and was in any event superseded on 17 July 2012 by a "Rev A" Purchase Order for Seals (the "**2012 PO**") to be supplied in the context of a new JLR Premium Lightweight Architecture ("**PLA**") programme which was launched late in that year. The introduction of the PLA programme represented a change in certain vehicle models, specifically the incorporation of aluminium components into certain JLR vehicles to reduce their weight and improve their efficiency, and a significant increase in axle volumes (and, therefore, in the number of Seals needed). It is common ground that the Seals were fitted into a total of nine different JLR vehicle models during the Relevant Period.

11. It is Dana's case that, during the Relevant Period, the supply of Seals by FST was governed by the 2012 PO, incorporating a 2011 version of Dana's standard terms and conditions (the "**2011 Dana Terms**") which was then superseded by a "Rev B" Purchase Order dated 27 June 2013 (the "**2013 PO**"), also incorporating the 2011 Dana Terms. If Dana is right as to this contractual analysis, FST does not advance any alternative case as to the applicable terms and conditions, although it does assert that there was no authority on the part of the individual at FST to whom the 2012 PO was sent (namely Mr Kristek) to bind FST in relation to new and different contract terms.

12. Dana began to experience a high rate of warranty claims from JLR in respect of the Seals at the outset of the Relevant Period due (it says) to their premature failure, which caused oil to leak from the differential in the RDUs. The failure rate for Seals climbed in this period from about 0.1% (the generally accepted failure rate for this type of product in the industry, judged over an extended period of 36 or 48 months) to up to approximately 5% over 48 months, or 50 times higher than the normal, acceptable

failure rate. Additionally, during the Relevant Period there were three "spikes" when the failure rate increased even further, up to as high as 17%.

13. The parties undertook various investigations into the root cause of the problem, which Dana now identifies as defects in the Seals themselves, caused by FST. Dana alleges that the failing Seals were supplied by FST in breach of contract in that they were not of adequate or appropriate quality, not of satisfactory quality and not fit for the purpose for which they were used. I shall return to the detailed particulars of breach later in this judgment but observe for present purposes that those particulars have narrowed to a certain extent during the course of the trial.

14. Essentially, Dana's case is that FST failed to control the viscosity of the polymer feedstock that was introduced into the moulds to create the Seals. This failure, together with a design change to the mould itself which occurred in late 2013 and involved a reduction in the thickness of the Cap from 1mm to 0.3mm, led to non-uniform dimensions of the main sealing lip to the Seal (the "**Sealing Lip**") and thus to premature wearing of the Sealing Lip, a reduction in radial pressure exerted on the Shaft and a consequent leakage of oil from the differential. Dana's polymer expert identifies a statistically significant correlation (with a Pearson Product Correlation Coefficient greater than 0.75 or 75%) between high viscosity levels and the failure rate of the Seals following the design change to the mould.

15. The failure rate did not return to pre-September 2013 levels until in or about February 2016 following the introduction of a new mixer body into the machine used to mix the polymer. At or around this time there was also a change from the use of wax as an initial Seal lubricant to the use of grease.

16. FST denies any breach of contract but does not advance a positive case as to the cause of the premature failure of the Seals. Essentially, FST contends that Dana cannot prove breach, causation and loss. It points out that not all of the Seals failed, that there was more than one possible cause for the oil leak to the RDU (including causes for which FST is not responsible) and furthermore that the Seals were used by Dana on nine different vehicles across six different platforms ("platform" is a term used in the automotive industry to refer to the overall architecture of a vehicle) with two different axle variants, such that each combination posed differing stresses and forces on the sealing system. It says that "correlation is not causation" and it criticises Dana's case as a "post hypothesis" which seeks only to rule possible causes out, rather than focussing on establishing the root cause of the oil leakage from the RDUs.

17. Dana contends that it was obliged to replace large quantities of defective Seals under its warranty commitments with JLR. It now claims to recover the sums that it has reimbursed to JLR for the defective Seals, both in respect of the UK market and the export market, (currently a figure of £11,243,026), together with an indemnity for ongoing loss.

FST's Disclosure and Expert Evidence

18. Concerns have been raised by Dana in advance of, and at the trial, as to the lack of disclosure provided by FST. These concerns led to Mr Webb QC, acting on behalf of Dana, attaching an eight-page Appendix to his written opening submissions describing the various ways in which it is said that FST has failed over the course of these proceedings to comply with its obligations. Amongst other things, FST did not make it clear from the outset that it would have relevant documents stored in its Hungarian

plant, did not disclose all relevant documents prompting numerous requests from Dana which resulted in additional disclosure, produced a large number of documents in supplemental disclosure which were central to the dispute and produced further documents a few weeks before trial, which had been relied upon by its own experts but not seen by Dana and its experts.

19. The unsatisfactory nature of FST's approach to documents prompted me to order on the first day of trial that its solicitors should produce a witness statement identifying all documents and information to which its experts had had access in preparing their reports. This led to a witness statement being served from Mr Alexander Wildschütz, a partner at Fladgate LLP ("**Fladgate**"), solicitors for FST, on the morning of 10 May 2021 (the fourth day of the trial). In this statement, Mr Wildschütz explained that FST's technical experts had liaised with individuals at FST without any solicitor involvement and without creating notes of their conversations. This led to Fladgate reviewing all correspondence between individuals from FST and one or more of FST's experts (around 2,500 documents) and ultimately disclosing a further 175 documents to Dana. Mr Wildschütz provided a second witness statement on the morning of 14 May 2021.

20. This new disclosure, evidencing what Mr Webb described as an uncontrolled and unsupervised free flow of information between FST and its experts, including during the critical period between expert meetings and the signing off of their joint statement **(**the **"Expert Joint Statement**")**,** led to an application by Dana on 14 May 2021 to exclude FST's technical expert evidence. For the reasons set forth in my judgment (neutral citation [2021] EWHC 1413 (TCC)), I acceded to this application. In the circumstances, FST is precluded from relying upon any of its technical expert evidence at trial.

21. At the outset of his oral closing submissions, Mr Wygas, on behalf of FST, read out instructions to the effect that, "as far as Fladgate LLP is aware neither any member of the Defendant's staff nor any of the experts were informed that the manner in which the communications between the Defendant and the experts were conducted would not be compliant with the rules under the Civil Procedure Rules and/or the Technology and Construction Guide". In this regard, I note that none of FST's technical expert reports appears to have been compliant with the requirements of the Practice Direction to CPR Part 35, in that they all failed (i) to contain a statement that the expert understood his or her duty to the Court and had complied with that duty; (ii) to state that the expert was aware of the requirements of CPR Part 35, the Practice Direction and the Guidance for the Instruction of Experts in Civil Claims 2014; and (iii) to provide a statement of truth in the terms required by paragraph 3.3 of the Practice Direction.

22. Whilst not a matter for the Court in these proceedings, I am extremely surprised, to say the least, that not only has Fladgate failed to maintain appropriate levels of supervision and control over FST's experts, but it also appears not to have explained their duties to them or to have ensured basic levels of compliance with the requirements of the CPR.

The Issues

23. The parties produced an Agreed List of Issues, which I identify below.

Contract terms

1. Which, if any, standard terms and conditions were incorporated into the contract for the supply of the Seals during the Relevant Period; in particular:

1.1 were Dana's standard contract terms and conditions incorporated into the contract for the supply of the Seals during the Relevant Period, pursuant to the 2012 PO and/or any later Purchase Orders or, alternatively, pursuant to the 2013 PO?

1.2 in the event that Dana's standard terms would otherwise be incorporated in respect of the 2012 PO, can FST rely upon any purported lack of authority on the part of Mr Kristek to defeat such incorporation?

1.3 alternatively, were the FST Terms incorporated pursuant to a quotation of 2 April 2003?

Breach and Causation

3. What were the warranty claim rates in respect of leakage of oil from Seals supplied during the Relevant Period and how do such rates compare with an acceptable benchmark for warranty claim rates?

4. Were any Seals supplied by FST during the Relevant Period supplied in breach of contract in that they failed to meet the requisite contractual standard (express and/or implied terms)? In particular, did FST fail to manufacture the Seals in a manner that would render the Seals unable to serve their purpose of preventing oil from leaking in service, including for one or more of the following reasons:

4.1 failures properly to maintain the cavities and/or properly to manufacture the Seals in the cavities;

4.2 failures to manufacture the Seals with appropriate or consistent width dimensions of the Sealing Lip;

4.3 failures to manufacture in accordance with the hardness specification;

4.4 quality control issues, particularly in respect of: the flow and/or curing of the polymer and/or the post-curing processes and/or the viscosity of the polymer feedstock, which quality control issues were contributed to by changes made to the manufacturing processes and/or cavities and/or injection moulding machine (including changes to the dimensions of the runner system Cap in about September 2013).

5. If so, did any such breach of contract cause Dana loss and damage as claimed, namely loss and damage arising from the warranty claims in respect of failed Seals?

Limitation

6. If it is found that the FST Terms were incorporated into the 2003 Contract and continued to govern the supply of the Seals during the Relevant Period, it is accepted by Dana that, as a matter of German law, clause 8.4 of those terms would validly limit the limitation period to one year. The issues then arising are:

6.1 was the limitation period suspended under section 203 of the Bürgerliches Gesetzbuch (i.e. the German Civil Code) (the "**BGB**") from 30 April 2014 until 22 January 2018 (as Dana contends)? or

6.2 was the limitation period suspended under section 203 of the BGB from 31 October 2017 until 22 January 2018 (as FST contends)? or

6.3 was the limitation period suspended under section 203 BGB during some other period?

Quantum and relief

7. Having regard to the findings in respect of the above issues:

7.1. what is the quantum of the loss and damage suffered by Dana to date which is recoverable against FST?

7.2 is Dana entitled to a declaration for an indemnity in respect of on-going loss and damage in respect of FST's breaches of contract?

24. In addition to these agreed issues, it was accepted during closing submissions that FST has also pleaded (and continues to rely upon) a case of contributory negligence on the part of Dana.

The Factual Witnesses

25. The parties called a total of eight factual witnesses. Many of these witnesses gave evidence from overseas.

26. A number of the witnesses had intended to give evidence from Germany, but absent permission from the German Court, travelled to Austria to give their evidence.

27. On the evening of the first day of the trial, I was provided with a legal opinion on the taking of evidence in Austria by a foreign court (via video conference) by Daniela Karollus-Bruner of CMS Reich-Rohrwig Hainz Rechstsanwälte GmbH dated 5 May 2021, which expressed the view that, post Brexit, the bilateral treaty of 31 March 1931 between Austria and the United Kingdom (the Austro-British Convention on Mutual Legal Assistance BGBI 1932/45 (the "**Convention**")) governs the taking of evidence abroad by the courts of the respective other state. Article 8 of the Convention allows for evidence to be taken on Austrian territory without the intervention of state authorities, provided that a "Commissioner" in charge of the taking of evidence is appointed as a person authorised by the Court. Doctrine confirms that the Court can "commission" the presiding Judge herself. Accordingly, on 6 May 2021, I made an order pursuant to which I was commissioned to take evidence to be given in these proceedings from within the territory of the Republic of Austria.

28. One of Dana's witnesses is based in South Africa and I was provided with an opinion from the South African law firm Webber Wentzel to the effect that where evidence is provided voluntarily, it is not necessary to obtain prior approval from the South African authorities. Similarly, insofar as Dana relied upon factual and expert witnesses who are resident in the United States, I was provided with a letter from Crowell & Moring, Dana's solicitors, dated 4 May 2021 confirming that, again, provided the witness appears voluntarily, there are no legal obstacles under U.S. law to the provision of remote evidence.

29. One of Dana's witnesses is based in Shanghai, but absent a request having been made for authorisation to the competent judicial authorities in China, he travelled to the United Kingdom to give his evidence.

30. In general terms, I note that in cases where parties wish to rely on remote evidence from witnesses based in foreign jurisdictions, it is important that consideration is given well in advance to the legality of such evidence being given in their home jurisdiction and to the potential need for permission to be obtained from the relevant foreign court.

Dana's factual witnesses

31. Dana called the following witnesses of fact who were cross examined by Mr Wygas:

    a. Mr Marcus King, now Vice President of Off-Highway Global Sales, Business Development, Strategy and Program Management. Mr King has been employed with the Dana group since 1995, working for Dana Spicer between December 1995 and October 2004. As Purchasing, Logistics and Business Improvement Manager for Dana Spicer, Mr King had oversight of the purchasing function, including the relationship with FST. In his first statement, Mr King explains

(1) some of the background to the 2003 Contract, including why he believes that Dana Spicer's terms governed that relationship and (2) FST's understanding of the intended purpose and application of the Seals. In his second statement, Mr King focusses on documents created in 2003 which had not been available to him at the time of his first statement owing to the lockdown measures imposed in the United Kingdom as a result of the COVID-19 pandemic.

b. Mr Neale Marklew, warranty manager for Dana (originally in the guise of Dana Spicer) for 19 years. In his statement, Mr Marklew explains the process by which faulty parts are returned to Dana by JLR in respect of UK customers, the investigations that then ensue in relation to those parts and the means by which a sum is arrived at which is to be debited from Dana to JLR to reflect its responsibility for those faulty parts. Mr Marklew also explains the different process that applies for exports, in respect of which an extrapolation is undertaken from Dana's inspection of UK parts to arrive at a percentage of export parts in respect of which Dana then accepts responsibility to JLR.

c. Mr David Bray, applications engineering manager for Dana (originally in the guise of Dana Spicer) since 2001. Mr Bray is responsible for the application of Dana's Light Vehicle axle products in customer vehicles, including JLR, from prototype through to production. In his statement, Mr Bray explains the initial design and validation testing of the Seals by FST in 2003, the process by which Dana installed the Seals into the axles, the investigations undertaken by Dana to determine that its installation had not caused the oil leak from the Seals, the steps taken by Dana to rule out potential causes of the oil leak prior to the involvement of the Dana Quality and Warranty teams in the United States and the background to the changes made by FST in early 2016 to its design and production of the Seals, namely manufacturing them in different moulds and using grease as an initial lubricant instead of wax.

d. Mr Andrew Ashenfelter, a senior warranty manager at Dana Incorporated, the ultimate parent company of the Dana group. Mr Ashenfelter has had various roles with the Dana group since 2003, but has been in this role for approximately 5 years and oversees the group's global warranty team. He directly manages warranty claims made by customers based in North America and substantial claims by customers based elsewhere, together with all related part return investigations. In his first statement, Mr Ashenfelter comments on the investigation into the Seal failures that Dana, JLR and FST conducted from mid-2016 to late 2017, identifying the potential causes that were considered, investigated and ruled out. He then analyses the failure rate of the Seals in the Relevant Period before finally dealing with the financial loss suffered by Dana to the fourth quarter of 2019. In his second statement, Mr Ashenfelter provides what he describes as a comprehensive analysis of the failure rate of the Seals (this had not been possible at the time of his first statement owing to the lockdown measures in the United Kingdom implemented in response to the COVID-19 pandemic). In his third statement, provided a few weeks prior to the start of the trial, Mr Ashenfelter provides an updated analysis of the quantum of Dana's financial losses, up to the fourth quarter of 2020, quantifying those losses at £11,243,026.

e. Mr Alastair Wilkinson, a Dana Advanced Purchasing Buyer for Europe between January 2012 and February 2014. Mr Wilkinson was responsible for

coordinating new project launches and was directly involved with the launch of the JLR PLA programme, together with the 2012 PO and the 2013 PO. In his witness statement, Mr Wilkinson explains the background to the PLA programme and FST's knowledge of that programme, the significance of Purchase Orders and their role in the contracting process with suppliers (including FST) and the history of the 2012 and 2013 POs issued to FST.

32. Dana also relies on a statement from Mr Hill, Financial Controller to Dana and Dana Spicer, which was not challenged by FST and so was admitted in its entirety. Mr Hill deals in his statement with the process by which Dana supplied the axles to JLR (incorporating the Seals supplied by FST), was paid by JLR and was debited the amounts shown on debit notes for the repair and replacement costs of the Seal failures.

33. Save where Dana's witnesses qualified or changed their evidence under cross examination, I accept what is said in their witness statements; I formed the view that, for the most part, they were each trying their best to assist the Court in giving accurate evidence.

FST's factual witnesses

34. FST called the following witnesses of fact who were cross examined by Mr Webb, where necessary through an interpreter:

    a. Mr Martin Heldmann, an employee of FST since 2000 on its Product Development Team. Mr Heldmann worked on the development of the Seal, part number E55551. In his witness statement, Mr Heldmann explains the features of the Seal and describes the steps undertaken by FST in developing the Seal, from the production of a drawing, through the production of prototypes, the test phase and the Production Part Approval Process (the "**PPAP**").

    b. Mr Rudolf Bott, a qualified engineer who, for the last few years, has been director of automotive sales at FST. Mr Bott has been involved in FST's dealings with Dana since 2010, but in his first statement he explains (by reference to a review of relevant documents) the background to the parties' relationship, the supply process, the discussions and correspondence that took place between the parties in 2003 over the supply of Seals for the T5 Programme, the use of Purchase Schedules by Dana to request the rolling supply of Seals, the relevance of the order number used for the supply of Seals, his discovery of a copy of the 2012 PO in a redacted form and the change from using wax to using grease as a pre-lubricant for the Seals. Mr Bott had little or no direct, contemporaneous involvement in any of the matters he discusses in this statement. In his second statement, Mr Bott makes it clear that he only became directly involved in the issue of leaking oil in 2016 and that he was then tasked with the coordination and steering of internal meetings at which FST's technical personnel discussed the possible causes of the problem.

    c. Mr Matthias Kristek, a long-term employee of FST, who worked from 2002 until approximately April 2014 in Customer Service providing coordination between customers and FST's sites and logistics service providers. Between 2007 and 2014, Mr Kristek was the sole point of contact in Customer Services for Dana. In his witness statement, Mr Kristek explains the functions of the FST Customer Service department and his role within it. He then discusses the

process by which Dana has placed its orders with FST over the years and the specific circumstances surrounding the 2012 PO.

35. I formed the view that FST's witnesses did their best to provide accurate evidence to the Court, however, they were very often unable to assist with key issues, owing to the fact that those issues either fell outside their expertise, or concerned matters with which they had not been directly involved.

36. Indeed, I consider it to be telling that FST called:

    a. no witness who was able to explain its production process at the factory in Hungary where the Seals were, and are, manufactured. Such evidence would have been essential to meet Dana's allegations of manufacturing process and quality failures. I accept Dana's submission that I may infer from the absence of any evidence about such a key issue in the case that FST's decision not to adduce factual evidence as to its processes and procedures was a strategic election to avoid cross examination in respect of those procedures. I also accept that although FST can point to documents setting out internal processes and procedures, it has adduced no evidence from which I can conclude that those processes and procedures were in fact carried out in practice (indeed it is somewhat surprising that FST has produced not a single Corrective Action Report in this case, and yet the creation of such reports should have been commonplace in the event of any problem with the process). I note that this lack of evidence often left Mr Wygas with no choice other than to try to construct a defence out of little more than thin air; one example being his submission in closing that all Seals produced by FST were subject to a visual quality inspection at a magnification of 2.5. Whilst there was a document in the bundle that referred to such an inspection, there was not a shred of evidence as to such inspection, including who at FST had designed the procedure, whether it was actually carried out in practice, how it was validated and so on.

    b. no witness who could give evidence of any internal analysis on the part of FST as to how and why Seal failures were occurring. Like Dana, I am struck by the fact that a world-leading expert in the manufacture of seals has apparently not sought to undertake a comprehensive analysis of all possible causes of the failure of the Seals. I am inclined to agree with Dana that in the absence of any positive case being advanced by FST as to the cause of the failures, it would be reasonable for me to infer that FST has been unable to find an explanation for the premature failures of the Seals, other than defects in the Seals themselves.

    c. no witness who was able to deal with obvious questions arising in respect of the admitted manipulation of Cpk/Ppk production data by FST employees during internal testing of the Seals, which data was subsequently provided to Dana during the root cause analysis. I shall return to the significance of this later, but for present purposes I simply record that allegations of data manipulation were made against FST in the expert report of Professor Yadav served on behalf of Dana on 26 February 2021, and this manipulation is in any event evident from FST's own internal emails. The manipulation was not at any stage contested, but it was only in closing submissions that the Court finally received an apology from FST via Mr Wygas' written submissions. No attempt has ever been made to serve a witness statement suggesting any mitigating circumstances and the Court has not been told whether, and if so what, steps have been taken by FST

to discipline the employees involved. It is clear, however, that FST now accepts that there is no innocent explanation for the data manipulation. I am extremely surprised and concerned that FST has seen fit to treat what I consider to be a serious incident involving attempted deception of Dana during the root cause analysis in such a lackadaisical manner. I consider that the fact of this incident (taken together with FST's conduct in relation to its own technical experts and its failure to disclose information to Dana as to the change in the Cap thickness, to which I return later) serves to justify and support the drawing of the inferences to which I have referred above.

37. It became apparent during Mr Bott's cross examination that the only copy of the 2003 PO that had been discovered at FST's premises was a copy found in the legal department's papers, which had been heavily redacted to remove pricing information together with all reference to Dana's standard terms and conditions ("**the Redacted 2003 PO**"). Mr Bott, who had not been involved with the 2003 PO, was not able to assist as to the reason for these redactions and had not carried out any investigation into the circumstances in which FST employees had seen fit to make the redactions. However, he did say during his cross examination that the individual likely to have been involved in the redactions was Mr Martin White ("**Mr White**"), an individual who it would seem had been a key point of contact for Dana in the commercial relationship between the parties. It transpired during the hearing that Mr White had been approached by FST to give evidence, but he did not in the event provide a witness statement or appear at trial. No explanation was provided by FST as to why Mr White was not giving evidence.

38. Further to a direction from me, FST subsequently served a statement from Mr Moritz Kramer, Senior Legal Counsel based in the central legal department of the Freudenberg Group, confirming that the Redacted 2003 PO had been discovered in a folder in the archives of the legal department. Mr Kramer said that the Redacted 2003 PO appeared to be a photocopy of the originally redacted version and he said that he did not know who had made the comments and redactions on the original document. Unfortunately, this took matters no further. I shall return to the significance of the Redacted 2003 PO later in this judgment.

The Expert Evidence

Dana's Technical Experts

39. Dana called three technical experts. Broadly, they gave evidence in the fields of production data analysis, mechanics and physics of seals and polymer science:

    a. Professor Om Prakash Yadav, a Professor and Duin Endowed Fellow of Industrial Engineering at North Dakota State University, Fargo, USA. Professor Yadav has a Bachelor of Mechanical Engineering degree, a Master's degree in Industrial Engineering and a Ph.D in Industrial Engineering. His specialist field is in the area of Quality and Reliability Engineering, Operations Management and Manufacturing Systems. He has more than 35 years of teaching experience in this field in both the USA and in India. Between 2002 and 2004 he worked as a Reliability Engineer at Ford Motor Company and was involved in root cause investigations with suppliers whose requirements were not met. Professor Yadav was not instructed to consider the root cause of the failure to the Seals in

this case, but rather to focus on FST's production processes and whether these processes meet industry standards and good engineering practice.

b. Dr Robert Carbonara, for over 20 years a senior analyst at SEA Ltd and, since 2020, a Discipline Lead in Materials Science at SEA Ltd, a company of expert forensic engineers, scientists and consultants. His specialist field is the failure of material objects made from polymers, metals and ceramics. He has a Bachelor of Science degree in physics and a Ph.D in Materials Science. He has been carrying out failure analysis investigations for 32 years. Dr Carbonara was instructed by Dana to give his opinion on the cause of the failure of the Seals.

c. Mr Martyn Bennett, a specialist in polymer science and technology, specifically in elastomers (rubbers). His specialist field is rheology (the study of the flow of matter) and processing, particularly injection moulding and extrusion. Mr Bennett has a B.Sc. Hons in Applied Science (Physics and Materials). He worked for Avon Rubber Plc, a leading tyre and rubber goods manufacturer, for 29 years in a variety of roles focused on research and development of rubber materials, processes and products. Since then, he has provided polymer consulting services to leading companies and academic institutions globally. Mr Bennett was instructed by Dana to provide his opinion on issues relating to polymer science.

The Expert Joint Statement

40. The Expert Joint Statement was prepared and signed by all technical experts, but in circumstances where FST's technical expert evidence has been excluded by the Court (and with the agreement of the parties), I do not have regard to any of the evidence given by FST's experts in the Expert Joint Statement, save where they have reached agreement with Dana's experts.

The Impact of the exclusion of FST's technical expert evidence

41. In circumstances where I have excluded FST's technical expert evidence, the only expert evidence available to me relating to (i) the production of the Seals; (ii) the quality defects in those Seals; and (iii) the impact of those quality defects in service, is the evidence produced by Dana's experts.

42. In the circumstances, Dana submitted, and I agree, that I am not tasked with considering competing explanations for the premature Seal failures. Rather, on breach, the only issue for the Court is whether on the adduced evidence it is more likely than not that the Seals, which failed prematurely, failed to meet the relevant contractual standard of satisfactory quality and/or fitness for purpose and/or the agreed specifications for the product. On causation, the issue for the Court is whether the failure of those Seals to meet the relevant contractual standard is more likely than not to have caused or contributed to the excessive wear and leakage of those Seals in service.

The German Law Evidence

43. Both parties relied on experts in German law, who gave their evidence from Austria.

44. Dana relied on the evidence of Professor Ingeborg Schwenzer, a professor emerita of private and comparative law at the University of Basel, Switzerland. FST relied on the evidence of Professor Thomas Pfeiffer, a director of the Institute for Comparative Law, Conflict of Laws and International Business Law of Heidelberg University.

45. Although the reports from these experts together with their joint statement covered various issues of German law, by the time they gave evidence, the only issue of German law which remained relevant was the issue of limitation, and in particular the circumstances in which the limitation period could be suspended under German law by reason of negotiations between the parties. Although seemingly at odds on this topic in their reports and in their joint statement, I detected some narrowing of the issue during the course of the experts' oral evidence.

The Formation of the Contract and the Contract Terms (Issues 1.1 and 1.3)

46. It was common ground that the Court should determine the issue concerning formation of the contract by reference to English Law, notwithstanding that it is FST's case that what it refers to as "the Governing Contract" was in fact formed in 2003 and was subject to the FST Terms which are governed by German law.

47. Dana says that if I accept its case as to the formation of a new contract in 2012, superseding any pre-existing relationship between the parties, there is no need for me to consider the relationship between the parties in 2003. However, I consider that it would be better to put the 2012 transaction between the parties into context by considering the terms of their pre-existing relationship first.

The Law

48. It is common ground that in deciding whether the parties have reached an agreement (whether in 2003, or 2012, or at all), I should apply an objective test. In particular I should look at the communications passing between the parties to see whether, to all outward appearances, there has been agreement in the same terms as to the same subject matter (see Chitty on Contracts 33rd Edition ("**Chitty**"), Vol 1 at 2-002 and *Balmoral Group Ltd v Borealis [UK] Ltd* [2005] EWHC 1900 (Comm) per Christopher Clarke J at [385]-[386]).

49. I must therefore look to see whether an offer has been made with the apparent intention that it should be binding (notwithstanding that the offer may have been described as something else) and whether there has been a final and unqualified expression of assent to the terms of the offer, including by conduct. Where the acceptance is by conduct, it must be objectively clear that the act of acceptance was done with the intention of accepting the offer (see Chitty, Vol 1 at 2-009, 2-026, 2-029 and 2-075).

50. The general rule is that an acceptance has no legal effect until it is communicated to the offeror. However, an offer may, by its terms or impliedly, waive the requirement of communicating acceptance by inviting acceptance by conduct; for example, where an offer to purchase is made by ordering goods, dispatch of those goods might constitute acceptance (see Chitty, Vol 1 at 2-044 and 2-046(1)).

51. An agreement may be incomplete if the parties reach agreement only on essential matters of principle but leave important points unsettled, but on the other hand, an agreement may be complete although it is not worked out in meticulous detail. Thus an agreement for the sale of goods may be complete as soon as the parties have agreed to buy and sell, where the remaining details, including payment terms, can be determined by a standard of reasonableness or by law. See Chitty, Vol 1 at 2-121 and *Green Deal Marketing Southern Ltd v Economy Energy Trading Ltd* [2019] 1 CLC 522 at [97], per HHJ Keyser citing *Pagnan SpA v Feed Products Ltd* [1987] 2 Ll Rep 601, per Bingham J at 611 to the effect that:

"The parties may by their words and conduct make it clear that they do intend to be bound, even though there are other terms yet to be agreed, even terms which may often or usually be agreed before a binding contract is made…The parties are to be regarded as masters of their contractual fate. It is their intentions which matter and to which the Court must strive to give effect".

52. Terms and conditions in standard form contracts must be brought to the attention of the party being bound before or at the point the contract is made. Previous dealings between the parties on conditions will not necessarily operate to incorporate those conditions into a contract, but a 'course of dealing' might, where it has led to the parties' reasonably believing that the terms used in previous transactions are to govern the contract (see *Balmoral Group Ltd v Borealis [UK] Ltd* [2005] EWHC 1900 (Comm) per Christopher Clarke J at [356] "…where parties have dealt with each other more than once or twice, it may not be critical to the incorporation of standard terms that those terms be set out in a contractual document"). The party being bound need not have read or been made 'subjectively aware' of the importance or effect of the terms and conditions in order for 'reasonable notice' to have been given. In determining whether notice was reasonably sufficient, the Court must look at all the circumstances, but often the provision of printed conditions will be enough. Terms and conditions may also be incorporated by simple reference to them, provided there has been reasonable notice given, or by a reference to a website. (See Chitty Vol 1 at 13-010-13-015).

53. In relation to the contractual arrangements between the parties in this case in 2003, there is a "battle of the forms" argument, with each party alleging that the other contracted on its standard terms and conditions. Both parties referred me to *Tekdata Interconnections Ltd v Amphenol Ltd* [2009] EWCA Civ 1209, in which Dyson LJ described the "last shot doctrine" in the following terms:

"[23] The so-called "last shot" doctrine has been explained in Chitty on Contracts (30th edition) at para 2-037 as meaning that where conflicting communications are exchanged, each is a counter-offer, so that if a contract results at all (eg from an acceptance by conduct) it must be on the terms of the final document in the series leading to the conclusion of the contract"

and went on to say

"[25] In my judgment, it is not possible to lay down a general rule that will apply in all cases where there is a battle of the forms. It always depends on an assessment of what the parties must objectively be taken to have intended. But where the facts are no more complicated than that A makes an offer on its conditions and B accepts that offer on its conditions and, without more, performance follows, it seems to me that the correct analysis is what Longmore LJ has described as the "traditional offer and acceptance analysis", i.e. that there is a contract on B's conditions…the rules which govern the formation of contracts have been long established and they are grounded in the concepts of offer and acceptance. So long as that continues to be the case, it seems to me that the general rule should be that the traditional offer and acceptance analysis is to be applied in battle of the forms cases. That has the great merit of providing a degree of certainty which is both desirable and necessary in order to promote effective commercial relationships".

54. Longmore LJ was of the same view, saying at [11] that:

"the traditional offer and acceptance analysis must be adopted unless the documents passing between the parties and their conduct show that their common intention was that some other terms were intended to prevail".

55. Mr Wygas, on behalf of FST, submitted that the facts of this case are "on all fours" with *Tekdata*, a submission to which I shall return later.

The 2003 Contract

56. The relevant communications between the parties begin in December 2002. Although it is clear from the evidence that the parties have enjoyed a commercial relationship since around 1995, I have not seen or heard any evidence as to the details of their relationship or any pattern of trading prior to 2002 and no submissions have been made to me as to any previous course of dealing. I therefore proceed on the basis that there is nothing in the pre-existing relationship between them on which either side relies for the purposes of their arguments as to the formation of the contract.

57. I note also, that neither party contends positively for a "stalemate" with no contract at all beyond, at most, an implied obligation to pay a reasonable price.

The Communications between the Parties

58. According to Mr King, initial discussions took place between the parties in the final quarter of 2002, with subsequent discussions continuing into the first half of 2003. These discussions involved personnel from Dana's engineering, programme management and purchasing divisions. Mr White of Freudenberg Technical Products LP (a UK registered limited partnership "**FST UK**") was the main point of contact during these discussions.

59. By an email dated 3 December 2002, from Mr Ray Seasons to Mr Heldmann and Mr White at FST, with the subject heading "modification of the rear axle to a model 230", the following instruction was given by Dana Spicer: "please initiate the procurement of a seal drawing. Make new seal same as E54264 axially however modify the diameters accordingly". E54264 was a prototype seal which had already been developed by FST and was similar to seals that were used in BMW applications but which had not evolved into mass production.

60. On 10 December 2002, Mr Heldmann produced a preliminary drawing for the Seal showing the proposed design.

61. In further email exchanges between 2 and 5 February 2003 between Dana and FST, Mr Heldmann provided a further drawing for the Seal to Dana. The Seal was given Dana part number E55551.

62. On 2 April 2003, Mr White sent to Mr John Taylor of Dana Spicer a Quotation for "Dana Part Number E55551" ("**the 2003 Quotation**"). This read as follows:

> "Further to our recent discussions we are pleased to submit the following in accordance with Freudenberg Dichtungs-und-Schwingungstechnik KG terms and conditions.
>
> | | **DANA Part Number E55551** |
> |---|---|
> | Description | Radial Shaft Steel |
> | Dimension | 515 84 54 10/15mm |

Material	ACM
Production Tooling	26,680 Euro
Lead-time	12-14 weeks from receipt of order
Packaging	FDS Standard Cardboard Carton
Delivery	Included, excludes duty and local taxes
Volume forecast 31.3.03	Sales Price Euro/100
27,952	153.75
118,566	149.77
131,353	145.82
153,015	143.35
151,165	143.35
149,369	143.35

Notes:

- Offer subject to test and design specification freeze

We trust our offer is acceptable and look forward to your sample order, should anything be unclear please do not hesitate to contact me."

63. The FST Terms were not provided with the 2003 Quotation and it has not been suggested that Dana had previously received them in the context of any pre-existing dealings between the parties. There was no indication in the 2003 Quotation as to where the FST Terms could be found. Mr Bott confirmed that as far as he was aware from his investigations, the 2003 Quotation did not attach any terms and conditions.

64. Nevertheless a copy of the FST Terms was included in the bundle for trial. Clause 1 of the FST Terms provided that:

"These General Terms and Conditions apply to all our offers, contracts, deliveries and other services…including all future business relations, even if not explicitly and separately stipulated. The Terms and Conditions shall be considered as accepted at order placement or receipt of goods at the latest. Conditions to the contrary set by our Customer shall not be accepted. These may only be applicable with our express written consent."

This was obviously an attempt to displace the usual battle of forms analysis.

65. It was Mr King's evidence (which was not challenged) that the 2003 Quotation was "part of" the continuing discussions between the parties and was designed to set out FST's proposals in respect of the Seals.

66. On 24 April 2003, Mr White emailed Mr Ian Waldron of Dana Spicer saying that, as a nominated supplier for the JLR T5 Programme, FST needed "to complete APQP for the parts for which your company is supplying" and asking in particular for the "supplier timing dates and element ratings". Mr White reminded Mr Waldron that APQP (Advanced Project Quality Planning) was a continuous process throughout the project stage until sign-off.

67. On 25 April 2003, Dana Spicer issued to FST UK a "Letter of Intent" (the "**Letter of Intent**"), stating that it was Dana Spicer's intention to purchase various part numbers "as detailed in your quotation dated 2 April 2003" including E55551. The Letter of Intent asked FST UK to "with immediate effect instruct all necessary resource and sub-suppliers to proceed in order to meet our required build event dates and quantities detailed below". A table setting out build events and quantities was included in the

letter, which went on to ask FST to provide "by return" the latest timing plan for "supply, detailing, tooling, gauging, development and supplier tooling costs, by week, for the duration of your time line", explaining that this tight time line was necessary to ensure "the meeting of customer and programme requirements". The Letter of Intent went on to say that "All costs, payment terms and conditions will be mutually agreed between [*sic*] and Dana prior to purchase order placement".

68. It is Mr King's evidence that discussions were continuing between the parties at the time of, and after, the Letter of Intent and that specific terms and conditions governing the supply and purchase of the Seals were not agreed at that time. In cross examination Mr King said that he could not remember the specifics of these discussions, saying only that he recalled discussions between the parties in anticipation of a Supply Level Agreement, a draft version of which I have seen.

69. On 29 April 2003, Mr White emailed Mr Waldron saying that "Based upon your email and the letter of intent we have received, we have begun the APQP process for the radial shaft seals" including E55551. In relation to this part, Mr White said that a sample tool exists and that the lead time for serial tooling would be 8-10 weeks, at a cost of 26,680 Euro. He noted that the Letter of Intent "instructs us to proceed with all tooling necessary to meet PSW deadlines" and he went on to say:

"We accept this letter and treat it with the same value as an order. Serial tooling will begin this week for the three seals [including E55551]…We begin this work having the understanding that official orders are to follow in the very near future and that, should the project be stopped, DANA will pay all associated costs relating to tool production up to the time of project cancellation. Should this be a misunderstanding on behalf of Freudenberg or if DANA has an alternative view please share it by return. If DANA makes no specific reply to this issue it is agreed that DANA and Freudenberg have the same understanding regarding the letter of intent. Apologies if this point seems somewhat laboured however we have lost considerable sums of money in the past by acting on letters of intent and serial production orders not materialising…"

70. Later that same day, Mr Waldron replied saying he would respond to the questions raised in the next few days (no response has been found). The email went on to discuss the importance of tracking the time line for production and satisfaction of the APQP stages and final PSW requirements.

71. On 20 June 2003, under Order number 72791, Dana sent a purchase order (the "**Sample 2003 PO**") to FST issuing Initial Sample Documentation and asking for testing to be carried out and samples to be produced of, amongst other things, part E55551.

72. On the same day, 20 June 2003, also under Order number 72791, Dana issued a second purchase order to FST (the "**2003 PO**"). This is referred to by Mr King as a "blanket Purchase Order" which "sets the pricing for parts, but allows the customer to stipulate volumes and delivery dates at a later stage". Mr King described in his evidence how purchase orders were always produced in triplicate, on white, blue and green paper. The blue copy was held by Dana, whilst the white and green copies would have been sent to FST. These versions both had a pre-printed version of Dana's standard terms on the reverse side.

73. The first page of the 2003 PO states that all invoices against the purchase order must quote the purchase order number, item number and part number, that the invoice price must match the unit price stated in the purchase order and that "All Products/services

supplied against this purchase order MUST conform to current COSSH and health and safety regs. Please refer to clause 17 of our standard terms". There was a requirement that FST should sign and return the green acknowledgement copy within 7 days. No signed green copy of the 2003 PO has been located by either party.

74. In relation to the Seals, the 2003 PO identifies a unit price of Euros 1.4335 and a total value of Euros 413,540.38 (i.e. a total initial order volume of 288,482 units, agreed in principle with FST, as explained by Mr King). It also makes clear that parts are to be supplied "to quantities as per schedule after production run has been completed". Mr King explained that this reflected the fact that the precise delivery volumes and timings were to be (and subsequently were) set by Dana's material release schedules. In dealing with a number of other different parts, the 2003 PO states "This contract supersedes all previous contracts", a point which is not made in relation to the Seals, which, given the fact that the Seals were a new product, is perhaps unsurprising.

75. The 2003 Dana Terms included at clause 1:

> "Application of these Conditions
>
> (i) The Company only enters into contracts of purchase which are subject solely to these Conditions of Purchase which can only be altered or qualified by a document signed by a director of the Company and setting out in full the relevant alterations and qualifications and no other servant or agent has any authority to alter or qualify these Conditions in any way.
>
> (ii) Delivery by the Supplier shall of itself constitute an acceptance of the terms and conditions of the order where acceptance shall not previously have been communicated to the Company".

76. FST's disclosure included only the Redacted 2003 PO, a photocopy of the white copy, heavily redacted and annotated. In particular, the unit prices had been removed along with all reference to Dana's standard terms and conditions. There are no standard terms and conditions on the reverse of the document, but this would appear to be explained by the fact that FST believes that the original hard copy version was faxed by FST in the UK to FST in Germany and that the Redacted 2003 PO is the retained copy of this incoming fax. It was Mr King's unchallenged evidence that this purchase order was in fact the Sample 2003 PO for initial samples and not the 2003 PO for production. FST did not call any witnesses who were able to explain why this document had been redacted at the time or indeed why close attention appeared to have been paid to it. The evidence of Mr Kramer, referred to above, has not provided any additional clarity on this point.

77. The product development phase for the Seal was concluded when Dana signed the Initial Sample Report ("ISR") on 13/14 August 2003. The first delivery of Seals was received in August 2003.

78. Thereafter, Dana communicated its ongoing volume requirements to FST in the form of material release schedules, later renamed "Manifests". These referenced the original purchase order number (in this case 72791).

Discussion

79. Taking an objective view of these communications between the parties and construing them as a whole, in my judgment a contract was formed between the parties on the 2003 Dana Terms.

80. The 2003 Quotation includes a volume forecast and a sales price which appears to be dependent upon volumes, but it contains no details of the number of Seals to be manufactured nor any details by which future volumes could be set. I accept Dana's submission that it cannot be deemed an expression of willingness to contract on specified terms with the intention that it is to become binding as soon as it is accepted. Indeed, Mr Bott described this quote as providing "for volume dependent prices based on projected lifetime forecasts provided by Dana". It would appear that this was nothing more than an invitation to treat; an illustration of what the price might be depending on what commitments as to volumes could be given by Dana. Indeed, it is worth noting that the 2003 Quotation set out various different prices dependent on volume, whereas the parties ultimately agreed on a fixed price.

81. Furthermore, and importantly, the FST Terms were not attached to the 2003 Quotation, there was no indication as to where they could be found and no evidence that Dana had ever asked for them or seen them. In the circumstances, I do not see how the FST Terms could have been accepted by Dana or incorporated into any final contract between the parties and in my judgment they were not adequately notified to Dana. When I raised this problem with Mr Wygas during closing submissions, he was unable to point me to any evidence or legal principle in support of his case.

82. By its Letter of Intent, Dana expressed the intention to enter into an agreement for supply of the Seals, but, particularly given the background of ongoing discussions between the parties as to the terms of an overarching supply agreement, I do not consider that this Letter of Intent amounted to an acceptance of FST's offer (and it certainly did not amount to acceptance of terms and conditions which had not been adequately notified to Dana). Although it referred to an intention to purchase part numbers "as detailed in your quotation" and instructed FST to proceed to meet required build dates, it expressly stated that "All costs, payment terms and conditions will be mutually agreed between [*sic*] and Dana prior to purchase order placement". Notwithstanding the typographical error, objectively construed, this appears to me to be a statement of intent to negotiate the terms of a finalised contract, together with a statement to the effect that a formal order would in due course be placed by means of a purchase order (i.e. this was a necessary step to concluding the contract). It is not a final and unqualified expression of assent to the proposal set out in the 2003 Quotation and nowhere does it agree to the FST Terms. Accordingly, I agree with Mr King's evidence when he described the Letter of Intent as simply "an interim holding pattern…to make sure that things were progressing".

83. It was suggested to Mr King in cross examination that it was only terms and conditions relevant to payment that remained to be agreed at the time of the Letter of Intent, but he rejected that suggestion, explaining that the reference to "all costs, payment terms and conditions" concerned "all those overall terms and conditions. It was not just pricing. There were other elements to agree, per the broader supplier agreement we were looking to find". Examples of those additional terms included "how the capability of processes were being defined, how the packaging was being defined, tooling conditions, and then also capacity needs".

84. There is nothing in the documents passing between the parties or their conduct which shows that their common intention was that the FST Terms were to prevail. Even assuming in FST's favour that the 2003 Quotation was capable of amounting to an offer, the Letter of Intent did not accept that offer; on the contrary, it rejected it. Accordingly, I do not understand FST's submission that this case is on all fours with *Tekdata*; a submission that does not seem to me to help FST. In that case, the Court of Appeal applied the conventional 'offer and acceptance' analysis, rejecting the Judge's conclusion that the terms of the contract were the terms provided by Tekdata in its initial purchase order, and holding that a contract was formed on the seller's terms as it fired the last shot. The application of the last shot doctrine in the present case clearly results in Dana's terms being incorporated by the 2003 Purchase Order; it is of no assistance to FST.

85. That FST understood the Letter of Intent to have no binding contractual effect insofar as a long-term supply agreement is concerned appears to me to be plain from the terms of Mr White's email of 29 April 2003. FST relies on this email to show that it had commenced the APQP process further to an acceptance by Dana of the offer contained in its 2003 Quotation. However, to my mind the concerns expressed in the email about the potential to lose money by acting on a letter of intent, together with Mr White's explanation that work was being undertaken on "the understanding that official orders are to follow in the very near future", show instead that neither party considered there to be a binding supply contract between the parties. It may very well be that FST would have had some recourse in respect of wasted expenditure of "tooling production" in light of the email exchanges from around this time but I agree with Dana's submission that it is clear that Dana had not agreed to the FST Terms and that no formal contract for the ongoing supply of the Seals had been entered into.

86. Against that background, I consider that the 2003 PO (viewed objectively) represented a formal offer to purchase (in the first instance) 288,482 Seals at a unit price of Euros 1.4335 on the 2003 Dana Terms, which, on a conventional analysis (and indeed pursuant to the terms of clause 1 of the 2003 Dana Terms), was accepted by FST's conduct when it delivered the Seals requested in the order. There was sufficient information here to amount to an offer to contract – the total order value for each part was identified as well as a unit price, from which the initial order volumes agreed between the parties could be calculated; further, the 2003 PO identified the mechanism by which volumes and delivery dates would be communicated at a later stage. It was accompanied by a hard copy of the 2003 Dana Terms printed on the reverse of each page. The fact that it has proved impossible for either side to find the "green" copy of the acknowledgment does not appear to me to affect matters one way or the other.

87. There is no evidence of any concern being raised by FST as to the incorporation of the 2003 Dana Terms. On the contrary, there is evidence that someone at FST (very possibly Mr White) paid close attention to the Sample 2003 PO (which also had the 2003 Dana Terms on the reverse of each page). The Redacted 2003 PO shows a detailed review and includes handwritten notes made on a memo headed "Ferngespräch" (phone call). These included notes which made reference to clause 17 of Dana's standard terms in respect of COSSH and H&S regulations, as well as a note that referred to the Supply Level Agreement "for <u>other</u> terms and conditions" (<u>emphasis added</u>). I accept Dana's submission that I may infer from this that the 2003 PO and the 2003 Dana Terms were closely scrutinised by FST and their content carefully considered. I also infer that FST

appreciated that the 2003 Dana Terms would have legally binding effect. There is no evidence that these terms and conditions were challenged or rejected by FST.

88. Thereafter, the parties' subsequent dealings, in the form of release schedules and Manifests, were all dealings on the terms, and under the umbrella, of the 2003 PO and the 2003 Dana Terms.

89. It would appear that the discussions between the parties as to the formalisation of an overarching supply agreement came to nothing in 2004. Mr Bott was asked about a draft supply agreement which appears to have been amended by FST in April 2004. I note that FST expressly removed the reference in that draft to Dana's terms and conditions (albeit at the same time retaining the application of English law and jurisdiction). However, this draft is long after the 2003 Contract between the parties was formed and inadmissible to the question of contract formation. Whilst I appreciate that its existence shows that the parties were intent upon negotiating a global supply agreement, nevertheless, that does not seem to me to preclude the formation of a contract in respect of the Seals based on the offer set out in the 2003 PO.

90. Finally, I should say something further about the Redacted 2003 PO. This was the only 2003 purchase order that was disclosed by FST, but the Dana terms and conditions did not appear on the back of the copy and references to Dana's terms and conditions have been redacted, together with prices. FST's witnesses were unable to assist on the origins of this document, which was not originally disclosed by FST in its Extended Disclosure. Dana expressed concern in its written closing submissions that the Redacted 2003 PO is part of a "pattern" of deliberate behaviour by FST designed to achieve a strategic advantage in the litigation. Amongst other things, Dana points to FST's manipulation of production data and its inappropriate involvement with, and influence over, its experts, saying that the Redacted 2003 PO appears to be yet another example of underhand conduct designed to mislead Dana and the Court.

91. Whilst I have considerable sympathy with Dana's concerns in this regard and whilst I accept that, insofar as explanations were advanced by FST's witnesses for the redactions, those explanations do not appear to make any real sense, I am not prepared (and do not need) to make a specific finding about FST's conduct in relation to the Redacted 2003 PO. In his witness statement, Mr Kramer explains that he located the Redacted 2003 PO in the summer of 2019 in a folder in the archives of FST's legal department. The redactions were already present on the document (which was itself a copy) and it seems to me to be entirely possible that the redactions were made long before these proceedings commenced or even anticipated. In any event, whatever the truth about the circumstances in which the redactions were made, I consider that it is clear that in 2003 the parties entered into a contract for the supply of the Seals on the 2003 Dana Terms.

The 2012 Purchase Order

92. When the 2012 PO was sent to FST, the parties had been in a commercial relationship for many years, with FST supplying large quantities of Seals to Dana in accordance with Dana's requirements under the T5 Programme. Given my conclusions as to the 2003 Contract, it does not matter whether the 2012 PO created a new contract between the parties or not; the parties were contracting at all material times in any event on Dana's terms and conditions. FST has not sought to advance any positive case as to the

contractual position in 2012 and, for this reason, I consider that Dana is correct to say that it does not even need to rely on its primary case of a new contract in 2012.

93. However, in case I am wrong as to my analysis of the position in 2003, I now go on to consider what took place in 2012.

94. Dana's evidence, which I accept, is that the process of issuing a purchase order, as a means of formally communicating pricing special requests and changes to terms and conditions to suppliers, was followed in 2012. At this time, Mr Wilkinson's evidence is that Dana wished to make various improvements to its systems and processes for issuing and storing purchase orders and the new PLA programme was seen as an opportunity to make those changes. The PLA programme represented a significant increase in axle volumes as a result of which Dana required many more Seals from FST, and also led to the supply of Seals to two new vehicle models.

The Communications between the Parties

95. In April 2012, Dana held a 'Supplier Readiness' meeting at which it gave a presentation to its suppliers for the PLA programme. The attendees were given a pack of documents entitled "Dana Premium Light Architecture – Supplier Launch Readiness", which included a copy of the 2011 Dana Terms. It seems that, as a supplier, FST was invited to this meeting but there is no evidence as to whether any representative of FST in fact attended. However, Mr Wilkinson's evidence, which I accept, is that if any supplier did not attend, he, or members of his team, would have telephoned that supplier to discuss the content of the presentation, including that the 2011 Dana Terms would apply to the subsequent supply relationship. Accordingly, even if FST was not at the presentation, I find that it would have been informed of the new PLA programme and of Dana's intention that the 2011 Dana Terms would apply to all future supplies of Seals in advance of receiving the 2012 PO. I note in this regard that the contemporaneous documents (including an email chain from April 2012 between Mr Wilkinson and Mr Bob Holloran) show that Dana was in contact with the FST sales team in the spring of 2012 and was discussing the PLA programme and the capacity that would be required.

96. Thus the 2012 PO (the first purchase order placed by Dana with FST for Seals after the launch of the PLA programme – hence the reference to "Rev A") was issued by Dana covering all parts that FST was supplying to Dana at that time and making it clear that the 2011 Dana Terms, "in conjunction with any applicable Supplemental Terms and Conditions apply to this order. Copies of which are available on request or at http://supplier.dana.com." A new order number (650507) was now applied to the Seals, which were identified at a unit price of 1.4335 Euros. Furthermore, whilst the 2003 PO had specified that delivery was DDU (i.e. Delivery Duty Unpaid), the 2012 PO now specified DAP to Dana Birmingham (i.e. Delivery at Place).

97. Clause 1 of the 2011 Dana Terms was in different terms to clause 1 of the 2003 Dana Terms. It read as follows:

> "Supplier's acknowledgement of, or fulfilment of any part of, the Purchase Order, or any other conduct by Supplier which recognises the existence of a contract pertaining to the subject matter of the Purchase Order, will constitute acceptance ("Acceptance") by Supplier of the Purchase Order, these Terms and Conditions and the documents referred to herein (collectively, the Agreement)".

98. The 2012 PO was emailed by Mr Marsh, a member of Dana's Purchasing team, to Mr Kristek on 17 July 2012 under the subject title "X351 Blanket Purchase Order". Mr Marsh asked that the order numbers on the purchase order be referenced "on all deliveries and invoices". Mr Kristek responded to Mr Marsh on the same day, confirming that order numbers would be referenced on all deliveries and invoices. Mr Kristek copied Mr Holloran, an account manager and member of FST's sales team who, according to Mr Bott was "in charge" of FST's contractual relationship with Dana, into this email. Mr Kristek also separately forwarded the 2012 PO to Mr Holloran.

99. Following the 2012 PO, Dana issued various material release schedules, which were a 'call off' for the supply of parts under that order.

100. Thereafter, FST supplied the Seals referring to the order number 650507 and part number E55551 in its delivery notes and invoices.

Discussion

101. If I am right that there was an ongoing contract between FST and Dana in 2012 governed by the 2003 Dana Terms, then in my judgment, the 2012 PO had the effect of replacing that original contract and incorporating the new 2011 Dana Terms. If I am wrong, and any ongoing contract was governed by the FST Terms, then I consider that the events of 2012 had the effect of bringing a new contract for the supply of the Seals into existence on the 2011 Dana Terms.

102. The 2012 PO amounted to an offer by Dana to contract with FST on updated terms. FST acknowledged receipt of the 2012 PO, understanding it to relate to a new programme, and acknowledged that the new order number for E55551 Seals would be referenced on all future delivery notes and invoices. FST's attention had been drawn to the 2011 Dana Terms in the months leading up to the 2012 PO, and the 2012 PO itself made it plain where those terms could be found.

103. There is no evidence to suggest that either Mr Kristek or Mr Holloran reverted to Dana to express any concern over the terms of the 2012 PO, whether as to price, delivery terms or the incorporation of the 2011 Dana Terms. There was no attempt by FST to make a counter-offer or to propose the application of its own terms. Indeed, there was no indication at all that the parties would not be dealing on the 2011 Dana Terms.

104. Accordingly, I accept Dana's submissions that FST's acknowledgement on 17 July 2012 (made without any reservation) was sufficient to amount to an acceptance of the 2012 PO, both at common law and within the meaning of section 1 of the 2011 Dana Terms. Applying the objective test, the parties had "to all outward appearances agreed in the same terms on the same subject matter" on 17 July 2012. If I am wrong about that, however, then the fact that FST proceeded to manufacture and thereafter dispatch the Seals in response to the 2012 PO, without ever suggesting that the 2011 Dana Terms did not apply, leads me to conclude that the parties were *ad idem* and that a new contract had been formed.

105. FST maintains that no new contract was formed either in 2012 or 2013 and that the documents relied upon by Dana are all "post contractual" documents "to allow the delivery of various parts". Further, it says that the 2012 and 2013 POs were simply "administrative".

106. During his cross examination, Mr Wilkinson accepted that the email of 17 July 2012 sent under the subject title "X351 Blanket Purchase Order" was dealing with

"administrative issues" (owing to the fact that it expressly states "We would like to confirm that all administration issues have been covered…"). Mr Wygas placed great emphasis on this evidence in his closing submissions, suggesting that it was consistent with the fact that (i) the FST invoices after the 2012 PO did not mention the 2012 PO; and (ii) FST had no record of the 2012 PO until it was provided in disclosure. However, I do not consider Mr Wilkinson's evidence to be as significant as Mr Wygas suggests for the following reasons:

a. I accept Dana's submission that Mr Wilkinson had not appreciated at this point in his cross examination that he was being asked about the email sending the 2012 PO to FST (as became clear later when he expressly referred to the fact that the new contract had been formed when the 2012 PO was sent to FST by Mr Marsh – which was a reference to the same email);

b. I have no doubt that Mr Wilkinson understood that the 2012 PO was the basis of a new contractual relationship between the parties, not least because he explained that in his view Mr Kristek copied the email to Mr Holloran "because it's a purchase order so he would need to have a view on it". I reject FST's submission that Mr Holloran "could presumably dismiss the receipt of the 2012 Purchase Order as it was not a communication from Mr Wilkinson to him", a submission which is unsupported by any evidence;

c. the invoices sent after the event are of no assistance on the question of contract formation; and

d. given the state of FST's disclosure, I can attach no significance whatever to the fact that it had no record of the 2012 PO until it received a copy of it from Dana on disclosure.

107. On any objective analysis, the 2012 PO was not "purely administrative", as FST contends, and I find that the parties did not treat it as such. Dana was embarking on a new PLA programme and it made obvious sense for there to be clarity around the parts that were to be supplied pursuant to this programme and the applicable terms and conditions. I accept Dana's submission that Mr Kristek's decision immediately to copy in Mr Holloran to his response to the 17 July 2012 email and separately to forward a copy of the 2012 PO to him, indicates his understanding of its significance.

108. Further, I reject FST's case that, as a matter of law, the production and dispatch of the Seals could not amount to acceptance of the offer made in the 2012 PO. As the extracts from Chitty to which I have already referred make clear, an offer may expressly or impliedly waive the requirement of communication of acceptance, such as "when an offer invites acceptance by conduct" (Chitty on Contracts at 2-046). Mr Kristek explained the commercial reality of the parties' relationship very clearly in his evidence, namely that if there had been a problem with the supply of parts requested in a purchase order he would "at the earliest opportunity be speaking about that to the buyers at Dana". There is no evidence of any communication from FST notifying Dana that it could not, or would not, deliver the parts identified in the 2012 PO.

The 2013 Purchase Order

109. On 27 June 2013, Dana issued the 2013 PO which was also expressly subject to the Dana 2011 Terms; this was sent by Mr Wilkinson to Mr Holloran by email. The new purchase order contained a part (2004958) which had previously been supplied to Dana

Austria GmbH at a unit price of 3.53 Euros. This part was now identified with a unit price of 3.57 Euros. Mr Wilkinson explained, and I accept, that in early 2013 production of the axles to which this part was fixed was transferred from Austria to the UK. The 2013 PO was intended to make it clear that, henceforth, supply of this part would be to Dana at an increased price.

110. Following its receipt of the 2013 PO, FST began to supply this part to Dana at the price identified in the 2013 PO. FST continued to supply the E55551 Seals and other parts identified in the 2013 PO.

Discussion

111. Given the contractual role played by purchase orders in the relationship between the parties, a role that both parties appear to have understood very well as is evidenced by a number of communications passing between them in 2015, and given the addition of a new part to the overall supply contract, I accept that the 2013 PO was a yet further new contract, also incorporating the 2011 Dana Terms. Again there is no evidence to suggest any attempt on the part of FST to reject the incorporation of the 2011 Dana Terms at this time.

112. I agree with Dana that it is important that, absent the 2013 PO, there would have been no contract between Dana and FST in relation to part number 2004958. The 2013 PO was necessary to put in place a new contract between FST and Dana, rather than Dana Austria GmbH, to whom that part had previously been supplied. The offer made by the 2013 PO was again accepted by FST's conduct in supplying the E55551 Seals together with the other parts identified in the 2013 PO. I note that the fact that the 2013 PO was very obviously a new contract for the supply of a new part, is not consistent with FST's pleaded position that the purchase orders were of no contractual effect or were "post contractual" documents and I reject FST's case that the 2013 PO was purely administrative.

Conclusion on Contract Formation (Issues 1.1 and 1.3)

113. In my judgment, and in light of the analysis set out above, the Seals supplied during the Relevant Period were supplied under the 2012 PO and 2013 PO on the 2011 Dana Terms, which provide for English law. There was no pre-existing Governing Contract prior to the 2012 PO on the FST Terms (on the contrary, I have found that the 2003 Contract was concluded on the 2003 Dana Terms) and therefore the FST Terms were incapable of governing the relationship between the parties in the Relevant Period.

114. In the circumstances, the issues concerning limitation under German law (issues 6.1-6.3) fall away, as the contractual relationship between the parties was at all times governed by English law. The Agreed List of Issues confirms that FST accepts that English law would apply in the event it fails to prove incorporation of the FST Terms into the 2003 Contract and that those terms continued to govern supply during the Relevant Period. Notwithstanding this, and in case it may later become important, I address briefly the issues of German law later in this judgment.

Alleged Lack of Authority (Issue 1.2)

115. Given my conclusion that the FST Terms never applied to the contractual relationship between the parties, which was governed at all times by Dana's terms and conditions,

FST's pleaded case on lack of authority in relation to the 2012 PO will not assist it further. However, for completeness, I deal with it briefly below.

116. FST contends that the 2012 PO was sent to Mr Kristek who (as Dana knew or should have known) had no authority to bind FST owing to the fact that his role was "simply administrative", as a member of FST's customer services team. Accordingly, it contends that FST is not bound by the terms of the 2012 PO, including the 2011 Dana Terms. I reject this case for the following main reasons:

a. Mr Kristek plainly had apparent authority to bind FST. FST's delivery notes recorded that he was Dana's point of contact and gave his telephone number and email address. He was described as being in the "Sales Automotive" department. He did not suggest in his evidence that he had ever informed anyone at Dana of an absence of authority and Mr Bott confirmed in cross examination that he did not remember any document having been sent by FST to Dana setting out "who did and who did not have authority to do what". Mr Wilkinson's evidence was that Mr Kristek did not inform Dana of any alleged lack of authority and indeed never provided any clear explanation as to his remit. The fact that there was evidence at trial to the effect that Mr Kristek dealt with the administration of orders between Dana and FST does not, in my judgment, detract from his apparent authority.

b. During his cross examination, Mr Kristek confirmed that he would forward any requests that were outside his role and responsibilities to individuals within FST who could deal with such matters. He took this step in relation to the 2012 PO (i) by copying Mr Holloran in to his reply to the 17 July 2012 email and (ii) by asking him a specific question about a change to the delivery notes that would be required by reason of the 2012 PO in an email sent to him the following day. The 2012 PO was attached to this email. FST subsequently made the change to the delivery notes suggested by Mr Kristek and it was Mr Kristek's evidence that Mr Holloran must have approved this change.

c. There is no question that Mr Holloran had authority to bind FST. Mr Bott accepted as much in cross examination, saying "He was in charge as a key account manager for Dana and this meant he was working on quotes, receiving purchase orders for programmes and then initiating all the necessary steps internally in the sales department". Mr Holloran indisputably received the 2012 PO from Mr Kristek before FST supplied the Seals in acceptance of the offer made in the 2012 PO and, as I have already said, I reject the suggestion by FST that he must simply have dismissed receipt of the 2012 PO as it had not come directly to him from Mr Wilkinson, a suggestion for which there is no evidence.

Breach and Causation

117. Before turning to consider the issues agreed by the parties, I should first record my views in relation to Dana's expert evidence.

Dana's Experts

118. As Mr Webb rightly pointed out in his closing submissions (and as I have mentioned), the exclusion of FST's expert evidence leaves the Court in the rather unusual position of not being required to make any comparison between the expert evidence adduced by the respective parties. Nevertheless, I accept that I must still consider the evidence of

Dana's experts with a critical eye, not least because of the numerous criticisms of that evidence levelled by Mr Wygas.

119. In general terms, I consider that each of Dana's experts was endeavouring to assist the Court and showed a proper appreciation of his duties to the Court. As I observed on more than one occasion to Mr Wygas during closing submissions, if FST had been able to rely upon the evidence of its technical experts, I suspect that he may have had more scope for challenging aspects of Dana's technical expert evidence. However, as things stand, I am simply not in a position to determine that technical propositions put to Dana's experts in cross examination (with which they disagreed) are correct.

120. Two examples of this will suffice. The first concerns Dr Carbonara's evidence as to the Stribeck Curve, which I address further below. The second arises in the context of questions posed by Mr Wygas to Dr Carbonara about the significance of the Shaft in preventing leakage; a proposition with which Dr Carbonara disagreed saying that it was more important that the Seal "plays a role" in preventing leakage. At the time of these questions, Mr Wygas noted that Professor Salant was likely to be asked about this topic, no doubt anticipating that Professor Salant would disagree with Dr Carbonara. But I have only Dr Carbonara's evidence on the subject, which I accept. I specifically reject the suggestion made in FST's written closing submissions that Dr Carbonara's evidence on this was "remarkable evidence given that a large amount of the evidence in this case has actually focused on the shaft…". This is incorrect. Mr Wygas has sought to focus on varying other possible causes during the trial, including the Shaft, but none of those has been pleaded and FST has no positive case that the cause of the defects was issues relating to the Shaft.

121. Mr Wygas submitted that none of Dana's experts has any expertise in the field of tribology, the science and engineering of interacting surfaces in relative motion, including the study and application of the principles of friction, wear and lubrication. This he said casts serious doubt on the failure mechanism identified by Dr Carbonara and Mr Bennett in their reports. I reject this submission, for the reasons identified below in relation to the evidence of each expert, which I shall now consider by reference to the key criticisms raised by Mr Wygas, before returning to look at that evidence in the context of the issues between the parties.

Mr Bennett

122. Mr Bennett frankly accepted in cross examination that he did not have any qualifications in the tribology of pinion seals, but, as his report made clear, he is an expert in polymer science, specialising in rheology, the study of flow of matter and processing, particularly injection moulding – the process used by FST to manufacture the Seals. During his cross examination, Mr Bennett specifically confirmed that Avon Rubber Plc "do injection moulding". It was essentially Mr Bennett's view that the root cause of the Seal failures was the result of particular elements of FST's manufacturing processes and equipment. At the heart of his evidence was his opinion as to the effects on temperature and pressure of the Cap change made by FST in September 2013 and the consequent detrimental impact on the flow of the polymer into the mould.

123. I accept Mr Webb's submission that this is pure polymer science and has nothing whatever to do with tribology. I see no basis for disregarding Mr Bennett's evidence in this regard and there is no contrary evidence to explain the effects of the change in the Cap, or the impact of high viscosity during the moulding process. During his oral closing submissions, in response to a point from me to the effect that he had not put to

Mr Bennett that a change in the Cap thickness would not have any adverse effects on the polymer as it is injected into the mould, Mr Wygas said "I didn't put that to Mr Bennett, I had no basis to put that to Mr Bennett".

124. Mr Wygas criticises the statistical analysis undertaken by Mr Bennett on a number of grounds, to which I shall return later in this judgment. For present purposes suffice to say that, whilst it does seem to me that I should approach Mr Bennett's statistical analysis with caution, FST has not shown it to be incorrect. No competing analysis has ever been presented by FST to suggest that any different way of assessing the data would produce different results. In the circumstances, and notwithstanding that I accept there are alternative ways in which the same analysis might have been undertaken, I accept in principle that the relationship that Mr Bennett identifies as between viscosity of the polymer feedstock and Seal failure rates does exist. Certainly, as Mr Webb points out in his written closing submissions, FST has been unable to offer any alternative explanation as to why there should be such a striking relationship between viscosity and failure rates.

125. Overall, therefore, I accept Dana's submission that Mr Bennett's evidence as to the impact of the Cap thickness change and the effects on the polymer as it was injected into the mould was not in any way undermined or really even challenged during his cross examination. I accept that evidence. Further, whilst his statistical analysis could have been done differently, I reject the suggestion that it is so flawed that it is "unsafe". In any event, I also reject FST's suggestion that Dana cannot succeed without the benefit of this statistical analysis. For reasons to which I shall return, it is my judgment that Dana has amply proved its case, whether or not Mr Bennett's statistical analysis is taken into account.

Dr Carbonara

126. Dr Carbonara describes his specialist field as the failure of material objects made from polymers, metals and ceramics. He confirms in his report that he has investigated matters in which tribology has been an issue, including in disputes involving sealing. Dr Carbonara provides evidence on broad engineering issues and details of the consequence of manufacturing a pinion seal with material properties and dimensions different from those intended, such as those identified by Mr Bennett. He traces through the design of pinion seals and explains the fundamental importance of the primary Sealing Lip and how it operates.

127. Mr Wygas explored Dr Carbonara's field of expertise during cross examination, suggesting that Dr Carbonara was not an expert in tribology, and that insofar as he had any experience of tribology it related to metals. Dr Carbonara rejected this characterisation, pointing out that, although he is not a member of the Society of Tribologists and Lubrication Engineers, he is nevertheless an expert in some aspects of tribology and he has previously been involved in issues of tribology relating to sealing.

128. Although Dr Carbonara accepted that he has never previously investigated the failure of a rotary pinion seal, absent evidence to indicate that his views (no doubt based on his relevant expertise in the failure of polymers including seals) are misguided or stem from an incomplete or inaccurate understanding of the tribology of pinion seals, I am not in a position to find that he is not qualified to give evidence about the cause of the failure of the Seals in this case. Professor Salant, one of FST's experts, appears to be a leading authority on pinion seals (having authored a number of papers on the subject to which Dr Carbonara referred in the course of preparing his report), but ultimately his evidence

was not before the Court, his expertise was not tested, and Dr Carbonara rejected the suggestion made to him in cross examination that various publications on which Professor Salant had relied in his report were authoritative in relation to rotary lip seal design. I am simply not in a position to gainsay Dr Carbonara's evidence on this, just as I am not in a position to find that the failure mechanism identified by Dr Carbonara is "wrong", as FST submits. There is no expert evidence before the Court which is in any way inconsistent with Dr Carbonara's analysis.

129. Mr Wygas put to Dr Carbonara that he had not had regard to the correct standard in considering the tolerances for linear dimensions, a point that Dr Carbonara accepted, but the German industry standard to which he was referred during his cross examination which deals with rotary lip seals for motor vehicles was a standard dating back to 1984 and it would appear from the disclosure provided by FST during the course of the trial (specifically an email dated 3 November 2020) that Professor Salant had sought help from FST as to the relevant standard to be applied in relation to hardness tolerance and had been told that it was difficult to find because it was in German. In the circumstances, I do not consider that I can dismiss Dr Carbonara's evidence on this ground.

130. My Wygas also sought to discredit Dr Carbonara's explanation of the operation of the Seal by reference to the Stribeck Curve, first by suggesting that his source of information on the Stribeck Curve was a commercial website relating to automobile racing – a non-point because Dr Carbonara explained that he had merely used this link because it was a better graphic depiction of the curve than his original citation; and second by suggesting that the Stribeck Curve was not an appropriate curve to use to explain different modes of lubrication, but that Professor Salant's reference to the Reynolds Equation was more appropriate. When Dr Carbonara explained why he considered the Stribeck Curve to be the more appropriate representation of the modes of lubrication, Mr Wygas' only response was "we may well disagree". Mr Wygas' difficulty, however, is that absent the evidence of Professor Salant there is no basis on which he can properly submit that I should reject Dr Carbonara's evidence. Whilst I have excluded his evidence, it appears to me to be worth noting that Mr Jackowski's report had explained the same phenomenon in a similar manner to Dr Carbonara and also by reference to the Stribeck Curve.

131. In general terms, therefore, I accept Dana's submissions that Dr Carbonara's evidence as to the mechanisms by which the premature wear to the Seals has occurred is credible and was not undermined in cross examination. I accept that evidence. There is no contrary evidence whatsoever to explain the fact of the premature failures.

Professor Yadav

132. Professor Yadav gave evidence on production data analysis. Mr Wygas sought to undermine his evidence, primarily on the grounds that it was based (i) on no experience of chemical batch processes; and (ii) on limited information, submitting in closing that Professor Yadav had "very little, if any, credibility".

133. Looking at these two main criticisms:

    a. first, it is true that Professor Yadav accepted that he had never worked on any chemical batch processes and that he had had 35 years of teaching experience in the US and India. However, although it was put to Professor Yadav that chemical batch processes should be treated differently, there is no evidence

whatever that the Seals were made by a chemical batch process as far as statistical process control methods are concerned or, indeed, that chemical batch processes should actually be treated differently from other processes. Mr Wygas' submission in his written closing that "comparing a chemical process, which the experts have compared to baking a cake, with a machining or assembly process, where matters can clearly be more tightly controlled, is comparing apples and pears" has no evidential basis. Accordingly, I fail to see how this point undermines Professor Yadav's evidence that any manufacturer must evaluate the ability of its process to produce parts to specification consistently (i) at the outset of production; (ii) upon any changes to its process; and (iii) on an ongoing basis throughout production. His evidence demonstrates that, contrary to industry standards and practice, FST did not use statistical process control methods to validate its process after the major tooling adjustment of the Cap thickness reduction, or to monitor output on an ongoing basis. FST has provided no answer to this.

b. second, it is also true that Professor Yadav carried out a statistical process control analysis based on a level of data which he accepted might not be robust. However, as he made clear during his cross examination, the data he had used was the only data that he had available to him from FST. Furthermore, he also explained that his conclusions were not based on his data analysis alone. Instead, as he identified in his report and in cross examination, he had identified that FST did not carry out any contemporaneous Cpk analysis (as it should have done), and did not design any control charts or otherwise carry out any continuous monitoring of the state of its process in the Relevant Period. He went on to say "Since I didn't see any of that, that indicates to me basically, FST did not validate the process, did not continuously monitor the stability and capability of the process on an ongoing basis and did a retrospective analysis. So I used that information, I looked at the retrospective analysis and I validated that by using whatever the data given to me". I reject any suggestion that this approach affects Professor Yadav's credibility.

134. I have already remarked upon the fact that it is striking in this case that FST has not chosen to call any factual witnesses to address its processes or its production data. Mr Wygas was accordingly left to make bricks without straw in his cross examination of Professor Yadav. Thus:

a. he sought to suggest that Professor Yadav was mistaken in his understanding as to the minimum Ppk (retrospective capability) and Cpk (predictive process capability) values (Ppk of 1.67 and Cpk of 1.33) used in the automotive industry. However, not only were the values used by Professor Yadav plainly based on his extensive knowledge of production data analysis and industry standards, but also there is no evidence before the Court to support Mr Wygas' suggestion that there is a distinction between the terminology used for Ppk and Cpk in the US and Europe. Mr Jackowski agreed in his CPR Part 35 Replies that a Cpk of 1.33 (the value used by Professor Yadav) is now used in the automotive industry. The internal FST document on which Mr Wygas relied in putting this point has not been the subject of any factual evidence and, if taken at face value, would appear to be inconsistent with every other reference before the Court indicating that Ppk is always a higher value than Cpk. FST itself appears to have acknowledged the need for a Cpk of 1.33 (consistent with the

value identified by Professor Yadav) in the email to which I refer below in which they sought to manipulate data;

b. he cross-examined Professor Yadav about an internal Dana specification in respect of which there is no evidence that it was ever shared with FST, much less that it constitutes an agreed standard that outlines the process capability expected of FST for its Seal production. As Professor Yadav remarked, this document concerns failure analysis and not quality control. I accept Dana's submission that it is of no apparent relevance to the issue as to the appropriate quality standards which should be used to assess FST's processes.

135. I reject the submission that Professor Yadav's evidence lacks credibility. On the contrary, I find that his evidence makes clear that FST should have, but did not, adequately monitor the capability of its processes and that those processes were not capable. I accept that evidence. These are points with which FST appears to have agreed, acknowledging internally in response to Dana's request for capability analyses during the parties' joint root cause investigation that it did not collect sufficient data to monitor the capability of its process (e.g. in an email of 28 October 2016: "In 2014 we had too few measured values so I cannot evaluate the Q-das") and its process was not capable (e.g. the same email of 28 October 2016 "the SL is not capable"). It was Professor Yadav's unchallenged evidence that "SL" is the German language abbreviation for dust lip diameter, one of the specifications for the Seals.

136. Rather than present this picture to Dana, FST manipulated its process capability data, as described by Professor Yadav in detail in his report, and presented Dana with falsified information. By way of example, an internal FST email of 2 November 2016 instructs: "It is important that we are capable (also the SL). Therefore please hide outliers so that the value is over Cpk 1.33…We would also need the capability evaluations of 2015…without outliers, so that the SL is also capable". A revised capability analysis was attached to the response sent on the same day, which, according to Professor Yadav, shows that FST "did in fact alter the original data set and thereby improve the apparent results of its analysis". Indeed the improved results changed the Ppk values for the specification:

a. of Cavity 1 from 0.86 (i.e. well below the 1.67 that is required in the automotive industry, and was FST's target) to 2.00 (i.e. well above what is required in the automotive industry and suggestive of a well-controlled process); and

b. of Cavity 2 from 0.90 (again, far below the required 1.67) to 1.92 (again well above the industry standard and suggestive of a well-controlled process).

Professor Yadav confirms in his report that "increases in Ppk values of this magnitude are impossible without changing the data set".

137. Aside from a rather half-hearted attempt to suggest to Professor Yadav that the removal of outliers in a capability analysis might be permissible (a suggestion which Professor Yadav rejected in the context of a retrospective analysis where the alteration of several data points "completely violates the entire statistical control process standards or the good engineering practice"), FST made no real effort to challenge Professor Yadav's evidence about this manipulation (including the analysis that he did himself to show precisely what the manipulation had achieved) and, as I have said, called no factual evidence to seek to explain it. It was Professor Yadav's evidence, which I accept, that FST deliberately presented to Dana better process performance results than it in fact

had, by manipulating the original data set and that "this is a severe departure from not only good engineering practice, but also basic ethical standards…The manipulation is not minor. It changes the analysis from one showing a process that is completely out of control, to one purporting to show a very well-controlled process." When asked in re-examination whether he might be wrong in this assessment, Professor Yadav responded "No, absolutely not. I am very confident because I have never seen anything like that before in my life". It is unsurprising that FST has (albeit extremely belatedly) now admitted to this manipulation.

138. Dana invites me to infer from the manipulation (described by Mr Wygas in closing as arising in the "heat of the moment, the chips are down, it's November 2016, there is pressure on everybody about why are these seals failing") that FST knew there was a problem with the production of their Seals and wanted to hide it. I asked Mr Wygas why I should not draw that inference in light of the admitted manipulation on the part of FST, to which his response was that I should only draw that inference if I can say that the Seals were being produced out of specification and he submitted that there was no evidence that any of the Seals had been produced out of specification. I beg to differ and will return to this point later in this judgment.

139. In summary, I reject FST's submissions that Professor Yadav's evidence lacks credibility. It was not undermined in cross examination and there is no evidence available from FST which could possibly challenge it. I accept it in its entirety.

Inspection of Seals by the Experts

140. In his written closing submissions, Mr Wygas noted that Dana's experts had been provided with only 10 Seals from the Relevant Period, but said that Mr Marklew had given "remarkable" evidence that all of the defective Seals in the UK had been shipped back to the US for inspection once Dana started to receive large numbers of returns. Mr Wygas submitted that Dana should have a "stockpile" of these failed Seals and that these should have been provided to Dana's experts to enable them to carry out a proper sampling exercise. Mr Wygas went on to say that "Dana provides no explanation as to why those Seals (which FST now knows are in a central location) have not been provided in this litigation" and that in circumstances where Dana has neither taken the opportunity to inspect these Seals, nor offered that opportunity to FST "Dana has failed to prove its case".

141. I agree with Mr Webb, when he said in closing that this was a serious allegation to make and yet, as he pointed out, it was not an allegation that had previously been made by FST. Indeed, it does not seem to be an allegation that is either fair or accurate. Mr Webb drew my attention to a letter from Crowell & Moring of 30 May 2019 in which they informed Fladgate that Dana had in its possession "around 2,500 seals" and I accept that at that point, if FST or its experts had wanted to ask to inspect the Seals, they could have done so. However, there was no response to the letter. Mr Webb told me (and Mr Wygas did not dissent) that they had discussed the question of preservation of the Seals at around the time of the CMC, including that Dana was particularly keen to see unused Seals from the Relevant Period which it considered were likely to be important in the context of testing. Mr Webb went on to say that nobody had ever suggested that any of the experts might be assisted by having access to the stockpile of Seals other than a very small selection. He explained that the reason for this, which is also set out in the reports of Mr Bennett and Dr Carbonara, is that there is only a limited amount of information that can be obtained from a seal that has been in service. It was

not suggested to either of these experts that they were wrong in their assessment of the limited usefulness of used seals.

142. I note that Mr Wygas did not try to resurrect this point in his oral closing submissions and it appears to have been thoroughly bad. FST has been aware that Dana had substantial numbers of defective Seals in its possession since (at least) May 2019, it has not sought to inspect these Seals and it has not sought to challenge Dana's evidence that an inspection of these Seals would produce only limited information. Accordingly, I reject the suggestion that Dana has somehow failed to prove its case for this reason alone.

Warranty Claim Rates (Issue 3)

143. Although this issue remained at the close of the trial, I did not understand FST to advance any evidence or arguments to counter Dana's pleaded position.

144. In short, I accept Mr Ashenfelter's evidence that during the Relevant Period the Seals failed at overall rates of 5.2% (for Land Rover vehicles) and 4.4% (for Jaguar vehicles) within 48 months of service. The failure rates peaked in March 2014 at 12.1% for Land Rover vehicles as a whole and at 17.1% for Jaguar vehicles as a whole. The elevated failure rates occurred on Seals fitted to all nine vehicle models (six Jaguar and three Land Rover) then in production, including the L319 model that was part of the previous T5 Programme. I accept Mr Ashenfelter's evidence in his second statement that the different vehicle models each show similar patterns in Seal return rates – a point also made by Mr Bennett in his report, who observes that in conjunction with his analysis of the defects in FST's mixing and injection moulding processes and quality controls, this shows that differences between vehicle models, including in differentials, oils, Shafts and Shaft manufacture did not contribute to the failures.

145. These failure rates far exceed the failure rate of around 0.1% within 36 months of service which Mr Ashenfelter identified as being acceptable in the automotive industry for parts of this nature and which broadly represented failure rates experienced both prior to and after the Relevant Period. Mr Ashenfelter had extracted the underlying data from JLR's online failure rate database. FST has not pleaded or asserted any alternative actual failure rate.

146. FST pleaded in its Amended Defence that "0.1%...is an acceptable failure rate" (paragraph 26.4) and that "failures below the rate of 0.1% are considered acceptable" (paragraph 32). I infer from this that FST accepts that failure rates in excess of 0.1% are unacceptable. Certainly, FST has not pleaded or asserted any alternative acceptable failure rate.

147. Professor Yadav opined in his report that the generally acceptable failure rate would in fact be lower than 0.1%, but it is not necessary for me to determine whether he is right about this. I accept the evidence of Mr Bennett in his report that "failures of the magnitude observed in this case (i.e. for the vehicles built between around October 2013 and February 2016) far exceed an acceptable level and should be a source of significant concern, warranting a major investigation by the component supplier into the root cause".

Breach of Contract

Relevant Contract Terms

148. Dana relies on the express terms of the 2012 PO and 2013 PO, each incorporating the 2011 Dana Terms, together with implied terms of satisfactory quality and fitness for purpose, pursuant to section 14 of the Sale of Goods Act 1979.

149. With respect to product performance, the 2011 Dana Terms include the following requirements:

a. Clause 7(a): "Supplier will manufacture all Products in strict conformance with the terms of the Agreement, including any specifications provided by Dana or its customers"
b. Clause 15(a): "Supplier represents, warrants and covenants that the Products will…(iii) be free from defects in design (even if the design has been approved by Dana), material and workmanship…, (iv) be merchantable and fit for their intended purpose; (v) [be] in conformity with all specifications, drawings, samples and performance requirements or other descriptions furnished by Dana or Dana's customer(s)."
c. Clause 23: "Supplier will achieve continuous quality improvement in the manufacture, production and distribution of the Products. Supplier will comply with the quality assurance process, inspections and standards specified by Dana for suppliers providing goods and services similar in nature to the Products. Supplier will further comply with all mandatory quality standards, product certification and other quality related requirements under applicable law".

150. Further Clause 15(a) of the 2011 Dana Terms provides that "These warranties are in addition to any warranties implied or provided for by Law or otherwise made by the Supplier and will survive acceptance and payment by Dana".

151. Section 14 of the Sale of Goods Act provides that:

> "…
> (2) Where the seller sells goods in the course of a business, there is an implied term that the goods supplied under the contract are of satisfactory quality.
> (2A) For the purposes of this Act, goods are of satisfactory quality if they meet the standard that a reasonable person would regard as satisfactory, taking account of any description of the goods, the price (if relevant) and all the other circumstances.
> (2B) For the purposes of this Act, the quality of goods includes their state and condition and the following (among others) are in appropriate cases aspects of the quality of goods-
> (a) fitness for all the purposes for which goods of the kind in question are commonly supplied,
> (b) appearance and finish,
> (c) freedom from minor defects,
> (d) safety, and
> (e) durability.
>
> …
> (3) Where the seller sells goods in the course of a business and the buyer, expressly or by implication, makes known-

(a) to the seller,

…

any particular purpose for which the goods are being bought, there is an implied term that the goods supplied under the contract are reasonably fit for that purpose…"

152. My attention was drawn by Mr Webb to the following extract from Benjamin's Sale of Goods (11th Edn) at 11-050:

"Where the goods are capable of use for a number or range of purposes, it seems that the seller's liability depends upon whether a special purpose within the range was indicated. If so, the suitability must be for that purpose; otherwise it must apparently (despite the words 'that purpose' in the provision) be for any purpose that is either known to the seller or reasonably foreseeable by him".

Overview on Breach and Causation

153. The key to Dana's case on breach and causation, as articulated by Mr Webb in closing, is the change in Cap thickness of the moulds in September 2013 from 1mm to 0.3mm. This was a substantial change to the injection moulding process, which FST appears to have introduced without undertaking adequate investigations into its impact. The change coincided with the sudden increase in failure rates, which failure rates continued until early February 2016, when they subsided.

154. It is common ground that the change in Cap thickness was not notified to Dana at the time it was made, or in response to a 2016 request for a listing of all tooling activities in 2013, or at the outset of this litigation or when FST notified its own experts of the change (by at least November 2019). FST's Extended Disclosure omitted to include documents relating to the Cap change and it was only in May 2020, some six months later and shortly before the original trial date, that FST produced documents to Dana (following the threat of a specific disclosure application) which revealed the fact of the change. In the meantime, apparently appreciating the significance of the Cap change in the context of this litigation, FST undertook its own flow simulation modelling in April 2020 (the "**2020 FEA Simulation**") which it did not disclose to Dana until 16 April 2021, very shortly before this trial. The suggestion in Mr Wildschütz's second witness statement that this simulation was undertaken in response to the issue being raised by Dana appears to be inaccurate and the only explanation that has ever been given for its non-disclosure (that it was "an oversight") is hard to believe.

155. Dana invites me to infer from this that FST deliberately withheld the fact of the Cap change and the documents relating to it from Dana until May 2020 (including throughout the joint root cause investigation) and that FST continued to withhold relevant information about the Cap change (especially the 2020 FEA Simulation) until the eve of trial and even then only disclosed that information because of a targeted Part 35 request. In my judgment, and in all the circumstances (including the admitted manipulation of data to which I have already referred), this is a reasonable inference to draw. I also accept that it is reasonable to infer that there would have been no reason to withhold the information about the Cap change had FST not recognised its fundamental significance to the issues in this case. Indeed that recognition appears to be evidenced by the fact that FST's in-house specialists informed one of its technical experts, Mr Jackowski, that they had conducted a flow simulation to validate the Cap thickness change prior to introducing it in September 2013, information which (as I

record in my judgment excluding FST's technical expert evidence) was then included in Mr Jackowski's report, but which has turned out to be entirely untrue.

156. Against that background, Dana submits, and I agree, that FST's decision not to call any factual evidence on its processes and procedures and not to advance any positive case as to the cause of the premature failure of the Seals becomes explicable. As Dana submitted in their written closing submissions:

> "No positive case on processes or procedures could possibly be advanced without highlighting the significance of the cap thickness change and opening up witnesses from the Hungarian plant to cross examination on the serious process failings. No positive alternative case could be advanced to argue that the seal leakages were caused by something other than inherent defects precisely because the problem so clearly lies with the quality of the seals themselves".

157. In his oral closing submissions, Mr Wygas sought to suggest that FST may not have fully appreciated the importance of the Cap change, but to my mind this just illustrated his difficulties caused by a lack of evidence about FST's manufacturing processes; in this instance a total lack of any evidence from FST as to what they did or didn't understand about the Cap change. Mr Wygas acknowledged, however, that he had no explanation whatever as to why the documents relating to the change in the Cap thickness had not been provided to Dana at the earliest opportunity.

158. Mr Wygas sought in his written and oral closing submissions to focus FST's defence to the claim on the failure on the part of Dana to rule out a variety of possible causes of the oil leaks during its root cause analysis. He maintained that the existence of these other possible causes meant that the Court could not find on balance that the Seals were themselves defective or that they had caused the leakage of oil where the root cause analysis did not exclude all other options. He had no explanation for FST's failure to plead any of those alternative possible causes and thus no real basis for criticising Dana's experts for failing to consider them. His written closing submissions barely mentioned the Cap thickness change and when I asked him during his oral closing submissions how he could maintain his case as to other causes in the face of the evidence that the failure rates had gone up when the Cap thickness was changed and had returned to normal following replacement of the mixer body he was unable to provide any satisfactory answer, eventually responding that "it may well be the case that…the cap thickness change ended up producing a seal which, for example, was less resistant to shaft lead or less resistant to corrosion or contamination". However, he frankly accepted that FST had produced no evidence to support such a hypothesis, notwithstanding that it would have been in their interests to do so, and ultimately he was forced to concede that "…there is no evidence. I am hamstrung in relation to it".

159. In the circumstances, I have no difficulty in accepting the evidence of Mr Bennett that the Cap change will have affected the operating pressures, temperatures and flow of the polymer through the cavity/mould such as to necessitate adjustments to the pressure, temperature and flow speed. I did not understand this to be contested during closing submissions. There is no evidence that any such adjustments were made and again, I also accept Mr Bennett's evidence that quality issues including polymer flow issues, scorch and premature cure, were likely to result during periods when polymer with a high viscosity was used and that his inspection of used Seals evidences the presence of such quality issues. FST's records indicate that polymer viscosity was generally high, but fluctuating, during the Relevant Period until a new polymer mixer came online in

late 2015 and the failure rates of the Seals fell back to acceptable levels. I accept Mr Bennett's evidence that the impact of the new polymer mixer would have been to stabilise the viscosity levels and thereby effectively to remove the deleterious effects of the Cap thickness change. I shall return to the results of the 2020 FEA Simulation in due course, but suffice to say that Mr Bennett's evidence is that it was based on fundamentally flawed assumptions.

160. I am satisfied that Dana has established breach on the part of FST of the express and implied terms to which I have referred, and I am bound to say that Mr Wygas did not really seek vigorously to defend the case on breach in his oral submissions, focussing primarily on causation as the main battle ground. During the course of his oral closing submissions he accepted that "cap thickness is clearly one issue" but continued to assert that Dana had not established that it was "the issue", by which I understood him to mean the causative issue. However, I am also satisfied, on balance, that the defects to the Seals caused the leakage of oil from the RDUs. I now turn to set out my reasons in full.

Were the Seals supplied during the Relevant Period supplied in breach of contract?

161. Mr Webb submitted, and I accept, that it is sufficient for Dana to establish on balance that the Seals were defective such that they failed to meet the relevant contractual requirements. Before turning to address the detailed evidence on breach of contract by reference to the individual allegations of breach identified in Dana's claim and set out at 4.1-4.4 of the Agreed List of Issues, I should briefly address the question of the quality and purpose of the Seals.

162. The experts instructed by both parties agreed in the Expert Joint Statement that a properly performing pinion seal should be capable of preventing leakage of the lubricant fluid (an acknowledgement on the part of FST's experts which was inconsistent with its pleaded position that the pinion seal merely *assists* with preventing oil leakage).

163. It is common ground that there was leakage of oil from large numbers of Seals. However, FST contends that the "specific purpose the Seal was put to in each vehicle was materially different" and that it was not told "what those multiple purposes were". I reject that submission for the following reasons.

164. FST has supplied E55551 Seals to Dana since 2003 and Mr Wygas accepted in opening that "the environment in which the Seal was going to be used in 2013 onwards was the same that had been used in 2003".

165. Mr Bray's evidence in his statement was that "Neither the introduction of the PLA program in late 2012, nor of the Jaguar vehicles…between 2007 and 2015, materially altered the operating conditions of the Seals", that there were no "material changes in or around this time period to the designs of the axles into which they were installed" and that accordingly FST had continued using the same design. In closing, Mr Wygas submitted that during his cross examination, Mr Bray had deviated from this evidence, admitting that there were in fact numerous changes to the operating conditions of the Seal under the PLA program. However, that was not my understanding of his evidence in cross examination. The transcript shows clearly that although Mr Bray accepted that there had been a number of "changes in the PLA program", it was not specifically suggested to him that these changes materially altered the operating conditions of the Seals, and FST has no evidence to support any such proposition.

166. My Wygas also contended that no details were provided of the technical changes identified by Mr Bray in his evidence during the presentation given by Dana to its suppliers in April 2012, a proposition that was confirmed in cross examination by Mr Wilkinson. However, in circumstances where FST has no evidence that these changes in fact altered the operating conditions of the Seals, this does not seem to me to assist FST's case. In any event, I note that the presentation does include design schemes for the PLA programme rear axles.

167. I reject FST's submissions that Mr Ashenfelter's evidence to the effect that the failure rate on one vehicle model (the X260) was different at one point in time from another vehicle model (the X250) "demonstrated that the environments in which the Seals were placed were materially different". On the contrary, as Mr Ashenfelter made clear "…you are talking about differences in production timeframe as well so it's not just – not as simple as just looking at model to model because you also see in the other models that were ran (*sic*) throughout the period, you have peaks and valleys in that performance as well". Mr Wygas expressly put to Mr Ashenfelter "You don't accept that the seal performed "better" in the X260 than the X250?" to which Mr Ashenfelter responded "No". Further, contrary to FST's submissions, there was nothing in Mr Bennett's evidence to support the proposition that the specific purpose the Seals were put to in each vehicle was materially different.

168. I accept Dana's submission that the PLA Programme did not raise any abnormalities or idiosyncrasies in terms of the continuing purpose to which the Seals were to be put. FST's own evidence (in the shape of Mr Heldmann's statement) was to the effect that the primary factor in respect of the design of the Seal (and in particular the correct standard lip profile) is the dimensions of the Shaft. There is no evidence before the Court that these dimensions changed. Mr Heldmann confirmed that there is frequently overlap when designing components which are used in different models of vehicle from the same manufacturer and the same manufacturing group and that different models and even different series can have identical parts in common. Therefore "It is…not unusual for a product which was originally developed for use in a specific model to be subsequently used in another model or another series". FST was in any event provided with Feasibility Considerations for the use of the E55551 Seal under the PLA programme which expressly identified the different configurations of vehicle axles.

169. Finally, FST submits that even if it was informed of the circumstances in which the Seals would operate, it was not informed that the Seals would have to operate "on shafts which had lead, or with oil which was contaminated". However, this is really just another way of asserting FST's causation case, to which I shall return in due course.

170. I accept that the Seals were of unsatisfactory quality and were not fit for the purpose for which they were commonly supplied. I also accept that they fell short of the "durability" requirement in section 14(2B)(e) of the Sale of Goods Act 1979. Specific examples of the ways in which the Seals were of unsatisfactory quality and not fit for purpose are provided in the sections of this judgment below addressing issues 4.1-4.4. I note that there is considerable overlap between these issues and that, so as to avoid duplication, I have tried to cross refer where possible.

Failure properly to maintain the cavities and/or to manufacture the Seals in the cavities (Issue 4.1)

171. Professor Yadav's evidence, which I accept, is that FST did not design control charts, calculate Cpk values or otherwise carry out any continuous monitoring of the state of its process during the Relevant Period. It only calculated the Ppk as part of the root cause investigation (i.e. retrospectively) and it wrongly presented the results as CpK values.

172. This failure to carry out continuous process monitoring was contrary to industry standards and good engineering practice. It was compounded by an additional failure on the part of FST to collect sufficient data on a regular basis to ensure a comprehensive understanding of the state of its manufacturing process. Professor Yadav records that FST only took measurements of approximately one subgroup per month, whereas to ensure effective monitoring, data should have been collected far more frequently so as to identify any abnormality or shift in the process (i.e. daily if possible, or at least once a week).

173. The consequence of these failures is that FST cannot have known, at the time of production, whether or not its process was stable or capable of consistently producing parts that conformed to specification. The absence of any Corrective Action Reports evidences this total lack of awareness on the part of FST as to the performance of its manufacturing process. Mr Bennett's evidence is that FST's rheology specifications for the polymer compound were set in the 1980s, whereas initial production of the Seals began in 2003. There is no evidence that FST checked whether the rheology specification was appropriate for the Seals.

174. On 27 May 2020, long after the date for provision of its Extended Disclosure, FST disclosed a list of maintenance actions carried out on Cavities 1 and 2 from March 2013. During the Relevant Period, FST carried out 15 maintenance actions on Cavity 1 and 12 maintenance actions on Cavity 2. Mr Bennett's unchallenged evidence is that he would not expect to see maintenance being repeated so frequently and that the clear inference is that the initial maintenance was not being done properly.

175. According to Professor Yadav none of these actions was carried out as a corrective action as a result of continuous process monitoring and FST made no attempt (as it should have done) to re-validate its process by way of re-designed control charts after any of the maintenance or repair actions recorded in this list. This meant that FST had no means of understanding the effect of those maintenance and repair actions on its manufacturing process and no means of satisfying itself that the Seals were capable of meeting their specification.

176. Crucially, FST's list of maintenance actions failed to identify the reduction in the Cap thickness of Cavities 1 and 2 from 1mm to 0.3mm which occurred in September 2013. This change appears to have been made for the purpose of "waste reduction". No attempt was made by FST at the time either to re-validate this change or to submit it to a PPAP of the type originally undertaken by FST in or around 2003, at the time of the initial validation of its process for Cavities 1 and 2. The failure to undertake a PPAP meant that Dana was not notified of the change.

177. During his closing submissions, Mr Wygas asserted that there was no need for the Seals to undergo a PPAP in respect of the change in Cap thickness "because of the way the seal was manufactured". He went on to say that it was his understanding that "the PPAP

is done in certain circumstances. It was not done here because the criteria for re-PPAPing it was not necessary". However, yet again, there is no evidence whatever from FST to support this assertion.

178. Mr Wygas referred to a Test Report document entitled "Test Report – shield thickness reduction", which he said recorded the testing that was in fact carried out by FST in relation to the Cap change. However, FST adduced no evidence about this testing, Dana had no opportunity to explore in cross examination the nature and adequacy of the testing and I am certainly not in a position to conclude that it was satisfactory or that it provided evidence that the Cap thickness change would not impact the manufacturing process. In any event, in circumstances where Mr Wygas did not challenge Mr Bennett's evidence as to the impact of the Cap change, I do not see the relevance of this testing.

179. Notwithstanding the information that FST apparently gave to Mr Jackowski at the time of preparation of his report, that it had carried out a mould flow software simulation in 2013 at the time of making the Cap change, it now transpires (in circumstances more particularly recorded in my judgment excluding FST's technical expert evidence) that no such simulation was carried out. As Mr Bennett explained in his evidence in chief, a simulation of this type would look at what impact the geometrical changes made by reason of any tooling modifications would have on the filling process and the way the material flows and scorches.

180. Similarly, FST failed to carry out any "short shot" tests before starting production and after making the Cap thickness change. Mr Bennett explained that tests of this sort (which essentially involve filling the mould to varying degrees and looking at the impact of the flow of the material) are a very cheap and easy way of understanding how the mould is filling and how the material is processing. In Mr Bennett's view, it would have been good engineering practice to carry out such tests and they would have determined whether the moulding parameters required adjustment in order to maintain product quality and performance.

181. FST did carry out the 2020 FEA Simulation, but it chose not to disclose the results of that analysis until 16 April 2021. The court has no factual or expert evidence from FST on the results of this analysis. During his examination in chief, Mr Bennett took me through a video of the flow simulation and some related documents (which in one case he confirmed appeared to be a simulation of the original Cap rather than the "thinner" Cap, albeit that he said there would be a corresponding one for the thinner Cap which would have been used for the purposes of comparison). He then took me to the results of the analysis pointing out that:

    a. while it was possible to tell that the change had resulted in an increased temperature, it was impossible to tell where exactly that temperature rise occurred; and, importantly

    b. that the simulation commenced in the wrong place, namely at the "sprue in the tool" rather than in the injection moulding machine itself, such that all the calculations in the model based on a start temperature of 65 degrees Centigrade would be wrong – they would be far too low.

182. Accordingly, Mr Bennett described the analysis as "wholly inadequate" and "a great missed opportunity" because in his view FST "could have used this model to actually simulate the effect of [the Cap change]". However, he confirmed that a simulation of

this type, albeit using the correct assumptions and parameters, should have been carried out in 2013. He also said that if such an analysis had been done at the time of the Cap change, there would be no reason to carry out a further simulation in 2020 unless the original results had been lost, or "they don't believe the results, or there was something that they realised they had missed out of the model, that needed to be re-addressed".

183. I accept Mr Bennett's evidence that "Cap thickness reductions of this magnitude are major tooling changes that are highly likely to affect the properties and performance of the finished seals, regardless of whether or not consequential adjustments are made to moulding parameters". He explained that this was because:

a. when the thickness of the Cap is reduced, more pressure is required to push the compound to the cavity at the same speed;

b. if the pressure is not appropriately increased (by adjusting the moulding machine parameters) the compound will flow more slowly into the cavity gathering more heat on its way and, in turn, creating the risk of scorch (i.e. premature linking of the polymer chains). Further the pressure may not be enough to ensure that the compound fills the extremities of the cavity, such that the finished Seals will not have the desired dimensions. I note that there is no evidence from FST that the pressure was increased at the time of the Cap change;

c. even if the pressure is increased, this will cause the compound to generate more heat through internal friction, again risking scorch;

d. the effects of scorch and/or underfilling of the cavity will be that the Seal does not achieve its desired dimensions at the moulding stage and/or its dimensions will change in service due to increased swell. These dimensional variances will be most severe at the Sealing Lip area and are unlikely to be uniform around the circumference of the Seal.

184. It was Mr Bennett's evidence that in order to fulfil their sealing function, Seals must have precise dimensions and material properties. Such a level of precision cannot be achieved without very tightly controlling the mixing process and closely monitoring the key properties of the mixed compound, something that FST patently failed to do. One key property is viscosity (or fluidity) of the compound. This is important for a variety of reasons identified by Mr Bennett, including that:

a. an increase in viscosity will result in an increase in the amount of heat generated as the rubber compound flows through the feed system into the cavity;

b. subjecting the compound to inappropriately high temperatures will result in early curing, which causes the compound to experience scorch;

c. at points where partially cured surfaces meet, there will be visible indents, or weld lines, where the polymer has not crosslinked properly across the joint. This internal flaw acts as a conduit for the permeation of oil into the bulk of the rubber increasing swell – and consequential dimensional deformation – of the Seal in service. This swell and deformation will be most pronounced in the parts of the Seal that make contact with the oil in service, including the main Sealing Lip;

d. the swell will likely create non-uniform dimensional deformation around the circumference of the Seal and also reduces the physical properties of the compound (such as tensile strength, stiffness and abrasion resistance) in turn reducing the ability of the Seal to withstand wear and prevent oil leakage;

e. where premature cross-linking takes place, the pressure from the injection moulding machine will force flow to occur, which will break up the cross-link network, resulting in a Seal that is not properly cured;

f. if premature cure (i.e. solidity) of the compound reaches a sufficient level during filling of the cavity, then its ability to flow within the cavity will be reduced, such that the polymer may not be fluid enough to force the remaining air from the mould. If this occurs, then the extremities of the cavity may not fill with the consequence that the moulded Seals will not achieve the desired dimensions. This under-fill of the cavity is particularly likely to affect the dimensions of the main Sealing Lip, as well as the oil and air side angles of the Seal, because of the direction of flow of the compound in the cavity, which makes these areas more difficult to reach. The effect on these dimensions is unlikely to be uniform around the Seal circumference;

g. even if the compound is able to reach the extremities of the cavity, its high viscosity will cause it to be poorly compacted by the pressure applied during the injection moulding process. This will again further reduce the Seal's resistance to the oil in service, resulting in swell.

185. An analysis by Mr Bennett of FST's viscosity data, disclosed only on 29 May 2020 and with a very limited testing rate for Seal production of effectively 0.02%, shows considerable fluctuation in the viscosity levels until late 2015, with monthly average viscosity levels consistently falling in the middle or upper part of the specification range. From late 2015 onwards, the variation in recorded viscosity values reduces to the lower part of the specification range. It is Mr Bennett's unchallenged evidence that viscosity variations of the magnitude observed until late 2015 indicate that the mixing process was not adequately controlled in this period.

186. Mr Bennett's opinion is that "the cap thickness reductions compounded the effects of a high viscosity compound, adversely affecting seal performance" and accordingly I accept Dana's submission that, on balance, the change in Cap thickness resulted in the manufacturing process being unable to cope with the high viscosity compound.

187. I note that it was also Mr Bennett's opinion, which I accept, that on the information available to him, FST's production process and quality controls in respect of mould temperature were not consistent with good engineering practice or appropriate to ensure that the Seals were fit for purpose of conformed to specification. Furthermore, that information showed that the mould surface temperature was frequently too hot, which would itself cause scorch. In this respect it was Mr Bennett's view that FST's failures adequately to control mould temperature could also have contributed to the Seal failures by further increasing the scorch that would have resulted from the high viscosity compound and reduced Cap thickness cavities.

188. I pause here to note that FST submitted that there was no evidence that the cavities did not fill properly. In his closing written submissions Mr Wygas contended that all Seals produced by FST were subject to a visual quality inspection at a magnification of 2.5 and further that had there been any examples of a lack of fill on returned Seals, this

would have been visible on Seals inspected in the US. Once again, however, it seems to me that Mr Wygas was seeking to make bricks out of straw:

a. first, there was no evidence from FST that it did in fact subject all Seals to a visual quality inspection at a magnification of 2.5 (the only evidence for this was in an FST document called "Control Plan" – however, as I have already pointed out, there is no basis on which I can find that FST in fact carried out the inspections referred to in this control plan).

b. second, as to the evidence that could be obtained from returned Seals, Mr Bennett inspected a sample of 10 such Seals, as he explains in detail in his report, using approximately 40x magnification (or higher). These Seals were all heavily swollen due to the amount of oil exuding from the body of the polymer, but his evidence is that "many of the images clearly show moulding defects…consistent with what I would have expected to see, given the likely impact of the high compound viscosity and tooling changes" he had identified. It is his evidence that these surface defects (including flow marks indicating scorch of the compound) are not merely cosmetic, but affect the performance of the Seal. Specifically they provide access points for fluids to interact with the polymer, leading to oil swelling from the middle of the Seal and thus dimensional changes in service. Many of the samples showed worn or badly formed lip profiles. However, Mr Bennett also noted that "Because the swell that the returned seals experienced in service makes their moulding defects less apparent, it is impossible to determine the extent of those defects on manufacture…". This seems to me to answer the suggestion that further inspection of seals would have provided additional evidence. It does not, however, support the proposition, advanced by FST, that "Dana cannot prove this element of its case". On the contrary, Mr Bennett's evidence shows, on balance, that the returned Seals were suffering from precisely the defects he had anticipated would be present in light of the combination of a high viscosity compound moulded in cavities with reduced Cap thickness. That the poor condition of the returned Seals makes it impossible to determine the full extent of the defects on manufacture is neither here nor there.

189. During his oral evidence, Professor Yadav described FST's processes as "out of control most of the time". His retrospective analysis of FST's processes over the Relevant Period, using FST's data, demonstrates a largely unstable process with a very significant number of processes relating to specific specifications for the Seals falling below the benchmark Ppk value of 1.67 set by FST and considered appropriate in the Industry more generally. In around a third of cases, the Ppk value was even less than 1.00. Professor Yadav said in his report that in his experience it was extremely rare to see Ppk values this low: "They indicate very poor process performance and very high variability throughout the Relevant Period". For some specifications, including the dust lip diameter, the height dimensions and the radial force, there was not a single Ppk value of 1.67 or greater over the entire Relevant Period. Professor Yadav described FST's process stability and Ppk values as "among the worst I have seen in my experience". He expressed the view that "it is statistically highly likely that many of [the] seals would not have met specifications".

190. Against that background, I have no difficulty in inferring that FST sought to manipulate its Ppk values, as I have previously described, in circumstances where it realised that its processes were out of control and wished to hide that fact from Dana during the root

cause analysis with a view to persuading Dana to look elsewhere for the cause of the oil leaks.

191. For all the reasons identified above, I consider that FST was in breach of its express and implied obligations in that it failed properly to maintain the cavities (and in this context I make it clear that I understand the Cap thickness reduction and the assessment of the consequences of the Cap thickness reduction to be part of the maintenance of the cavities) and/or failed properly to manufacture the Seals in the cavities. I consider that, on balance, the Seals were not of satisfactory quality owing to these failures, and further they were not fit for the purpose identified above.

Failure to manufacture the Seals with appropriate or consistent width dimensions of the Sealing Lip (Issue 4.2)

192. Dr Carbonara's evidence, which I accept, is that in order to form and maintain a stable lubricating layer capable of preventing direct contact between the Seal and the Shaft (and thus preventing excessive Seal wear), it is essential that the dimensions of the main Sealing Lip are tightly controlled (i.e. uniform) in the design and manufacturing process. Dr Carbonara cited various technical publications in his report which supported this proposition. If the Sealing Lip width is not uniform around the circumference of the Seal, the radial pressure exerted by the Seal on the Shaft will not be uniform and this will result in a non-uniform and unstable lubricating layer, as demonstrated by the Stribeck Curve, which explains how friction affects lubrication.

193. A stable uniform lubricating layer is necessary because the Seal is not designed or intended to make direct contact with the Shaft. Rather the Seal and the Shaft should only contact the lubricating layer that sits between them. Any unintended direct contact causes the Seal to wear, which in turn widens the Sealing Lip, making the area greater over which the garter spring exerts force so that the radial pressure the Seal exerts on the Shaft is reduced.

194. FST appears to have been aware of the critical role of the Sealing Lip design in forming an effective lubricating layer and, in turn, preventing oil leakage, as is clear from what appears to be a presentation on Seal Technology given by FST in June 2003. Further, FST's internal Work Instructions make it clear that "The sealing edge is decisively responsible for the dynamic sealing behaviour…" and that "Irregularities on the sealing edge…can therefore interfere with the sealing behaviour". FST's design drawing describes the quality of the main Sealing Lip as a "critical item" and specifies "primary sealing lip no cuts, tears, excessive flash, blisters, voids, flow lines and knit lines". Mr Heldmann's understanding in cross examination was that a flow line was an anomaly that might arise in the process of production by reason of the way in which the polymer flows into the cavity. He agreed that the presence of any of these things would be regarded by FST as "defects" and could lead to the penetration of oil into the Seal, which itself could cause swell. He also agreed that from an engineering perspective swell can cause a lack of uniform dimensions. He accepted that any of these factors could lead to leakage of the Seal in service.

195. Notwithstanding FST's understanding of the critical role of the Sealing Lip design, it would appear that FST did not seek to measure or evaluate in any way the consistency of the Sealing Lip width on the Seals supplied to Dana.

196. Indeed this critical role made it all the more important that FST monitored its manufacturing process so as to ensure uniformity and consistency of design. I have

already dealt at length with its failures in this regard and with Professor Yadav's findings which are also relevant here. Dr Carbonara saw no evidence that FST measured or evaluated in any way the consistency of the Sealing Lip width on the Seals sent to Dana. Whilst there is evidence that FST measured the Sealing Lip diameter in the period between January 2013 and December 2016, it did so in relation to only 0.04% of Seals produced, an insufficient sample to be determinative in any event.

197. In his written closing submissions, Mr Wygas contends that publications to which he took Dr Carbonara in cross examination plainly show that the agreed specifications for the angle of the Sealing Lip were well within the recommended range. Dr Carbonara responded that these publications were not authoritative and very far from finding, as FST invites me to do, that Dr Carbonara's response was "clearly nonsense", I accept Dr Carbonara's evidence for reasons I have already given. Absent any expert evidence from FST, I cannot say whether any particular publications are "authoritative"; I certainly cannot do so in the face of evidence from Dr Carbonara to the contrary.

198. Dr Carbonara microscopically measured the dimensions of 10 returned Seals, using magnifications of up to 200x. His inspection revealed extensive wear and deformation to the Sealing Lip area and helix bars, with substantial distortion in shape and size from the intended geometry. The Sealing Lip widths were as much as ten times, or more, larger than the Sealing Lip widths in unused Seals (manufactured between November 2016 and November 2017) to which Dr Carbonara also had access. Dr Carbonara's findings from his inspection of the returned Seals were consistent with Mr Bennett's findings (referred to above) that the Seals were all subject to swell; which itself causes the dimensions of the Seals to change in service. It was Mr Bennett's view (again as recorded in more detail above) that any under-fill of the cavity brought about by the change in Cap thickness coupled with the use of a high viscosity polymer will have affected the dimensions of the Sealing Lip.

199. During the root cause investigations, FST reported in a presentation that the Seals that it had examined "show [an] excessive wear band", a finding that is consistent with the findings of Dr Carbonara and Mr Bennett. At the time, FST postulated that this could be caused by, amongst other things "poor lubrication conditions". It is Dr Carbonara's view that "This type of wear is only consistent with the seal having come into direct contact with the rotating pinion shaft" (i.e. by reason of unstable lubrication).

200. Dr Carbonara's view is that this direct contact, arising by reason of poor lubrication, has two potential causes – first a non-uniform Sealing Lip width resulting in non-uniform radial pressure; and second issues with the way in which the Seal and Shaft interact (i.e. Shaft defects and Seal installation issues). However, Dr Carbonara has ruled out the latter because (i) the wear identified on the failed Seals is consistent with a non-uniform Sealing Lip; and (ii) the parties' testing and analysis during the root cause investigation strongly suggest that Shaft defects and Seal installation issues were not the cause.

201. Indeed various of FST's test reports record that "The shaft shows no abnormalities" and that although a counter clockwise machining lead had been found, that could be considered "not to cause an oil leakage". These test results did however report a "wide wearband" at the Sealing Lip. Furthermore, FST's own specialist statistical analysis department, Six-Sigma, concluded in a document dated 4 October 2017 and marked "Internal document not for customer" that neither the dust or main Sealing Lip wear

could be correlated to "Lead Direction of Shaft OR Lead Angle"; similarly that the wear groove depth found on the returned Seals could not be correlated to the lead angle.

202. It is Dr Carbonara's evidence that non-uniform Sealing Lip widths will prevent the formation of a stable lubricating oil layer between the Seal and the Shaft and that without this stable lubricating layer, the Seal will experience excessive wear, well beyond what might be expected in the initial break-in period of the Seal when some wear inevitably occurs, such that it is unable to fulfil its sealing function. The lack of uniformity in the Sealing Lip widths can only have resulted from FST's production process, in Dr Carbonara's view, and will have resulted either at the point of manufacture or by reason of non-uniform expansion (swelling) in service. Dr Carbonara explained this in his oral evidence as follows:

"if you have some localised disruption in dimension, whether it comes from the manufacturing process directly or from the fact that the manufacturing process was deficient and allowed swelling to occur in the seal, you are getting the same effect. You are getting a non-uniform circumferential dimension of the sealing lip which doesn't allow a stable lubricating boundary layer to form".

203. Mr Bennett's evidence to which I have already referred explains why these issues are, on balance, likely to have occurred here: (i) poor production methods resulted in Seals with defects such as flow marks, which resulted in increased swelling in service, in turn creating non-uniform dimensional deformation around the circumference of the Seal; and (ii) high viscosity levels combined with the adverse impact of the Cap thickness change resulted in cavities that would not properly fill, including at the main Sealing Lip, causing irregularities in dimensions of the Sealing Lip.

204. Mr Wygas contended in his written closing submissions that "Dr Carbonara and Mr Bennett have alighted between themselves on a brand new failure mode for pinion seals" and he asserted that "it is a highly theoretical failure mode which could only have been considered possible by people with little or no experience of how pinion seals actually operate". For reasons I have already made clear when addressing FST's criticisms of Dana's expert evidence, I cannot possibly accept this submission. I have no evidence whatever on which to find that the likely failure modes identified by Mr Bennett and Dr Carbonara are in any way theoretical, or indeed that similar failure modes have never previously been seen in pinion seals. Indeed, Mr Wygas' attempt later in his written closing submissions to appeal to "common sense" on the issue of the failure mechanism, just serves to illustrate the difficulties faced by FST in the absence of any expert evidence of its own.

205. Further and in any event I note that the Association for Rubber Product Manufacturers Sealing System Leakage Analysis Guide considers "insufficient lubrication at seal lip" to be one of five probable causes of "Excessive Wear" on a leaking Seal. In my judgment there can be no serious dispute that excessive wear of a Sealing Lip causes leakage and Dr Carbonara and Mr Bennett have described the mechanism by which this occurs. There is no evidence to the contrary.

206. In the Expert Joint Statement, Dr Carbonara acknowledged that the dimension of the Sealing Lip is not specified in industry standards. Mr Wygas suggested in closing that the fact that industry standards do not mention the width of the Sealing Lip should have caused Dr Carbonara seriously to question the modes of failure that he (and Mr Bennett) had identified. Mr Wygas pointed to Dr Carbonara's statement in cross examination that "most standards assume that the lip will be uniform", noting that industry standards

do not assume anything and that if any dimension in a pinion seal was required to be uniform, it would have been specified as such in the relevant standards. However, once again I have no expert evidence on this from FST and I note that Dana is entirely right to say by way of response that FST has not presented any industry standard that *permits* a non-uniform width dimension at the main Sealing Lip. I am certainly not in a position to determine (absent expert assistance) that Dr Carbonara's evidence about this is wrong.

207. Dr Carbonara inspected 20 unused Seals manufactured between November 2016 and November 2017 (i.e. after the Relevant Period). These Seals exhibited, to varying degrees, Sealing Lip widths which were not uniform around their circumferences. The Seals showed evidence of issues with the polymer filling the cavity in the Sealing Lip area, such that the Sealing Lip was not properly formed by the configuration of the cavity. Furthermore, six of the ten unused Seals for which Dr Carbonara carried out oil and air side angle measurements were outside of FST's specification. Dr Carbonara's view, which I accept, was that "at least with respect to the process used to make the unused seals I reviewed, FST was producing seals of questionable quality". Dr Carbonara inferred that Seals manufactured during the Relevant Period suffered the same issues, but to an even greater degree, although he expressed caution owing to the fact that the unused Seals were not made with the same equipment or process parameters as Seals manufactured in the Relevant Period. I have no reason to doubt Dr Carbonara's evidence.

208. In all the circumstances, I consider that FST was in breach of its express and implied obligations in that, on balance, it failed to manufacture the Seals with appropriate or consistent width dimensions of the Sealing Lip. I consider that, on balance, the Seals were not of satisfactory quality owing to this failure, and further that the Seals were not fit for the purpose identified above. Dr Carbonara's view, which I accept, is that the excessive wear, in service, which he identified is "clear evidence that these seals leaked due to non-uniform sealing lip widths around their circumference". He explained his analysis very clearly whilst giving his evidence:

> "What happens…is that as the wear occurs on the sealing lip, the diameter of the sealing surface increases because now the seal is getting worn and now the garter spring cannot exert more pressure because as that gets larger, you have to contract the garter spring in order to increase the pressure. So what happens is, once the wear gets to that point and the pressure is decreased, you have leakage".

Failure to manufacture the Seals in accordance with the hardness specification (Issue 4.3)

209. Given the overwhelming evidence as to breach in relation to issues 4.1, 4.2 and 4.4, I need deal with this allegation only briefly.

210. During his opening submissions, Mr Webb accepted that the focus of this case is not on hardness, but said "that is not to say that hardness is completely irrelevant and you will see that the experts do analyse that and do look at that in some detail as an issue".

211. Dana submits, as a matter of inference, that, on balance, Seals will not have been produced during the Relevant Period which complied with the hardness specification. It accepts that FST did not in fact test the hardness of the Seals they produced (instead measuring coupon samples of the polymer compound which Dr Carbonara considered insufficient to determine the hardness of the finished Seals), but it relies primarily upon (i) the fact that there is no evidence that FST carried out regular checks as to whether

the Seals conformed to the hardness specification; and (ii) Mr Bennett's view that there is a link between viscosity and hardness, such that if materials have a different state of cure that "will affect technically the hardness" and further that premature crosslinking (scorch) leads to a reduction in physical properties, including hardness. Mr Bennett considers that "seals produced outside the hardness specification are more likely to fail in service and if a seal is of insufficient hardness, its ability to swell will be greatly increased and its resistance to the oil in service will be correspondingly reduced…".

212. The high point of Dana's case on this issue is Mr Bennett's view that "Freudenberg's quality controls in respect of the hardness of finished seals were not consistent with good engineering practice or appropriate to ensure conformity of the seals with specification or fitness for purpose".

213. Dr Carbonara's relevant evidence does not take matters any further: he notes in his report that "it is very important for the desired hardness of a seal to be properly specified and achieved in manufacturing" and that "Since FST (again contrary to good engineering practice) did not test the hardness of finished seals, it cannot have known whether or not the seals that it was supplying to Dana complied with the hardness specification. To the extent that any seals were below FST's hardness specification, this would have exacerbated the wear as a softer material wears faster than a harder one". In his oral evidence Dr Carbonara acknowledged that hardness does not independently have a direct impact on Seal performance and he accepted that tests for hardness could only be done on a new Seal. There is no evidence that either party has tested any new and unused Seals from the Relevant Period for hardness.

214. On balance, and in circumstances where neither expert is able to say that there has been a breach of the hardness specification, I am not satisfied that I have sufficient evidence on which to infer breach.

Quality Control Issues, particularly in respect of: the flow and/or curing of the polymer and/or the post-curing processes and/or the viscosity of the polymer feedstock, which quality control issues were contributed to by changes made to the manufacturing processes and/or cavities and/or injection moulding machines (including changes to the dimensions of the runner system cap in about September 2013) (Issue 4.4)

215. In dealing with Issues 4.1 and 4.2, I have largely dealt with the overarching quality control issues arising in respect of FST's manufacturing process. I consider that FST was in breach of its express and implied obligations in the quality control issues identified and I consider that, on balance, the Seals were not of satisfactory quality owing to this failure, and further that the Seals were not fit for the purpose identified above.

216. FST manufactured the Seals in cavities with reduced Cap thickness in a process which was entirely unvalidated and unable to handle the high and fluctuating viscosity of the polymer compound. This resulted in Seals being produced which were not of satisfactory quality or fit for purpose. In particular, the Seals produced suffered from all the consequences of poor flow through the cavity, including scorch/poor cross linking and premature curing, incomplete filling of cavities, flow lines and weld lines. The resulting Seals lacked appropriate durability.

217. For present purposes I should add one or two additional points.

218. It was Mr Bennett's evidence that the failure rates increased dramatically at the time of the Cap thickness change. From that point in time to the end of the Relevant Period, variations in failure rates were closely aligned with variations in the viscosity of the polymer compound. This strikingly close relationship was shown by Mr Bennett in Figure 10 of his report.

219. On 30 September 2015, FST replaced the body of the machine that it used to mix the compound from which the Seals were moulded. The mixer body is the part of the machine that contains the rotors and provides space for the mixed material to move around and flow between the rotors during mixing. It was Mr Bennett's evidence that over time, the mixer would wear, meaning that the clearances between the rotors and the body become too large for efficient mixing to take place. This ultimately results in a poorer quality of mix and increased viscosity levels. On replacement of the mixer body, the clearances between the rotors and the body are reduced, which in turn substantially reduces the viscosity of the mixed compound.

220. Viscosity data provided by FST evidenced that immediately following the change in the mixer body, the fluctuations in recorded viscosity values reduced considerably. Monthly average viscosity levels fell from consistently higher than 3.6 ML to consistently lower than 3.6 ML.

221. It was Mr Bennett's view, which I accept, that given the effects of the high compound viscosity that he identified during the Relevant Period, a substantial reduction in viscosity levels will have improved the properties and performance of the finished part. Compound mixed using the new mixer body would have been used to mould Seals from around November 2015 onwards and those Seals would have been installed in vehicles built from around December 2015 onwards. Accordingly, it was his view that "the introduction of the new mixer body was the main cause of the failure rates of the seals reverting to normal levels".

222. This evidence is important because it helps to provide the Court with the final piece of the jigsaw in relation to the Seal failures. Those failures began in 2013 when viscosity levels were high and the change to the Cap thickness was made. They continued until early 2016 when the new mixer body would have acted to reduce the viscosity levels of the polymer, so rendering it less likely that defects would be caused by the Cap change alone. The failure levels then returned to normal. The close correlation between the various manufacturing changes and the beginning and end of the Relevant Period seems to me to provide significant support for Dana's case that the cause of the leaking oil was defective Seals. There is no evidence to explain why any other possible cause identified by Mr Wygas would have been confined to the Relevant Period.

223. Mr Bennett carried out a correlation analysis between viscosity and Seal failure rates between October 2013 and February 2017 (the latest date for which FST disclosed viscosity data), concluding that it demonstrated a very strong statistical relationship between viscosity and failure rates. Indeed it was his view that that relationship remained robust whether the assumed time lag between Seal production and vehicle production was two, three or four months.

224. In my judgment, Dana does not need to rely on Mr Bennett's analysis to prove its case – I accept Mr Webb's submissions that there is already ample evidence to establish breach on the part of FST on the balance of probabilities. However, because it was central to the criticisms levelled by Mr Wygas at Mr Bennett's evidence and because,

if it were to be accepted, his statistical analysis would provide yet further, very substantial, support for Dana's case, I shall now consider it in more detail.

225. Mr Wygas criticised Mr Bennett's analysis on a variety of grounds. Key amongst these were: first that, by his own admission, Mr Bennett was not a statistician; second that Mr Bennett had not been instructed to carry out a statistical analysis; third that the data points used by Mr Bennett had been "stretched" over an inappropriate period and ignored a spike of failures in June 2013 (this latter point was accepted by Mr Wygas to be mistaken during his oral closing submissions when he conceded that the "spike" had been a spike in viscosity and not Seal failures); fourth that Mr Bennett had not analysed the Jaguar and Land Rover data separately although he admitted that it would have been more accurate to do so; fifth that he had chosen not to analyse the failure rate per vehicle, despite having the data available to do so and despite admitting in cross examination that if he was doing his analysis again he would "potentially look closer at each individual vehicle"; sixth that Mr Bennett assumed the same time delay between Seal production and vehicle production on every vehicle model notwithstanding that the underlying data demonstrated a five month time range for each of the three peaks in the Relevant Period; and seventh that Mr Bennett admitted that had he been aware that some vehicles were being repaired on multiple occasions, he would have taken that into account in his analysis.

226. I accept that various of these points hit home. Mr Bennett was obliged to make a number of concessions when being cross examined about his analysis and it was clear that, if called upon to do it again, he would probably have taken a rather different approach and factored in some additional information. However, on balance, and having given careful consideration to the competing submissions of the parties, I am not prepared to discount Mr Bennett's analysis for the following reasons:

    a. although Mr Bennett is not a statistician, he explained that he had nevertheless done what he would commonly do in his professional work (for experimental design purposes and for analysing historical data), i.e. undertake a statistical analysis to test his findings. In other words, he is familiar with the process and has experience of using statistical analysis in practice. This also explains why Mr Bennett decided to undertake such an analysis notwithstanding that he had not been instructed to do so;

    b. as to the time period adopted for his statistical analysis, Mr Bennett explained that he had adopted the Cap change as the start of the analysis because data from before and after this change represented "two different populations" which, given the substantial increase in failure rates occurring at the same time as the Cap change, would appear to be correct;

    c. as to the criticism that it was inconsistent to include data after the mixer body change, I accept Mr Bennett's explanation that the variable that he was controlling for was compound viscosity at the mixing stage. Because the mixer body change only impacts on that variable, there is no reason to exclude from his analysis data that occurred after that change;

    d. as to the suggestion (which Mr Bennett accepted) that he could have gone about his analysis in a different way, amongst other things by looking at smaller data sets, I agree with Mr Webb that the fact that Mr Bennett chose not to do this does not undermine his analysis. In particular I accept Mr Bennett's explanation that "If you are looking at small samples or small sections of the relationship,

the noise within that small sample that you have is actually quite significant. If you then look at the bigger picture, the noise levels become effectively reduced over the entire scale that you are looking at";

e. FST chose not to undertake any form of alternative analysis, which it could have done, even after seeing Mr Bennett's report. There is no evidence that, for example, looking at each individual model of vehicle would have made any difference at all to the overall analysis. In any event, FST has no positive pleaded case that any difference in vehicle models caused or contributed to the Seal failures;

f. as to the suggestion that Mr Bennett should have taken account of different time lags for different individual vehicle models, Mr Bennett did take this into account. As he explained, he sensitised his analysis for various time lags and the correlation remained robust at time lags of up to four months;

g. I accept that if one takes the whole vehicle cohort and plots it against the viscosity data then one sees a striking coincidence of data, particularly considering the limitations in the data (only one data point per month for vehicle returns). As viscosity goes up, after the Cap change, so do failure rates; as viscosity declines, after the change to the mixer body, so too failure rates decline. By February 2016, the failure rates get back to almost zero and stay there. Taking account of the difficulty of determining the precise time lag between compound mixing and vehicle build, the drop in polymer viscosity appears to align with the replacement of the mixer body. FST has offered no alternative explanation for this striking relationship between viscosity and failure rates. I accept that Mr Bennett's analysis shows that this correlation is not down to chance.

Did any breach of contract cause the loss and damage to Dana arising from the warranty claims in respect of failed Seals? (Issue 5)

227. It will be clear from my analysis on the issue of breach that I am satisfied that, on balance, the failure of the Seals is more likely than not to have caused the excessive wear and leakage of the Seals in service.

228. FST's central defence at trial was premised on the submission that Dana was unable to prove its case. This submission relied on attacking the views of Dana's experts, but it also relied heavily upon the proposition that the root cause analysis carried out by Dana (and addressed by Dana's witnesses in their evidence) had not ruled out various other potential causes and that, in the circumstances (and absent proper investigation by Dana's experts of those other potential causes) it was impossible to say, on balance, what the cause of the oil leakage was.

229. Such a defence, if supported by a pleaded case setting out the possible alternative causes together with expert evidence analysing those alternative causes, would not be in the least unusual. However, absent any positive pleaded case from FST as to the alternatives and absent any expert evidence to counter the views of Dana's experts, it is a somewhat surprising proposition.

230. In closing submissions, Mr Wygas criticised the evidence of Dana's experts on the grounds that it had failed to address the various potential causes of the oil leakage identified at the root cause analysis stage, including potential issues with the Shaft lead,

corrosion, contamination and press depth (i.e. installation of the Seals into the axle). He submitted by reference to contemporaneous documents and to the factual evidence of Dana's witnesses that various of these possible failure mechanisms had never in fact been satisfactorily ruled out by Dana and that, in reality, despite Dana's expert evidence being presented as providing a positive conclusion as to the cause of the oil leakage, it was actually based on excluding other possibilities and yet there was no evidence that those other possibilities had in fact been satisfactorily excluded.

231. I reject these submissions. Whilst I accept that there is contemporaneous evidence of both parties considering other possible causes during the root cause analysis, as one might expect, nevertheless:

a. FST's own internal analysis (not shared with Dana during the joint root cause analysis) shows that it found no correlation between the wear to the Seals which resulted in the premature Seal failures and any of the alternative causes it investigated;

b. Dana's witnesses confirmed that Dana had ruled out other possible causes. In his cross examination of Mr Ashenfelter and Mr Bray, Mr Wygas extracted various concessions as to the fact that it was possible that oil leakage could have been caused by one or more other potential failure mechanisms (not the responsibility of FST), and he sought to rely heavily on these concessions during his closing submissions. However, as Mr Wygas accepted during those submissions, Dana's factual witnesses could not give opinion evidence. Their views, extracted during cross examination in the absence of any pleaded positive case as to causation, carry little weight and certainly cannot be relied upon to undermine the views of Dana's experts;

c. Mr Wygas sought to criticise Dana in his closing submissions for not calling any evidence from the individuals in the US with responsibility for carrying out the root cause analysis, suggesting that contemporaneous documents indicated that no conclusion had been arrived at as to the root cause and that the "only reasonable conclusion" the Court could reach from Dana's failure to call these individuals was that their evidence would be unhelpful to Dana's case. Mr Wygas went so far as to suggest that "not providing evidence of the real root cause analysis carried out in the US is fatal to Dana's case". However, as with a number of other points made by Mr Wygas in his closing submissions, this point had no substance and was described by Mr Webb (in my view, correctly) as "an error and a myth". In fact, Mr Ashenfelter is the senior warranty manager for the whole of the Dana group. He is based in Ohio and, as he explained in his evidence, he was at the heart of carrying out the root cause analysis;

d. importantly, at the time of the root cause analysis, Dana was not informed of the tooling change to the Cap thickness; information which I infer FST knew to be significant. Had Dana been informed earlier, it might have been possible to bring the losses to an end at an earlier time. I can only infer, as I am invited to do, that FST did not divulge this information to Dana in order to "put it off the scent" during the root cause investigations and to distract attention away from it during these proceedings. Where Dana's experts now (finally) have access to full information about the Cap thickness change they have been able to provide clear and compelling evidence as to the cause of the failure.

232. As I pointed out during closing submissions, none of the potential causes identified by Mr Wygas has been pleaded by FST and no positive case has ever been run by FST as to the cause of the leaking oil, a point with which Mr Wygas was forced to agree. During submissions, Mr Wygas suggested that it was FST's view that there were a combination of possible causes, but, again, this has never been pleaded. I do not see why Dana's experts were required to analyse all of the potential causes of the Seal failures in circumstances where FST has never sought to assert a positive case as to those causes. I note in this regard that other possible causes were not included as specific issues in the agreed disclosure review documents and nor were they agreed for discussion between the experts in the Expert Joint Statement. During his closing submissions, Mr Wygas acknowledged that "It may well be that these amendments [to plead other possible causes] should have been made in relation to when disclosure was obtained…And it may well be the case, my Lady, that the defendants had a better answer on things like torque to rotate. But the defendant can't put that forward".

233. In the circumstances, I accept Mr Webb's submission that Dana's experts were entitled to provide their opinions as to the most likely cause of the Seal failure without considering the host of other possibilities now postulated by Mr Wygas and I see no reason to consider each and every one of those possibilities in this judgment.

234. In his opening submissions, Mr Wygas submitted that there were "real similarities" between the facts of this case and the facts of the well-known case of *Rhesa Shipping Co v Edmunds, The Popi M* [1985] 1 WLR 948. In that case, the owners of a ship that had been lost at sea in calm waters sought insurance cover on the grounds that the loss must have been caused by the "perils of the sea". The insurer's case was that the shipowners had not proved the reason for the loss of the ship and so could not prove their case. Mr Wygas submitted that the ship owner's case was based on eliminating other causes and he relied on the speech of Lord Brandon to the effect that:

> "The shipowners could not, in my view, rely on a ritual incantation of the generic expression "perils of the sea", but were bound, if they were to discharge successfully the burden of proof to which I have referred, to condescend to particularity in the matter".

Mr Wygas submitted by reference to *The Popi M* that Dana could not simply assert that because the RDU leaked, therefore FST must be at fault and that Dana has to show that it has excluded all causes (which are not FST's responsibility) of each constituent part of the sum claimed by way of damage.

235. In my judgment, however, this is to misunderstand the decision in *The Popi M*, which did not find that to prove loss, a claimant must rule out all other potential causes of loss categorically. On the contrary, the House of Lords said that a claimant's burden of proof is "a balance of probabilities" and that the Court must "be satisfied on the evidence that it is more likely to have occurred than not".

236. *The Popi M* was concerned with the approach the Court should take in the very unusual situation where it is presented with a number of improbable causes such that it cannot properly make a finding in favour of the claimant. That is most certainly not the case here. As Mr Webb submitted, there is nothing remotely improbable about a pinion seal failing to fulfil its function because it is of unsatisfactory quality. To my mind, *The Popi M* is simply not engaged on the facts of this case.

237. In this regard, Mr Webb drew my attention to the conjoined appeal in Ide v ATB *Sales Ltd* and *Lexus Financial Services T/A Toyota Financial Services UK Plc v Russell* [2008] PIQR P251. These cases, brought under the Consumer Protection Act 1987 ("**the CPA**"), concerned the burden of proof and mechanisms of causation in relation, respectively, to an accident involving a bicycle and a fire at a garage. Mr Webb submitted, and I accept, that the reasoning of the Court in dealing with a form of quasi strict liability under the CPA is equally applicable to breach of contract cases, including claims under the statutory terms implied by the Sale of Goods Act, which impose strict liability with no requirement to prove negligence.

238. Unlike this case, the defendants in each case had positively advanced alternative explanations for the cause of the accident and the fire. Thomas LJ pointed out that

> "*The Popi M* was a very unusual case and as these two appeals demonstrate, the difficulties identified in that case will not normally arise. In the vast majority of cases where the judge has before him the issue of causation of a particular event, the parties will put before the judges two or more competing explanations as to how the event occurred, which though they may be uncommon, are not improbable. In such cases, it is, as was accepted before us by the appellants, a permissible and logical train of reasoning for a judge, having eliminated all of the causes of the loss but one, to ask himself whether, on the balance of probabilities, that one cause was the cause of the event. What is impermissible is for a judge to conclude in the case of a series of improbable causes that the least improbable or least unlikely is nonetheless the cause of the event…"

239. Each case thus involved competing explanations for the cause of the damage but the Court of Appeal rejected the suggestion that either case was a *Popi M* case, concluding that the correct approach was to analyse which of the competing causes was the stronger possibility.

240. In this case, where FST has chosen to plead no positive case, I have not even been presented with a number of competing explanations from which I must choose. I have instead a mass of compelling expert evidence identifying the likely failure mechanisms of the Seals and supporting the proposition that Seals which failed prematurely in service were not of satisfactory quality, absent any other explanation being established.

241. I also infer, as I have already made clear, that (i) the failure to plead any alternative explanation, (ii) the failure to rely on any evidence as to its manufacturing processes, (iii) the manipulation of data as to those manufacturing processes, and (iv) the failure to disclose information to Dana about the change to the Cap thickness, indicates knowledge on the part of FST that there is no such alternative explanation that it can credibly advance. In the circumstances, I fail to see how any of FST's submissions about the results of the root cause analysis improve its position.

242. This is not a situation in which I can conclude, as Mr Wygas invites me to do, that the proximate cause of the leaking oil, even on the balance of probabilities, remains in doubt, with the consequence that Dana has failed to discharge the burden of proof. The correct test is not whether the Court can exclude all other possibilities (which are possible although may be less likely than the probable cause). The test to be satisfied is whether a possible cause is more likely than not to be the case. As Toulson LJ made clear in *Milton Keynes Borough Council v Nulty* [2013] EWCA Civ 15:

"[34] So at the end of any such systematic analysis, the court has to stand back and ask itself the ultimate question whether it is satisfied that the suggested explanation is more likely than not to be true. The elimination of other possibilities as more implausible may well lead to that conclusion, but that will be a conclusion of fact; there is no rule of law that it must do so.
[35] The civil 'balance of probability' test means no less and no more than that the court must be satisfied on rational and objective grounds that the case for believing the suggested means of causation occurred is stronger than the case for not so believing".

243. I have concluded that the evidence is more than sufficient to satisfy me that it is more likely than not that the defects in the Seals caused the oil leakage. I simply draw attention here to the evidence of Professor Yadav as to the number of Seals that would have been produced out of specification based upon their calculated process performance:

    a. for Seals produced in Cavity 1:

        (i) during 2013, between 2.4% and 5.4% (i.e. between 24,284 and 54,129 Seals outside specification);

        (ii) during 2014, between 3.1% and 4.1% (i.e. between 31,145 and 40,608 Seals outside specification); and

        (iii) during 2015, 1.1% (i.e. between 11,143 and 11,471 Seals outside specification).

    b. for Seals produced in Cavity 2:

        (i) during 2013, between 0.6% and 1.0% (i.e. between 6,107 and 10,027 Seals outside specification);

        (ii) during 2014, between 3.3% and 5.5% (i.e. between 32,949 and 54,675 Seals outside specification); and

        (iii) during 2015, between 1.5% and 2.5% (i.e. between 14,611 and 24,612 Seals outside specification).

244. According to Professor Yadav, if Seals do not meet specification, they are "highly likely" to fail. A failed Seal is one which leaks and thereby does not fulfil its primary purpose of sealing. I ask rhetorically why it would have been necessary for FST to engage in the (now admitted) manipulation of its data had it not appreciated that if its system was out of control it would produce Seals that were out of specification and liable to fail.

245. I should add that, contrary to submissions made by Mr Wygas, it is not necessary for Dana to prove the precise mechanism of the premature failure (see *Ide v ATB Sales Ltd* [2008] EWCA Civ 424), merely that the evidence is supportive of the conclusion that, on the balance of probabilities, the Seals leaked prematurely by reason of FST's breaches of contract, which resulted in Seals being manufactured which were not of satisfactory quality or fit for the purpose of preventing oil from leaking from the differential. I have accepted Dana's case that, on balance, a significant proportion of Seals were not of the requisite durability (within the meaning of section 14(2B) of the Sale of Goods Act 1979). There is no expert evidence from FST to suggest any other possible cause.

246. By reason of the premature failures of the Seals, I accept that Dana was obliged to reimburse, and has reimbursed, JLR for the repair costs (including parts, labour, handling and other associated costs). Dana's obligation to reimburse JLR for these costs is not disputed.

Limitation (Issue 6)

247. Given my conclusion that the contractual relationship between the parties was at all times governed by Dana's terms and conditions such that it was subject to English law, the issue of limitation under German law does not arise. However, I deal with it very briefly below.

248. Overall, it appears to have been common ground between the German law experts that:

a. in the event of incorporation of the FST Terms into the contract, then clause 8.4 (which provides that claims for defects of delivered products shall lapse 1 year after delivery of the products) would be valid under German law: a one year limitation period would apply;

b. a new limitation period would apply for a claim based on each individual Seal. That limitation period would begin with the delivery of each Seal;

c. the limitation period has been properly invoked by FST;

d. section 203 of BGB applies both for contractual limitation periods and statutory limitation periods. It provides that:

"If negotiations between the obligor and the obligee are in progress in respect of the claim or the circumstances giving rise to the claim, the limitation period is suspended until one party or the other refuses to continue the negotiations";

e. the limitation period was suspended by reason of negotiations between the parties;

f. the negotiations between the parties ended on 22 January 2018 when FST sent a letter to Dana definitively rejecting its claims. As of that date, Dana would have had at least 3 months to commence proceedings in respect of any claims that were not time barred prior to the start of the suspension of the limitation period;

g. Dana issued the proceedings on 14 February 2018.

249. The main area of dispute between the experts was as to the meaning of section 203 BGB and thus the date on which the suspension of the limitation period commenced. In short, Professor Schwenzer opined that section 203 BGB should be given full effect and interpreted broadly. It was her view that there is no requirement for either party to formulate and articulate a specific claim at the outset of negotiations: limitation is suspended where the parties engage in any kind of exchange of views on either the claim or the circumstances giving rise to it. Professor Pfeiffer, on the other hand, took the view that negotiations could only begin once a claim had already been asserted and he pointed to various precedents in support of his approach.

250. Simply looking at the wording of section 203 BGB, I find it difficult to accept Professor Pfeiffer's view. It seems to me to be clear that section 203 expressly provides for two circumstances in which negotiations may bring about a suspension of the limitation

period: first, where they are in progress "in respect of the claim" and second where they are in progress in respect of the circumstances "giving rise to the claim". If Professor Pfeiffer is correct, then there would be very little, if any, distinction between these two situations.

251. Indeed it became clear during Professor Pfeiffer's evidence that whether a claim has been asserted is a multi-factorial question which would be decided by a German court by reference to:

a. the wording of the relevant document;

b. the relationship between the parties;

c. the factual matrix insofar as that is known to the parties (such as prior dealing or the general understanding of mechanisms in the industry); and

d. the objective understanding of the parties judged by reference to the reasonable person standing in their shoes, save where the parties can be shown to have had the same subjective understanding, in which case it is permissible to have regard to that subjective understanding.

252. To my mind, this brought Professor Pfeiffer's position closer to that of Professor Schwenzer in that the express assertion of the existence of a claim is plainly not necessary in all cases.

253. Furthermore, I note that the broad interpretation favoured by Professor Schwenzer appears to be consistent with the purpose of the legislation, as agreed by both experts, namely to facilitate discussions between the parties and to avoid unnecessary commencement of proceedings. It is difficult to see how a limitation period as short as one year (or in the case of the German statutory period, two years) could operate fairly in the absence of a mechanism for suspending time which operates generously.

254. Having regard, then, to Professor Schwenzer's interpretation, I consider that negotiations for the purpose of section 203 BGB commenced on 30 April 2014, as Dana contends. On this date, Mr Marklew emailed FST raising the issue of the leaking Seals in the following terms:

"Hi Martin, I have received 2off Jaguar X152 Rear axle back from Jaguar with pinion oil leak (Reported) Can you please take a look at the seal's part No 55551 and flange and report your findings. Can you please confirm the address is correct."

255. I accept Dana's submission that this was a communication that triggered lengthy engagement between Dana and FST to investigate the causes of the Seal leaks and that it had the effect of commencing negotiations in respect of circumstances giving rise to a claim and thereby of suspending the running of the limitation period. Whilst the question of when negotiations began for the purposes of the operation of section 203 is plainly a matter for the Court, I note Professor Schwenzer's evidence that from a legal perspective, Mr Marklew's email of 30 April 2014:

"was all that Dana could do at that time, and all that was required. The German Courts would understand the commercial context of the communication – which does not appear frivolous – and, as such, conclude that Freudenberg should have understood that this was the opening of an exchange that might become adversarial, depending on the outcome of the investigation".

256. Accordingly, I reject FST's contention that negotiations only began on 31 October 2017. I find that negotiations began on 30 April 2014 and that they continued until 22 January 2018.

257. In the circumstances, had it been relevant, I would have found that Dana's claim is not time barred by reason of clause 8.4 of the FST Terms. It was brought in time.

Quantum and Relief (Issue 7)

258. Paragraph 18(b) of the Dana 2011 Terms provides as follows:

> "Indemnification by Supplier: Supplier agrees to defend, indemnify, and hold harmless Dana, its affiliates and customers…..from and against any and all judgments, settlements, awards, losses, claims, actions, demands, causes of action, liabilities, direct and indirect damages (including loss of profits, consequential damages and punitive damages), costs, fines, penalties, assessments, charges and expenses (including reasonable attorneys' fees, experts' fees, professional fees and internal and external costs of investigations, litigation, hearings, proceedings, documents and data productions and discovery), however described or denominated, arising out of, incidental to or resulting from Supplier's performance of the Agreement, including: i. any breach by Supplier of any of its representations, warranties, covenants or obligations set forth in the Agreement….."

259. Dana therefore has a contractual entitlement to be reimbursed for the losses, costs, damages, expenses and claims that it has paid to JLR arising out of, incidental to, or resulting from FST's breaches of contract in supplying the defective Seals.

260. The position is not dissimilar under the statutory provisions. The correct measure of damages for a claim under section 14 of the Sale of Goods Act 1979 is as set out in section 53(2) of the Act, namely "the estimated loss directly and naturally resulting, in the ordinary course of events, from the breach of warranty".

261. Dana relies upon the long standing principle in *Biggin & Co Ltd v Permanite Ltd* [1951] 2 KB 314, in which the Court considered a buyer's appropriate measure of damages against the supplier of a defective product to be the sum of the settlement the buyer paid to its own customer to which it supplied the defective product. Dana also points to Bence Graphics International Ltd v *Fasson UK Ltd* [1998] QB 87, where the Court of Appeal held that the correct measure of damages was the buyer's liability to its sub-buyers (and not the difference between the goods at the time of delivery and the value if they had fulfilled the warranty):

> "the buyer who has paid to his sub-buyer damages and costs for breach of the undertaking in the first contract of sub-sale…..may recover the amount paid by him to the sub-buyer, together with his own reasonable costs in reasonably defending the sub-buyer's claim against him; the damages and costs paid or incurred by the buyer are taken as the measure of damages for the seller's breach of the original contract" per Otton LJ at 97H.

262. Accordingly Dana submits that its direct and natural loss in this case is the amount it has incurred in discharging warranty claims made by JLR, namely £11,243,026 up to the fourth quarter of 2020 (the latest quarter for which Dana had full warranty return data at the time of the trial), together with further ongoing warranty claims by JLR

thereafter. These losses are, it submits, in essence the costs of the repair work required as a result of the failed Seals.

Quantum of Damage (Issue 7.1)

263. In its written opening submissions FST conceded that "Pursuant to the supply agreements between Dana and JLR, Dana is obligated to reimburse JLR for repair costs attributable to Dana's RDUs, should they fail. FST does not dispute that under the relevant agreements Dana has a liability to JLR". I did not therefore understand Dana's legal entitlement to seek recovery of the amount it has paid to JLR in discharging warranty claims (or its interpretation of the authorities to which I have referred above) to be in dispute.

264. The details of Dana's liability to JLR were set out in Mr Hill's statement, together with the documents attached to it and were not challenged by FST.

265. Mr Hill's statement explains that under Dana's contracts with JLR, it has an "obligation . . . to reimburse JLR for the repair costs of axles that experience faults attributable to Dana or its suppliers within the specified warranty period. This arises out of the supply agreements between Dana and JLR…, the JLR Global Terms and Conditions, JLR Warranty Recovery Web Guide and/or JLR Warranty Statement of Work".

266. According to those contracts, within a specified sample market, "The Supplier's liability shall be based on the actual warranty-related costs and expenses incurred by the Buyer". "For the avoidance of doubt the default sample market/s for Jaguar and Land Rover shall be the U.K.". In practice, I understand this to mean that each part returned to Dana as part of the UK warranty process is individually examined and its failure mode identified and recorded.

267. Outside of the sample market, "The Supplier's liability shall be based on an Acceptance Factor calculated each quarter of a year . . . using the warranty repairs and inspections made in the sample market during that quarter". "[T]he Phrase 'Acceptance Factor' means the percentage of Goods deemed to be non-conforming based on the results of inspected goods accepted by the Supplier (Category 1) from the sample market/s . . . as compared to the total number of inspected goods".

268. Mr Marklew explained in his evidence that this approach is adopted because the high volume of parts returned worldwide (i.e. outside the UK market) are not returned to Dana for analysis. Accordingly, in order to calculate the level of worldwide warranty claims, it is necessary to extrapolate from the results of Dana's inspections of UK parts using a calculation which assumes that, had Dana inspected the export parts, it would have accepted responsibility for the same percentage of them as it did for the totality of the UK parts.

269. In this way, "[t]he extent of the Supplier's [ie Dana's] liability to the Buyer [ie JLR] for warranty related costs shall be calculated" by an "Acceptance Factor".

270. The "Acceptance Factor", described by Mr Ashenfelter in his oral evidence as the "Share Rate", is set across a supplier's warranty obligations to JLR and is not specific to the particular product failure. As the warranty states:

"The nonconformity, fault, defect or failure of the Goods subject to the warranty repairs need not be the same for all warranty repairs relevant to the specific time period(s) [and therefore,] the Supplier's responsibility for warranty related costs for defective Goods

will be determined by extrapolation of the Acceptance Factor to the Buyer's total warranty costs relating to warranty repairs / replacements done during the specific time period".

271. I accept Dana's submission that it would be disproportionate for JLR and Dana to require the return of all parts worldwide and to inspect and adjudicate on each part that fails worldwide in the same way as is done in the UK. The mechanism of developing a share rate using data gathered from the UK market and then applying that share rate to the export market is, in my judgment, a proportionate and appropriate way of resolving warranty claims without incurring the prohibitive costs that would be involved in individually examining all parts returned worldwide.

272. Mr Marklew explained in his evidence, which I accept, the warranty claim process that applied in respect of UK warranty claims and worldwide claims and the calculation that he undertakes to arrive at acceptance levels for Seals (i.e. the number of Seals for which Dana accepts responsibility to JLR) together with the warranty recovery debit notes issued by JLR to Dana representing the amount due for parts which have been given a Reject Defect code ("CAT 1 parts") by Dana following inspection indicating its acceptance of responsibility for the failure. The amount shown on the warranty recovery debit notes issued by JLR is the amount paid by Dana for those returned parts.

273. Mr Marklew explained that from the start of Q2 2015 for Land Rover and the start of Q4 2015 for Jaguar, JLR and Dana agreed that the highly elevated numbers of warranty claims caused by the defective Seals should not be allowed to contaminate the overall warranty share rate (an issue that could occur where one product failure is responsible for the vast majority of warranty claims and that part has a much lower repair cost than the others being returned, in which case applying a supply-wide share rate will result in an enhanced warranty obligation) and so they treated the defective Seal issue separately. This involved setting an Acceptance Factor or share rate which was specific to leaking Seals. Mr Marklew explained in his cross examination that this entailed applying "a lower level against the rest of the claims, which is mainly axles; because the quantity of seal repairs outweighs the axles…If we carried it over, the bill would be three times, four times as much". This approach meant that the share rate for leaking Seals did not include the situation where an axle was replaced due to a leaking Seal because the export warranty data does not differentiate between axles returned due to Seal leaks and those returned for other reasons.

274. Dana calculates its quantum claim by reference to its payments to JLR for the Seal leaks. As Mr Ashenfelter explained, these payments reimburse JLR for the repair costs, either in replacing the leaking Seals using 'seal kits' (given the Reject Defect Code 'DI') or replacing whole axles which was required before Seal kits were available and also where loss of oil due to failed Seals had resulted in damage to other parts of the axle (given the Reject Defect Code 'AB').

275. The calculation of Dana's loss is set forth in Mr Ashenfelter's first and third witness statements. In short, Mr Ashenfelter explains that owing to the fact that UK returns are individually examined and the failure mode recorded, it was possible precisely to calculate Dana's loss caused by leaking Seals in respect of these returns – this could be done by totalling all costs given a DI or AB return code. However, because failure modes are not recorded for each part in the exports (worldwide) warranty process, it was necessary for him to estimate the percentage of axle returns that related to Seal leaks. He did this by calculating the percentage of UK axle repair costs that related to

Seal leaks and applying it to the export axle repair costs. In my judgment, this was a proportionate and reasonable approach to take.

276. Mr Marklew provided Dana's legal team at Crowell & Moring with historic quarterly data for UK part returns, including repair costs and Reject Defect codes. The data was contained in Excel files which could be interrogated so as to separate out the amounts connected with Seal leaks (i.e. the costs given a DI or AB return code). Crowell & Moring then calculated relevant total repair costs and percentages (i.e. the total repair costs for all CAT 1 returns with DI codes; the total repair costs for all CAT 1 returns with AB codes; the percentage of the repair costs for all CAT 1 returns represented by the AB and DI code returns and so on). Mr Ashenfelter used the results of these calculations in quantifying Dana's losses from both UK and export warranty returns (save in respect of Q1 and Q2 2016 where repair costs by part were unavailable because of the way in which JLR had formatted the files, thus requiring Mr Ashenfelter to estimate repair costs in these quarters related to the Seals based on the percentage of total repair costs that these represented in other quarters).

277. FST has not pleaded a positive case on quantum, choosing merely to make a non-admission in its Amended Defence that Dana has reimbursed, or that it continues to reimburse, JLR (a point which it now concedes). However for the first time at trial, FST has raised a number of previously unheralded criticisms of Dana's quantum claim. The first, and perhaps most fundamental, is that Dana cannot prove its claim without expert forensic accountancy evidence.

278. I reject this contention for the following reasons:

a. Dana points out, rightly, that the parties and the court have a duty to restrict expert evidence to that which is reasonably required to resolve the proceedings pursuant to CPR 35.1;

b. Dana disclosed documents evidencing its quantum claim in November 2019 and March 2020 and these have since been updated. The disclosure included all warranty recovery debit notes and the underlying data (in Excel format) on which the quantum calculations were based. FST did not notify Dana, as might have been expected, that any aspects of the quantum claim were disputed and nor did it raise any concerns around Dana's quantum claim being addressed through documents and witness evidence alone at trial. FST made no attempt ever to create a counter-schedule or to engage with Dana in any other way on quantum;

c. as a practical matter, I accept that ordinarily the parties will be expected to liaise over whether expert evidence is necessary and, where appropriate, to take steps to seek permission from the Court. The Court will not grant such permission unless proper reason for it is shown. Contrary to FST's submissions in closing, a non-admission in a defence is wholly insufficient to alert a claimant to the fact that the defendant intends to take the point that expert quantum evidence is required at trial;

d. I accept Dana's submission that there is in fact no basis for forensic expert evidence. The measure of its claim can be straightforwardly determined based upon the sums it has paid out to JLR in respect of the warranty claims arising from the defective Seals. The mathematical calculations and assumptions upon which the claim is based have been fully explained by Mr Ashenfelter and the

underlying data that support those calculations has been disclosed – notwithstanding that during the trial it appeared that Mr Wygas was not aware that it had been disclosed. FST has never previously sought expressly to challenge Mr Ashenfelter's analysis or to suggest that it wanted to drill down into that analysis, whether by way of sampling or otherwise.

279. Second, FST contends that Mr Ashenfelter did not in fact carry out the calculations in respect of the UK data and the extrapolation of that data across to the export quarterly analysis, citing his evidence that the analysis was in fact carried out by Dana's solicitors and pointing out that the Court has no evidence whatever about how that analysis was carried out. Again, I reject this criticism.

280. A careful reading of Mr Ashenfelter's first statement combined with his oral evidence shows that the calculation that was carried out by Crowell & Moring (which related only to the UK warranty process) was mechanical; historical data was provided to Crowell & Moring, together with information about reject defect codes, so that they could identify all relevant UK repair costs. Mr Ashenfelter provided Crowell & Moring with a "basic template on what we had already done similarly for forecasting purposes". In his oral evidence Mr Ashenfelter explained that Crowell & Moring's analysis was "an analysis that we had already put together again for forecast reasons to try and understand accrual levels" and further that he had "walked through the analysis" undertaken by Crowell & Moring at the time of preparing his witness statement, "checked that the linkage was to the appropriate tab for that cost" and checked that the correct philosophy had been applied.

281. Importantly, Crowell & Moring does not appear to have made any decisions about how the calculation would be undertaken or the assumptions that would be applied. Mr Ashenfelter explains in his first statement how he carried out the extrapolation of the UK data to the export warranty returns and he was not challenged in respect of his methodology, save where he had chosen a different approach in 2020 to overcome an anomaly that occurred between the UK and export markets.

282. Mr Wygas criticised the Crowell & Moring calculation on the grounds that there was no evidence as to how Crowell & Moring had undertaken the exercise and whether, for example, an unsupervised paralegal had been involved in inputting the figures into the spreadsheet. However the trouble with this criticism is that FST has never before raised concerns about the underlying identification of relevant repair costs and has not sought, as it could have done, to interrogate that process and nor has it provided any alternative calculation by way of a counter schedule.

283. Third, My Wygas submitted that Dana should not recover its quantum in respect of the export market (about 70% of its claim) owing to its failure to inspect parts supplied in that market. However, it seems to me that such an outcome would not adequately reflect the loss that Dana has suffered. I have already referred to the proportionate approach that I consider JLR and Dana took in calculating warranty claims in respect of the export market and Dana's measure of damages has been set by the sums it paid out to JLR in respect of and flowing from the defective Seals. FST has not pleaded or submitted that such sums do not represent a reasonable compromise with JLR, or indeed that Dana failed to act as a reasonable commercial entity when evaluating JLR's claims, or further that these payments were not within the contemplation of FST. I am satisfied that Dana did act reasonably, as is plainly evidenced by, amongst other things, the fact that it negotiated a share rate with JLR that was specific to Seal leaks.

284. Fourth, Mr Wygas raised for the first time in closing submissions what he described as issues with the premise of the methodology and the way in which the calculation had been undertaken. These focussed on a lack of any justification for the 48 month failure period over which Dana seeks to recover its loss, the absence of complete data in respect of vehicle build dates, the apparent inclusion in the claim of Seals which would not have been produced in the Relevant Period and the fact that approximately 12% of Seals were being repaired more than once. None of these issues had been pleaded or otherwise identified by FST in advance of the trial and again, it seems to me that the short answer to these points is FST's failure ever to raise them previously. I agree with Mr Webb's oral submission in closing that it is far too late at trial to start picking holes in Dana's quantum claim in this way.

285. Further, in my judgment, principles of proportionality must prevail in relation to these types of points – especially when raised at the eleventh hour.

286. In applying the principle of proportionality, I have regard in particular to the recent guidance from the Supreme Court in *Sainsbury's Supermarkets Ltd v Mastercard Inc* [2020] UKSC 24 as to the task to be undertaken by the court in applying the compensatory principle at [217]-[218]:

> "[217] The court in applying the compensatory principle is charged with avoiding under-compensation and also over-compensation. Justice is not achieved if a claimant receives less or more than its actual loss. But in applying the principle the court must also have regard to another principle, enshrined in the overriding objective of the Civil Procedure Rules, that legal disputes should be dealt with at a proportionate cost. The court and the parties may have to forgo precision, even where it is possible, if the cost of achieving that precision is disproportionate, and rely on estimates. The common law takes a pragmatic view of the degree of certainty with which damages must be pleaded and proved…
> [218] In *Livingstone v Rawyards Coal Co*…Lord Blackburn in speaking of getting 'as nearly as possible' to the sum which would restore the claimant, recognised that the court's task in achieving reparation is not always precise. Similarly Lord Shaw in *Watson Laidlaw & Co Ltd*…spoke of restoration by way of compensation being 'accomplished to a large extent by the exercise of sound imagination and the practice of the broad axe' and of the attempt of justice 'to get back to the *status quo ante* in fact, or to reach imaginatively, by the process of compensation, a result in which the same principle is followed'. When the court deals with claims for personal injury, loss of life or loss of reputation, it has to put a monetary value on things that cannot be valued precisely. But the task of valuing claims for purely monetary losses may also lack precision if the compensatory principle is to be honoured, particularly when one is dealing with complex trading entities such as the merchants in these appeals…"

287. Importantly in this case, it is clear from the evidence that the warranty claims made either side of the Relevant Period were *de minimis* – i.e. under the industry accepted standard of 0.1%. Accordingly, it seems to me to be unlikely that the possible inclusion of Seals produced outside the Relevant Period will make any material difference to the claim and, in any event, FST had every opportunity to investigate whether this was the case but chose not to do so. Similarly I see no proper basis for the criticism of the 48 month failure period or the absence of complete data in relation to build dates. As Mr Webb pointed out in closing, Dana had identified build dates for approximately 50% of vehicles into which Seals were fitted. Obtaining build dates for the remainder would

have been a disproportionately time consuming task, particularly in circumstances where an adequate proxy exists in the form of the sale date and, in any event, FST has never suggested that it wanted to sample the remainder with a view to checking whether Seals had been included in the claim which had not been manufactured during the Relevant Period.

288. As for the issue of multiple repairs, Mr Wygas submits rather optimistically that this is "another reason why Dana cannot prove its quantum claim". I reject this contention. Whilst it is certainly the case that there is evidence that 12% of Seals included in the quantum claim were being repaired more than once, a situation which Mr Ashenfelter agreed in cross examination was likely to indicate "a system issue", Mr Wygas did not put directly to Mr Ashenfelter that those Seals should not have been included in the quantum calculation. The closest he got was to pose the question "…the seals that are repaired more than once, they will appear on your quantum claim more than once, will they not?" to which Mr Ashenfelter responded "Yes, if they were under the standard power train warranty term, yes". Mr Wygas did not follow this up by seeking to understand what the standard power train warranty term was or by suggesting that Mr Ashenfelter's calculation was flawed by reason of the inclusion of multiple repairs.

289. Finally, Mr Wygas pointed out that the categorisation of Seals for the purposes of JLR's warranty process was not sufficient to found a claim against FST because it required Dana to decide in broad terms whether it was responsible for repair costs rather than to take account of possible distinctions between possible causes of the defects such as contamination or Shaft lead. Again, I reject this criticism, which is largely addressed by my analysis of breach and causation.

290. As Dana points out, this claim involves the failure of approximately 30,000 Seals, yet FST has never chosen to plead a positive case or to suggest that it is necessary to look at the individual reasons for failure of each of those Seals. On the contrary, during the joint root cause investigation the parties proceeded on the shared assumption that it was appropriate to consider and test only a small sample of Seals. FST has never sought to conduct an expert analysis of Seals or to suggest any further, more extensive sampling. I agree with Dana that it would never be proportionate to undertake a detailed individual investigation into each of the 30,000 failed Seals. In any event, FST has adduced no expert evidence that any Seal leaked for any of the theoretical causes that it posits.

291. In all the circumstances, and taking a broad and proportionate approach to the assessment of damages, as I am required to do, I accept that Dana is entitled to recover £11,243,026 from FST by way of damages in this claim.

292. Dana presented an interest calculation as part of its closing submissions, but in circumstances where FST has not had an opportunity to respond to that calculation (and certainly had more important things to concentrate on in the limited time available for its oral closing submissions) I intend to leave the question of interest to be addressed, if necessary, together with any other consequential matters arising on the hand down of this judgment.

Indemnity (Issue 7.2)

293. Dana's evidence confirms that it is still reimbursing JLR for leaking Seals, albeit the quantum of such quarterly reimbursements has significantly diminished. It seeks an indemnity (at common law and pursuant to its standard terms) in respect of further loss occasioned by FST's breach of contract.

294. FST does not appear to challenge Dana's entitlement to an indemnity in principle, but it questions how losses can still be ongoing after the end of 2020, given that losses should relate only to Seals manufactured during the Relevant Period.

295. I am prepared to grant the declaration sought in the Re-Amended Particulars of Claim that Dana is entitled to an indemnity in respect of further loss occasioned by FST's breaches of contract, but I invite the parties to liaise over how any such losses are to be presented to FST and the time period in which they are to be paid. In the event that the parties are unable to reach agreement as to the protocol to be followed in making a claim under the indemnity, I suggest that this issue will need to be raised at the consequentials hearing.

Contributory Negligence

296. It is plain that neither party saw this as a serious issue; it was not included in the Agreed List of Issues and Dana did not address it in closing. However, for the sake of completeness, I should deal with it briefly.

297. Contributory negligence was pleaded by FST and in its written closing it submitted that in the event of a finding of liability, the Court should "take into account" the fact that there is evidence that the change of the pre-lubricant for the Seals from wax to grease (which in fact took place in 2016) could have taken place in 2013, that this would have ameliorated the issues caused by the wearing of the Sealing Lip (owing to the fact that grease is a more effective seal lubricant than wax) and that FST "cannot be liable (or entirely liable) for losses after 2013".

298. I reject this submission. Mr Wygas did not suggest to any of Dana's witnesses that they had been negligent in failing to require such a change and it is clear from the contemporaneous documents that they were exploring the possibility of a change from wax to grease during the Relevant Period for reasons which were entirely unrelated to the Seal failures: there is no evidence whatever that Dana considered the change might impact upon the Seal failures. Further and in any event I note the agreement of the experts in the Expert Joint Statement that the use of wax was not a cause or factor in the premature wear or failure. Dana originally pleaded in its particulars of breach at paragraph 18 of its Amended Particulars of Claim that the selection of wax rather than grease "further caused or contributed to the premature failures", a contention which was not pursued in closing.

299. In all the circumstances, I agree with Mr Webb that this case of contributory negligence does not begin to get off the ground.

Conclusion

300. For all the reasons set forth above, I grant judgment in favour of Dana in the sum of £11,243,026 together with an indemnity in respect of further loss caused by defective Seals manufactured during the Relevant Period.

301. I shall deal with all matters consequential upon this judgment following hand down insofar as they cannot be agreed between the parties.